

Florida Department of Education
Curriculum Framework

Program Title: Project Management Associate
Career Cluster: Information Technology

CCC	
CIP Number	0511100501
Program Type	College Credit
Standard Length	12 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other

Purpose

This certificate is part of the Technology Project Management AS degree program (1511100509).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as project managers and professionals incorporating IT project management strategies in their business activities in the Information Technology career cluster; provides technical skill proficiency, and competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to balance of business and technology components and allows the student to gain additional skills in the area of Project Management.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Project costs and budgeting.
- 02.0 Fundamentals of project management.
- 03.0 Full project life cycle and various project management processes.
- 04.0 Define stakeholder expectations and initiate a project successfully.
- 05.0 Create a comprehensive project plan.
- 06.0 Work in teams, manage team members, and interact with stakeholders.
- 07.0 Plan and monitor project budget and schedule.
- 08.0 Basic tools and techniques of managing project quality and risk.
- 09.0 Principles of identifying, developing, and managing resources.
- 10.0 Navigating a project experiencing scope, resource, and scheduling constraints through effective communication.
- 11.0 Technical and human aspects of project control, with a focus on change control.
- 12.0 Contextual relationship between the project and the organization that hosts the project.
- 13.0 Ethical considerations in every aspect of a project's operations.

Florida Department of Education
Student Performance Standards

Program Title: Project Management Associate
 CIP Number: 0511100501
 Program Length: 12 credit hours
 SOC Code(s): 15-1199

This certificate is part of the Technology Project Management AS degree program (1511100509). At the completion of this program, the student will be able to:	
01.0	Project costs and budgeting. The student will be able to:
01.01	Demonstrate an understanding of the basic accounting principles and practices.
01.02	Demonstrate an understanding of budgeting.
01.03	Demonstrate an understanding of costing.
01.04	Identify fundamental financial analysis concepts.
01.05	Describe financial analysis tools.
01.06	Understand and interpret financial reports.
02.0	Fundamentals of project management. The student will be able to:
02.01	Describe the importance of PM in the context of various organizational cultures and strategies, and summarize the typical components of the PM system and the processes that are considered essential to any project.
02.02	Select and describe an appropriate PM strategy for a new project that can meet stakeholder expectations in a given organizational context.
03.0	Full project life cycle and various project management processes. The student will be able to:
03.01	List and describe the project phases that make up a typical project, and summarize PM processes that occur within each.
03.02	Describe the typical PM process documentation and PM deliverables that are produced by project managers in each project phase.
04.0	Define stakeholder expectations and initiate a project successfully. The student will be able to:
04.01	Given an organizational context, project objectives, and recommended strategy, develop a sequence of categorized PM processes and activities that will meet stakeholder expectations.
04.02	Create, or identify, a project charter and its primary components, including writing a concise statement of business needs that the project will address.
05.0	Create a comprehensive project plan. The student will be able to:

05.01	Develop a PM plan that documents the actions necessary to define, coordinate, and measure all project activities, and to ensure control and management of costs and changes to the project.
05.02	Describe the components of the project plan and the interactions of the various processes of the project plan with other processes in the PM system.
06.0	Work in teams, manage team members, and interact with stakeholders. The student will be able to:
06.01	Select appropriate communication tools and methods to communicate with identified stakeholders, including commonly used templates for communication activities such as status reporting, issues tracking, change control, and project reviews.
06.02	Understand sources of conflict and, given a specific challenge, apply a problem-solving process that focuses on confronting and resolving the problem.
07.0	Plan and monitor project budget and schedule. The student will be able to:
07.01	Identify necessary labor and material resources, including contracted resources, and estimate how many units of each are required to meet project expectations.
07.02	Describe the fundamental types of time- and cost-estimating approaches and how these are best related to the time line of the project, becoming more specific as more information is known about project requirements, risks, and activities.
08.0	Basic tools and techniques of managing project quality and risk. The student will be able to:
08.01	Given a specific project context and plan, identify potential project risks and/or opportunities, evaluate each according to criteria for impact on the project, and document them in a prioritized risk register.
08.02	Demonstrate knowledge of the core quality processes and explain the role of each process in planning and managing projects.
09.0	Principles of identifying, developing, and managing resources. The student will be able to:
09.01	Demonstrate how teams are assigned and formed, and describe the stages of team development.
09.02	Enhance team capability after assessing personal strengths and weaknesses, and develop skills to manage a team and lead others.
10.0	Navigating a project experiencing scope, resource, and scheduling constraints through effective communication. The student will be able to:
10.01	Demonstrate ability to optimize the project schedule by allocating resources to the critical path.
10.02	Demonstrate ability to optimize schedules to maximize efficiency.
11.0	Technical and human aspects of project control, with a focus on change control. The student will be able to:
11.01	Demonstrate knowledge of how changes to project scope may affect the project's schedule, cost, and quality, and how to evaluate the impact and recommend a solution that produces the desired project product.
11.02	Describe how to monitor and control variances as they pertain to project cost, schedule, scope, and quality, and how to formally communicate such variances to the stakeholder.
12.0	Contextual relationship between the project and the organization that hosts the project. The student will be able to:
12.01	Describe how to manage a project in a matrix organizational structure, and illustrate how to successfully deliver a project when the PM might not be sufficiently empowered.

12.02	Demonstrate knowledge of key linkages between organizational and project-level issues, including decision making, motivation, and project roles.
12.03	Demonstrate knowledge and skills in procurement, supply-chain management, finance, cost management, and other business aspects of projects.
13.0	Ethical considerations in every aspect of a project's operations. The student will be able to:
13.01	Given a case study scenario involving ethical considerations, demonstrate how a project can be executed according to the standards of the organization hosting the project.
13.02	Demonstrate knowledge of situations involving unethical project activities, and best practices for whistle blowing and ethical decision making.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: Technology Project Manager
Career Cluster: Information Technology

CCC	
CIP Number	0511100502
Program Type	College Credit
Standard Length	24 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other

Purpose

This certificate is part of the Technology Project Management AS degree program (1511100509).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as project managers and professionals incorporating IT project management strategies in their business activities in the Information Technology career cluster; provides technical skill proficiency, and competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to balance of business and technology components and allows the student to gain additional skills in the area of Project Management.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstration in, and implementation of the main areas of information technology.
- 02.0 Interactive IT tools covering media, graphics, communications, word processing, spreadsheets, and presentation software skills.
- 03.0 Project costs and budgeting.
- 04.0 Human resources management activities.
- 05.0 Fundamentals of project management.
- 06.0 Full project life cycle and various project management processes.
- 07.0 Define stakeholder expectations and initiate a project successfully.
- 08.0 Create a comprehensive project plan.
- 09.0 Work in teams, manage team members, and interact with stakeholders.
- 10.0 Plan and monitor project budget and schedule.
- 11.0 Basic tools and techniques of managing project quality and risk.
- 12.0 Principles of identifying, developing, and managing resources.
- 13.0 Navigating a project experiencing scope, resource, and scheduling constraints through effective communication.
- 14.0 Technical and human aspects of project control, with a focus on change control.
- 15.0 Contextual relationship between the project and the organization that hosts the project.
- 16.0 Ethical considerations in every aspect of a project's operations.

Florida Department of Education
Student Performance Standards

Program Title: Technology Project Manager
 CIP Number: 0511100502
 Program Length: 24 credit hours
 SOC Code(s): 15-1199

This certificate is part of the Technology Project Management AS degree program (1511100509). At the completion of this program, the student will be able to:

01.0	01.0	Demonstration in, and implementation of the main areas of information technology. The student will be able to:
	01.01	Identify, use and connect hardware components and devices.
	01.02	Demonstrate the proper use and maintenance of PC hardware.
	01.03	Install & configure laptops and other mobile devices.
	01.04	Explain types of networks and connections including TCP/IP, WIFI and SOHO.
	01.05	Troubleshoot device and network issues.
	01.06	Identify and protect against security vulnerabilities for devices and their network connections.
	01.07	Install and support Windows OS.
	01.08	Understand Mac OS, Linux and mobile OS.
	01.09	Follow best practices for safety, environmental impacts, and communication and professionalism.
02.0		Interactive IT tools covering media, graphics, communications, word processing, spreadsheets, and presentation software skills. The student will be able to:
	02.01	Describe various interactive media tools and define their purpose & function.
	02.02	Demonstrate knowledge in opening, running and/or creating video clips and sound clips.
	02.03	Demonstrate knowledge of word processing software to create and modify documents in a collaborative environment.
	02.04	Demonstrate knowledge of spreadsheet software to create and modify workbooks to manipulate and analyze data.
	02.05	Demonstrate knowledge of presentation software to create and modify interactive presentations.
	02.06	Demonstrate the ability to work in an electronic collaborative environment.

02.07	Demonstrate proficiency with project management software.
03.0	Project costs and budgeting. The student will be able to:
03.01	Demonstrate an understanding of the basic accounting principles and practices.
03.02	Demonstrate an understanding of budgeting.
03.03	Demonstrate an understanding of costing.
03.04	Identify fundamental financial analysis concepts.
03.05	Describe financial analysis tools.
03.06	Understand and interpret financial reports.
04.0	Human resources management activities. The student will be able to:
04.01	Describe the importance of human resources.
04.02	Describe the components of the job requirement and analysis process.
04.03	Describe the important elements of effective human resource planning.
04.04	Apply leadership techniques and defend the use of appropriate practices for motivating teams and developing leadership abilities.
05.0	Fundamentals of project management. The student will be able to:
05.01	Describe the importance of PM in the context of various organizational cultures and strategies, and summarize the typical components of the PM system and the processes that are considered essential to any project.
05.02	Select and describe an appropriate PM strategy for a new project that can meet stakeholder expectations in a given organizational context.
06.0	Full project life cycle and various project management processes. The student will be able to:
06.01	List and describe the project phases that make up a typical project, and summarize PM processes that occur within each.
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08.01	Develop a PM plan that documents the actions necessary to define, coordinate, and measure all project activities, and to ensure control and management of costs and changes to the project.
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10.01	Identify necessary labor and material resources, including contracted resources, and estimate how many units of each are required to meet project expectations.
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11.0	Basic tools and techniques of managing project quality and risk. The student will be able to:
11.01	Given a specific project context and plan, identify potential project risks and/or opportunities, evaluate each according to criteria for impact on the project, and document them in a prioritized risk register.
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12.01	Demonstrate how teams are assigned and formed, and describe the stages of team development.
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13.0	Navigating a project experiencing scope, resource, and scheduling constraints through effective communication. The student will be able to:
13.01	Demonstrate ability to optimize the project schedule by allocating resources to the critical path.
13.02	Demonstrate ability to optimize schedules to maximize efficiency.
14.0	Technical and human aspects of project control, with a focus on change control. The student will be able to:
14.01	Demonstrate knowledge of how changes to project scope may affect the project's schedule, cost, and quality, and how to evaluate the impact and recommend a solution that produces the desired project product.
14.02	Describe how to monitor and control variances as they pertain to project cost, schedule, scope, and quality, and how to formally communicate such variances to the stakeholder.
15.0	Contextual relationship between the project and the organization that hosts the project. The student will be able to:
15.01	Describe how to manage a project in a matrix organizational structure, and illustrate how to successfully deliver a project when the PM might not be sufficiently empowered.

15.02	Demonstrate knowledge of key linkages between organizational and project-level issues, including decision making, motivation, and project roles.
15.03	Demonstrate knowledge and skills in procurement, supply-chain management, finance, cost management, and other business aspects of projects.
16.0	Ethical considerations in every aspect of a project's operations. The student will be able to:
16.01	Given a case study scenario involving ethical considerations, demonstrate how a project can be executed according to the standards of the organization hosting the project.
16.02	Demonstrate knowledge of situations involving unethical project activities, and best practices for whistle blowing and ethical decision making.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

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Accommodations

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**Florida Department of Education
Curriculum Framework**

Program Title: Geographic Information System
Career Cluster: Information Technology

CCC	
CIP Number	0545070213
Program Type	College Credit Certificate (CCC)
Program Length	21 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other

Purpose

This certificate program is part of the Computer Information Technology AS degree program (1511010305).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the creation of maps; creation of geographic data files; manipulation of geographic data; and analysis of geographic data using appropriate software.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Perform general computer application activities.
- 02.0 Demonstrate an understanding of geographic coordinate systems.
- 03.0 Perform map creation activities.
- 04.0 Perform GIS data file creation activities.
- 05.0 Perform GIS data file manipulation activities.
- 06.0 Perform GIS analysis activities.
- 07.0 Perform database operations.

Florida Department of Education
Student Performance Standards

Program Title: Geographic Information System
 CIP Number: 0545070213
 Program Length: 21 credit hours
 SOC Code(s): 15-1199

This certificate program is part of the Computer Information Technology AS degree program (1511010305). At the completion of this program, the student will be able to:

01.0	Perform general computer application activities. The student will be able to:
01.01	Select the most efficient method of file organization for a given situation.
01.02	Identify security procedures to maintain integrity of files.
01.03	Create reports using a word processing application.
01.04	Analyze numerical information using a spreadsheet application.
01.05	Create a database for storing information using a database application.
01.06	Communicate using an e-mail program.
01.07	Retrieve information from the Internet.
02.0	Demonstrate an understanding of geographic coordinate systems. The student will be able to:
02.01	Differentiate between different models for the shape of the earth.
02.02	Describe the characteristics of a global coordinate system.
02.03	Describe the characteristics of a geographic datum.
02.04	Compare and contrast different map projections.
02.05	Detail the characteristic of the Cartesian coordinate system.
02.06	Detail the UTM, UPS and State Plane coordinate systems.
03.0	Perform map creation activities. The student will be able to:
03.01	Set the appropriate geographic coordinate system for a map in the GIS application.
03.02	Add geographic data layers to a GIS application.

03.03	Manipulate data files that do not align correctly.
03.04	Symbolize each layer appropriately.
03.05	Label map features as needed.
03.06	Add map components such as legends, titles, scale bars, north arrows.
03.07	Publish the complete map in paper and electronic formats.
04.0	Perform GIS data file creation activities. The student will be able to:
04.01	Subset existing GIS data files to create new files.
04.02	Combine existing, adjacent GIS data files together to create new files.
04.03	Collect coordinate information using a GPS receiver in the correct geographical coordinate system.
04.04	Create new GIS data files using coordinate information.
04.05	Register aerial photographs or satellite images to a specific geographical coordinate system.
04.06	Create new GIS data files by digitizing on top of registered images.
05.0	Perform GIS data file manipulation activities. The student will be able to:
05.01	Create, delete and move GIS files between folders and computers.
05.02	Add metadata to GIS files.
05.03	Set coordinate system information for a GIS file.
05.04	Reproject GIS files to different coordinate systems.
05.05	Add and delete fields to a GIS database.
05.06	Manipulate values of field within the GIS database.
06.0	Perform GIS spatial analysis activities. The student will be able to:
06.01	Generalize maps by merging adjacent areas if they contain the same or similar attributes.
06.02	Overlay GIS files that cover the same area to create new files.
06.03	Create buffers around map features.
06.04	Manipulate digital elevation models (DEM's) to create slope, aspect, view shed and hill shade layers.

06.05	Create density maps from point features.
06.06	Interpolate point features to create continuous surfaces.
06.07	Generate spatial statistics on GIS files.
07.0	Perform database operations. The student will be able to:
07.01	Build a relational database.
07.02	Query, display and format data.
07.03	Save, retrieve and run queries.
07.04	Build and format reports.
07.05	Group and summarize data.
07.06	Insert, update, automatically generate and delete data.
07.07	Control transaction processing.
07.08	Create, confirm, modify and remove tables to store data.
07.09	Apply business rules to ensure data integrity.
07.10	Restrict user access to tables.
07.11	Improve query performance.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: Virtual & Augmented Reality Technologies
Career Cluster: Information Technology

CCC	
CIP Number	0550041118
Program Type	College Credit Certificate (CCC)
Program Length	19 credit hours
CTSO	Phi Beta Lambda
SOC Codes (all applicable)	15-1132, 27-1011, 27-1014, 27-1024, 27-4032

Purpose

This certificate program is part of the Game Development Design AS or AAS degree program 1550041100.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to stereoscopic image acquisition, game engines and their uses, basic techniques for creating interactive applications and how these techniques can be used for Virtual Reality (VR) and Augmented Reality (AR) projects. It mixes together knowledge from a variety of correlated topics, including computer graphics, tracking systems, and perceptual psychology. It targets the key areas of augmented reality (AR) and how to enhance real life objects and environments with digitally generated image overlays. Practical experiences in simulation conceptualization, design, development methodologies, essential programming techniques, Science, Computer Programming, Math, 2D and 3D Art are embedded throughout the program to emphasize the relationship between these areas and the field of immersive technologies.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Identify the tools used in game development.
- 02.0 Create simple 3D game environments.
- 03.0 Design game levels using creation tools and editors.
- 04.0 Code, compile, and execute programs.
- 05.0 Demonstrate knowledge of object oriented programming and design concepts.
- 06.0 Develop 3D programs.
- 07.0 Embed artificial intelligence (AI) methods and algorithms to create and modify games.
- 08.0 Evaluate artificial intelligence (AI) Path Planning.
- 09.0 Utilize agent architectures.
- 10.0 Create decision making systems.
- 11.0 Create and modify game tree systems.
- 12.0 Utilize genetic algorithms.
- 13.0 Create virtual reality environments.

Florida Department of Education
Student Performance Standards

Program Title: Virtual and Augmented Reality Technologies
 CIP Number: 0550041118
 Program Length: 19 Credit Hours
 SOC Code(s): 15-1132, 27-1011, 27-1014, 27-1024 and 27- 4032

This certificate program is part of the Game Development Design AS or AAS degree program 1550041100. At the completion of this program, the student will be able to:

01.0	Identify the tools used in game development. The student will be able to:
01.01	Identify different computer programming languages used for game development.
01.02	Review different development environments for game development.
01.03	Study automation software for game and software development.
02.0	Create simple 3D game environments. The student will be able to:
02.01	Reproduce simple objects in different coordinate systems.
02.02	Manipulate screen coordinates to create new game levels.
02.03	Convert and export objects and levels between different 3D environments.
02.04	Create simple shapes and structures that can be exported to games or game editors.
02.05	Modify an existing level in a game using editing tools.
02.06	Create a level that can be ported to an existing game engine or editor.
02.07	Create conditional statements and loops for games.
02.08	Modify sprites to add simple motion to games.
02.09	Develop a simple 2D side scrolling game using a game development software kit.
03.0	Design game levels using creation tools and editors. The student will be able to:

03.01	Distinguish the different level building tools.
03.02	Examine the game development process and application to help design new tools for building levels.
03.03	Distinguish the different types of levels in terms of fun factor.
03.04	Discuss how to decrease and increase the difficulty for players in each type of game level.
03.05	Create a new level for an existing game that is going to address all the issues of difficulty.
03.06	Create building blocks for game level editors and existing engines.
03.07	Create program that will be able to convert and export levels into game engines and level editors.
03.08	Modify existing items to make them exportable into game engines and level editors.
04.0	Code, compile, and execute programs. The student will be able to:
04.01	Write pseudocode and flow charts.
04.02	Apply the techniques of functional decomposition to break a programming design problem into smaller pieces.
04.03	Write code documentation.
04.04	Create programs that use all data types (float points, integers, long, double, Boolean, characters, and strings) and operators.
04.05	Create programs that use all existing operators.
04.06	Explain the properties of a variable, such as its name, value, scope, persistence, and size.
04.07	Create programs that use if, else if, and else statements to evaluate conditions.
04.08	Create programs that use logical operators (and, not, or), functions, conditional statements, structured and unstructured data types, and loops.
04.09	Write programs that use classes, data abstraction, encapsulation and polymorphism.
04.10	Test and design tests of software solutions.
04.11	Debug program code.
05.0	Demonstrate knowledge of object oriented programming and design concepts. The student will be able to:
05.01	Apply principles of object oriented programming (OOP).
06.0	Develop 3D programs. The student will be able to:

06.01	Use popular existing 3D libraries to draw, move, rotate, scale, and render 2D and 3D graphics.
06.02	Create 3D data files for storing simple 3D objects.
06.03	Discuss articles about techniques and methods of programming 3D graphics.
06.04	Create a design document for their final project using 3D graphics.
06.05	Create programs that will read in 3D items from data files and display the items in 3D on the screen.
06.06	Create their own 3D items to display in the program they write.
06.07	Convert real coordinates to virtual and screen coordinates.
06.08	Discuss different notation for 3D coordinate systems in games.
06.09	Create a 3D world with multiple 3D items and moving cameras.
06.10	Scale and skew all the 3D items in the 3D virtual world relative to their location to the camera to create realism.
06.11	Apply hidden surface removal algorithms.
06.12	Develop the 3D rendering pipeline.
06.13	Summarize articles about new and current 3D rendering hardware on the market.
06.14	Distinguish 3D rendering software and hardware available for developing games.
06.15	Modify programs that do texture mapping.
06.16	Develop 3D texture mapped objects.
06.17	Apply their own texture maps to objects they create.
06.18	Use texture mapping in the final project a 3D game.
06.19	Extract 3D objects in from a file.
06.20	Create 3D objects in a file.
06.21	Use C++ structures to store 3D objects in memory.
06.22	Use C++ classes to store 3D objects in memory.
06.23	Use data files and classes/structures to store 3D objects in the final project.

06.24	Create 3D objects that have curved surfaces and adding them to their 3D world of objects.
06.25	Discuss papers on different ways to program curved surfaces.
06.26	Use curved surfaces in the final project.
06.27	Create a design document for a 3D game that they are going to develop.
06.28	Create a 3D game that uses multiple 3D objects and textures.
06.29	Modify and writing programming that uses matrices multiplication for moving rotating, scaling objects in 3D.
06.30	Use matrix multiplication for converting from the real coordinate system to screen coordinates.
06.31	Summarize articles by giving a class presentation on future of networking and game development.
07.0	Embed artificial intelligence (AI) methods and algorithms to create and modify games. The student will be able to:
07.01	Examine the origins of artificial intelligence for games, and the first games to use artificial intelligence.
07.02	Analyze how AI is used in games.
07.03	Distinguish the different methods used to create AI for games.
07.04	Modify existing AI methods for games.
07.05	Create new AI methods games.
07.06	Discuss at what level of programming AI starts.
08.0	Evaluate artificial intelligence (AI) Path Planning. The student will be able to:
08.01	Research path planning.
08.02	Discuss the advantages and disadvantages of path planning.
08.03	Modify existing path planning code to change the behavior of the game's computer controlled characters.
08.04	Enhance existing games by creating computer controlled characters.
09.0	Utilize agent architectures. The student will be able to:
09.01	Modify code for different agent architectures.
09.02	Create computer controlled characters using agent architectures.

09.03	Combine aspects of agent architectures systems with other AI methods to create new systems for computer controlled characters.
10.0	Create decision making systems. The student will be able to:
10.01	Modify code for different decision making systems.
10.02	Create computer controlled characters using decision making systems.
10.03	Combine aspects of decision-making systems with other AI methods to create new systems for computer controlled characters.
11.0	Create and modify game tree systems. The student will be able to:
12.0	Utilize genetic algorithms. The student will be able to:
12.01	Modify code for genetic algorithms systems.
12.02	Create computer controlled characters using genetic algorithms.
12.03	Combine aspects of genetic algorithms systems with other AI methods to create new systems for computer controlled characters.
13.0	Create virtual reality environments. The student will be able to:
13.01	Modify programs that use different graphics libraries.
13.02	Use different graphics libraries in the final project and programming assignments.
13.03	Develop libraries to use with 3D software development.
13.04	Modify existing programs that use sound and music to add realism in game development.
13.05	Modify sound systems to add direction and distance to sound effects.
13.06	Use sound effects in programming assignments.
13.07	Distinguish different sound file formats with respects to quality, and size.
13.08	Use sound effects and music in the final project.
13.09	Modify existing programs that use different types of input devices in game development.
13.10	Use different input devices in the final project and programming assignments.
13.11	Use forced feedback devices for input.
13.12	Summarize papers on the future of input devices.

13.13	Create 3D transparent objects.
13.14	Summarize papers on alpha blending programming methods.
13.15	Use transparency or fog in the final project.
13.16	Distinguish partial systems in terms of their uses such as fire and explosions.
13.17	Modify and write programs that use partial systems for special effects.
13.18	Apply physics to particle systems for realism.
13.19	Distinguish different methods for creating shadows.
13.20	Experiment with different lighting effects.
13.21	Modify 3D programs to include lighting and shadow effects in a 3D world.
13.22	Apply light and shadow effects in games to add realism.
13.23	Create light sources and shadows in the final project.
13.24	Modify existing programs that use reflection and refraction.
13.25	Develop programs that use light reflection and refraction.
13.26	Use light reflection and refraction in the final project.
13.27	Modify programs that use texture mapping.
13.28	Create 3D texture-mapped surfaces.
13.29	Use texture mapping in the final project.
13.30	Modify programs that use collision detection and reaction.
13.31	Compare different collision detection algorithms in terms of CPU usage and accuracy.
13.32	Use collision detection in the final project.
13.33	Discuss advantages of different collision methods.
13.34	Modify programs that use visible-surface determination.
13.35	Apply different algorithms for visible-surface determination to determine their effect on the performance of games and the game engines.

13.36	Modify programs that use hidden line removal.
13.37	Apply different algorithms for hidden line removal to determine their effects on the performance on games and the game engines.
13.38	Apply basic physics to a 3D game environment.
13.39	Create simplified calculations to mimic real life physics.
13.40	Manipulate physics functions to be applied to existing data structures that store the 3D world.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda/PBL is/are the intercurricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: E-Business Technical Certificate
Career Cluster: Information Technology

CCC	
CIP Number	0552120101
Program Type	College Credit Certificate (CCC)
Program Length	24 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other

Purpose

This certificate program is part of the E-Business Technology AS degree program (1552120107).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Perform project management activities.
- 02.0 Understand issues related to e-Business.
- 03.0 Compare and contrast e-Business with traditional business.
- 04.0 Identify, classify and demonstrate management activities for e-Business.
- 05.0 Identify legal and ethical issues for e-Business.

Florida Department of Education
Student Performance Standards

Program Title: E-Business Technical Certificate
 CIP Number: 0552120101
 Program Length: 24 credit hours
 SOC Code(s): 15-1199

This certificate program is part of the E-Business Technology AS degree program (1552120107). At the completion of this program, the student will be able to:

01.0	Perform project management activities. The student will be able to:
01.01	Describe the role of project management (PM) within the organization.
01.02	Identify the strengths and weaknesses of various project life cycle designs.
01.03	Demonstrate the importance of project scope management.
01.04	Compare and contrast project selection methods.
01.05	Build a Work Breakdown Structure (WBS), Gantt chart, and Pert Chart and describe those different elements.
01.06	Compare and contrast types of cost estimates.
01.07	Examine cost control and earned value analysis.
01.08	Examine organizational planning, staff acquisition, and team development.
01.09	Examine risk identification, quantification, response development, and response control.
01.10	Compare and contrast project tracking and project reporting.
01.11	Understand change control and configuration control.
01.12	Understand subcontracting and outsourcing.
02.0	Understand issue related to e-Business. The student will be able to:
02.01	Explain the difference between intranet and internet and the role of each in e-Business.
02.02	Explain the history, purpose and use of the World Wide Web and how it has enabled e-business.
02.03	Describe the rise of various e-business models such as information and content models, broadcast/content aggregations models, interactive models, and content provider models.

02.04	Explain security issues related to electronic payment.
02.05	Explain issues of advertising, marketing and solicitation activities affecting e-business.
03.0	Compare and contrast e-Business with traditional business. The student will be able to:
03.01	Define describe the evolution e-business.
03.02	Describe how business operations have changed due to e-Business.
03.03	Explain the basic business models of electronic marketing.
03.04	Identify critical success factors for electronic marketing.
03.05	Explain the impact of the Internet on customers and markets for businesses.
03.06	Describe consumer buying behavior and organizational buying behavior.
03.07	Explain how service industries conduct business electronically.
03.08	Describe several innovative applications in the service sector.
03.09	Identify the various payment options in e-commerce.
03.10	Explain the strategic planning issues for e-business.
03.11	Identify the critical success factors of an e-business project/venture.
03.12	Describe the major components and impact of web-based economics.
04.0	Identify, classify and demonstrate management activities for e-Business. The student will be able to:
04.01	Define the role of the entrepreneur in global business-in the United States and across the world.
04.02	Describe the entrepreneurial profile.
04.03	Discuss the role of the internet in helping small business expand their global market.
04.04	Explain the importance of strategic management to a business.
04.05	Describe the components of a marketing plan and explain the benefits of preparing one.
04.06	Describe how to prepare financial statements & use them to manage the business.
04.07	Describe effective pricing strategies.
04.08	Discuss the links among pricing, image, and competition.

04.09	Explain what seed capital is and why it is so important to the entrepreneurial process.
04.10	Explain the difference in the three types of capital small businesses require: Fixed, Working and Growth.
04.11	Explain the stages in the location decision.
04.12	Describe the location criteria and outline the basic location options for retail and service business.
04.13	Explain purchasing, quality control, vendor analysis and managing inventory while using technology to gain a competitive edge.
04.14	Explain the challenges involved in the entrepreneur's role as leader and what it takes to be a successful leader.
04.15	Learn management succession and risk management strategies in family business together with ethics and social responsibility.
04.16	Describe, explain and discuss business's responsibility to employees, customers, investors and the community.
04.17	Describe management's historical role in business operations.
04.18	Compare and contrast different management philosophies.
04.19	Compare and contrast the employees' personal needs with those of the organization.
04.20	Describe methods managers can use to deal with management politics.
04.21	Describe the nature of management's legal environment for traditional and electronic environments.
04.22	Describe the planning process of managers.
04.23	Discuss the characteristics and functions of an organization chart.
04.24	Describe the act and benefits of delegation.
04.25	Summarize the components of job descriptions and specifications.
04.26	Define and describe the activities involved in making a job analysis.
04.27	Discuss potential problems in evaluating employees and methods to avoid problems.
04.28	Discuss strategies managers may use to build and sustain high morale and motivation.
04.29	Describe methods of direct and indirect compensation.
04.30	Describe various employee relations practices.
04.31	Summarize strategies to improve personal and organizational communication.
04.32	Discuss the role of information systems in the control system.

04.33	Discuss the steps in the basic decision making process.
04.34	Describe several factors that influence decision-making.
04.35	Distinguish among management functions.
04.36	Demonstrate knowledge of the relationship between authority and responsibility to task accomplishment.
04.37	Select the most effective communication systems.
04.38	Identify problems and make an appropriate decision.
05.0	Identify legal and ethical issues for e-Business. The student will be able to:
05.01	Describe the procedure to obtaining protection under intellectual property law.
05.02	Describe and recognize material that is defamatory.
05.03	Explain the right of publicity and the right of privacy.
05.04	Explain copyright assignment and the Visual Artists Rights Act.
05.05	Discuss licensing and registration issues.
05.06	Describe the importance in choosing a strong trademark.
05.07	Understand basic laws that apply to e-commerce.
05.08	Discuss the permission required for linking, revenue-sharing agreements, and liability issues pertaining to linking.
05.09	Explain other liability issues for ISPs.
05.10	Differentiate trademark protection and trade secret protection for their property.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: E-Business Security Technical Certificate
Career Cluster: Information Technology

CCC	
CIP Number	0552120102
Program Type	College Credit Certificate (CCC)
Program Length	24 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1142 – Network and Computer Systems Administrators

Purpose

This certificate program is part of the E-Business Technology AS degree program (1552120107).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Design, develop and implement physical, network, host, application, and user security systems for E-Business.
- 02.0 Maintain and monitor security policies.

Florida Department of Education
Student Performance Standards

Program Title: E-Business Security Technical Certificate
 CIP Number: 0552120102
 Program Length: 24 credit hours
 SOC Code(s): 15-1142

This certificate program is part of the E-Business Technology AS degree program (1552120107). At the completion of this program, the student will be able to:

01.0	Design, develop and implement physical, network, host, application and user security systems for e-business. The student will be able to:
01.01	Explain use and purpose of security policies.
01.02	Conduct a security audit.
01.03	Control access to systems, resources and data.
01.04	Explain and manage system security in common Operating Systems.
01.05	Describe concepts of web servers and their role in the network.
01.06	Plan and implement a web server.
01.07	Identify the various hardware and software requirements for a web server.
01.08	Explain how documents and files are stored on a web server.
01.09	Describe different methods for projecting future traffic on a web server.
01.10	Identify the necessary steps to ensure reliability and response of the server.
01.11	Describe and implement the process for effectively organizing a website.
01.12	Install, configure, and maintain a web server.
01.13	Publish a web document so that it is easily located through various search engines on the Internet.
01.14	Set up the web server so that dynamic content can be provided to users of the website.
01.15	Perform corrective and preventative maintenance on a web server.
01.16	Analyze server log files to determine trends in web server utilization.
01.17	Discuss Internet services operation and the security risk imposed by them on the network.

01.18	Identify vulnerabilities in World Wide Web protocols and counter-measures for securing them.
01.19	Describe the operation of electronic mail and news services protocols and how to effectively secure them.
01.20	Describe the operation of file transfer and printing service protocols and how to effectively secure them.
01.21	Describe the operation of remote access services protocols and how to effectively secure them.
01.22	Describe the operation of real-time conferencing service protocols and how to effectively secure them.
01.23	Properly configure and describe the operation of naming and directory services.
01.24	Describe the operation of authentication and auditing services protocols and how to effectively secure them.
01.25	Describe the operation of administrative services protocols and how to effectively secure them.
01.26	Describe the operation of the IP Security protocol.
01.27	Implement effective measures to secure various service protocols.
02.0	Maintain and monitor security policies. The student will be able to:
02.01	Identify basic network security.
02.02	Describe purpose and use of packet sniffing, firewalls and proxies.
02.03	Define web server security.
02.04	Protect against the risks of directory browsing.
02.05	Assess client security issues including ActiveX, JavaScript and Cookies.
02.06	Install and configure network security tools.
02.07	Explain the strengths, and weaknesses of cryptography as a security tool.
02.08	Describe authentication and identification schemes.
02.09	Define secure software.
02.10	Describe the use and purpose of encryption.
02.11	Define the advantages of Secure Socket Layer (SSL).
02.12	Define certificate authority.
02.13	Identify basic aspects of intrusion detection and steps to protect the web server from these threats.

02.14	Explain the history of cryptographic methodology.
02.15	Describe cryptographic attack models.
02.16	Describe the secret key and public key encryption methodology.
02.17	Use hashing techniques.
02.18	Use digital signatures in a network environment.
02.19	Explain applied cryptography.
02.20	Use authentication processes in heterogeneous environments.
02.21	Create secure environment through defensive programming.
02.22	Explain the basic elements of Security Testing and Auditing.
02.23	Describe the capabilities of effective signature filter techniques.
02.24	Explain the importance of architectural design detection of intrusions.
02.25	Describe interoperability aspects of various commercial IDS solutions.
02.26	Define and utilize various network based Intrusion Detection Solutions (IDS).
02.27	Detect various exploitation attempts in a network environment.
02.28	Explain intrusion detection and denial of service.
02.29	Describe techniques for gathering intelligence on intrusion detection and the latest tools and techniques used by hackers.
02.30	Define and recognize structured attacks and differentiate from unstructured attacks.
02.31	Explain management issues related to intrusion detection.
02.32	Implement appropriate security measures following risk analysis.
02.33	Implement appropriate security measures to minimize risks from hackers.
02.34	Issue and manage digital certificates.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: E-Business Software Technical Certificate
Career Cluster: Information Technology

CCC	
CIP Number	0552120103
Program Type	College Credit Certificate (CCC)
Program Length	21 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other

Purpose

This certificate program is part of the E-Business Technology AS degree program (1552120107).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Perform project management activities.
- 02.0 Conduct systems analysis and design.
- 03.0 Use various software applications, languages, and protocols for E-Business environment.
- 04.0 Develop software applications for E-Business environment.
- 05.0 Maintain systems quality and perform testing activities.

Florida Department of Education
Student Performance Standards

Program Title: E-Business Software Technical Certificate
 CIP Number: 0552120103
 Program Length: 21 credit hours
 SOC Code(s): 15-1199

This certificate program is part of the E-Business Technology AS degree program (1552120107). At the completion of this program, the student will be able to:

01.0	Perform project management activities. The student will be able to:
01.01	Describe the role of project management (PM) within the organization.
01.02	Identify the strengths and weaknesses of various project life cycle designs.
01.03	Understand the importance of project scope management.
01.04	Compare and contrast project selection methods.
01.05	Build a Work Breakdown Structure (WBS), Gantt chart, and Pert Chart and describe those different elements.
01.06	Compare and contrast types of cost estimates.
01.07	Examine cost control and earned value analysis.
01.08	Examine organizational planning, staff acquisition, and team development.
01.09	Examine risk identification, quantification, response development, and response control.
01.10	Compare and contrast project tracking and project reporting.
01.11	Understand change control and configuration control.
01.12	Understand subcontracting and outsourcing.
01.13	Discuss and analyze project management case study.
02.0	Conduct systems analysis and design. The student will be able to:
02.01	Perform a detailed systems investigation and analysis of the project.
02.02	Design the input and output for the system.
02.03	Design the data files for the systems.

02.04	Design the processing flow of the system.
02.05	Design a system to insure that only valid data is accepted and processed, completely and accurately.
02.06	Establish a project plan for the development and implementation of the systems.
02.07	Program and test the system.
02.08	Develop the final systems documentation.
02.09	Conduct necessary training and file conversion to properly implement the system.
02.10	Understand industry-standard models for developing and maintaining software such as the Capability Maturity Model.
02.11	Be able to use industry-standard tools and systems development tools.
03.0	Use various programming software applications, languages and protocols for E-Business environment. The student will be able to:
03.01	Explain the network protocols.
03.02	Explain how applets differ from applications in terms of program form, operating context, and how they are started.
03.03	Describe and use single- and multi-dimensional arrays.
03.04	Create classes that use inheritance aspects of the object-oriented paradigm.
03.05	Describe the error handling constructs.
03.06	Write a program that reads and writes text files.
03.07	Understand the hierarchy of classes designed for aggregate data such as Collections, and use sets and lists.
03.08	Identify deprecated classes, and explain how to migrate.
03.09	Explain and use event handling in a GUI.
03.10	Differentiate between client-side scripting and server-side scripting.
03.11	Manipulate the objects contained in the Document Object Model (DOM).
03.12	Use variables, constants, and arithmetic operators to create valid arithmetic expressions.
03.13	Dynamically alter the sequence of script execution.
03.14	Use built-in functions as well as create custom functions, subroutines, and procedures within software using scripting languages.
03.15	Create server pages.

03.16	Write programs that implement network connection objects.
03.17	Create and use server-side include files.
03.18	Create programs that communicate across the Internet using conventions such as Remote Method Invocation.
03.19	Understand appropriate use of and demonstrate ability to incorporate and utilize cookies in e-Business software.
03.20	Integrate standard object model components with server pages.
03.21	Create webpages using data from a database.
03.22	Implement programs that use local or remote databases with standard protocols.
03.23	Create applications such as Servlets that send HTML pages to Internet clients.
03.24	Use a scripting language on the server side of a distributed program.
03.25	Use a scripting language on the client side of a distributed program.
03.26	Implement levels of security in distributed software applications and applets.
03.27	Read simple UML diagrams, and create UML documents that model programs.
03.28	Use built-in objects for error handling, file creation, and dictionary access in e-Business software.
03.29	Understand the use of client-side operating system tools.
03.30	Produce software that can interface with operating system services used to broadcast messages within a domain.
03.31	Utilize appropriate operating system interfaces to redirect output.
03.32	Explain and implement emerging trends in XML-related technologies.
03.33	Explain and use the different elements that make code easier to read.
03.34	Explain and use the different data types available in scripting languages.
03.35	Explain and use standard control structures such as repetition, selection, and sequence in the appropriate programming language.
03.36	Output data from scripting languages.
03.37	Explain the benefits of using subroutines and libraries in code.
03.38	Debug code from scripting languages.
03.39	Explain basic Internet and server-side scripting security issues and common techniques to fix them.

03.40	Use a scripting language to create and manage form data submitted over the Internet.
03.41	Examine the use of shopping carts on the Internet and how scripting languages.
03.42	Examine the use of auctions via the Internet and how scripting languages.
03.43	Understand industry standard program design techniques.
03.44	Develop the logic for a program using both flowcharting and pseudo code.
03.45	Develop looping and nested looping logic.
03.46	Develop the logic of: three-level control break program, an extract program, an edit program, a file matching and an update program.
04.0	Develop software applications for E-Business environment. The student will be able to:
04.01	Design software applications that are accessible by a variety of wireless and wired devices.
04.02	Explain alternatives to dynamic content.
04.03	Integrate the push model of information delivery.
04.04	Use operating system services such as a personal web server for database development.
04.05	Explain server security and permissions.
04.06	Evaluate the advantages/disadvantages of different server platforms.
04.07	Explain scripting concepts and syntax.
04.08	Connect to common databases using standard protocols.
04.09	Display data from a database using a web interface.
04.10	Write and modify a database record using a web interface.
04.11	Enable web security features.
04.12	Design and implement a basic shopping cart application.
05.0	Maintain systems quality and perform testing activities. The student will be able to:
05.01	Identify the advantages and disadvantages of client-server computing.
05.02	Establish controls in a client-server framework.
05.03	Explain software testing methodology.

05.04 Describe the planning, executing and controlling of the testing process.
05.05 Perform Graphical User Interface testing.
05.06 Explain the server applications testing processes.
05.07 Explain testing in a networked application environment.
05.08 Incorporate cross-level functional testing within a data-driven framework-based environment.
05.09 Use client-server testing metrics.
05.10 Explain testing integration on the desktop.
05.11 Explain testing for web-based client-server applications.
05.12 Select and use appropriate automated test tools.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: E-Business Technology Technical Certificate
Career Cluster: Information Technology

CCC	
CIP Number	0552120104
Program Type	College Credit Certificate (CCC)
Program Length	21 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other

Purpose

This certificate program is part of the E-Business Technology AS degree program (1552120107).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Perform project management activities.
- 02.0 Demonstrate proficiency in the use of web browsers and access to Internet resources.
- 03.0 Conduct systems analysis and design.
- 04.0 Perform web server management activities.
- 05.0 Support E-Business applications and product development.
- 06.0 Maintain network infrastructure.
- 07.0 Perform technical requirements to support UNIX operating system.
- 08.0 Maintain systems quality and perform testing activities.

Florida Department of Education
Student Performance Standards

Program Title: E-Business Technology Technical Certificate
 CIP Number: 0552120104
 Program Length: 21 credit hours
 SOC Code(s): 15-1199

This certificate program is part of the E-Business Technology AS degree program (1552120107). At the completion of this program, the student will be able to:

01.0	Perform project management activities. The student will be able to:
01.01	Describe the role of project management (PM) within the organization.
01.02	Identify the strengths and weaknesses of various project life cycle designs.
01.03	Understand the importance of project scope management.
01.04	Compare and contrast project selection methods.
01.05	Build a Work Breakdown Structure (WBS), Gantt chart, and Pert Chart and describe those different elements.
01.06	Compare and contrast types of cost estimates.
01.07	Demonstrate cost control and earned value analysis.
01.08	Examine organizational planning, staff acquisition, and team development.
01.09	Examine risk identification, quantification, response development, and response control.
01.10	Compare and contrast project tracking and project reporting.
01.11	Understand change control and configuration control.
01.12	Understand subcontracting and outsourcing.
01.13	Discuss and analyze project management case study.
02.0	Demonstrate proficiency in the use of web browsers and access to internet resources. The student will be able to:
02.01	Describe proper Internet etiquette and usage.
02.02	Explain how to connect to the Internet.
02.03	Explain the purpose and use of browsers and search engines.

02.04	Understand and use web browser tools to navigate the web.
02.05	Demonstrate proficiency in electronic communication technologies by using email, setting up email accounts, and explaining communication and privacy issues specific to email.
02.06	Explain communication issues specific to email.
02.07	Participate in an email a web-based discussion group.
02.08	Explain the guidelines for evaluating information needs before beginning a search an electronic search.
02.09	Explain issues associated with pornography, free speech, censorship, filtering, and copyright on the web.
02.10	Describe how to critically evaluate online information content.
02.11	Capture images, text, sound, and data from web pages.
02.12	Work with File Transfer Protocol (FTP) clients.
03.0	Conduct systems analysis and design. The student will be able to:
03.01	Perform a detailed systems investigation and analysis of the project.
03.02	Design the input and output for the system.
03.03	Design the data files for the systems.
03.04	Design the processing flow of the system.
03.05	Design a system to insure that only valid data is accepted and processed, completely and accurately.
03.06	Establish a project plan for the development and implementation of the systems.
03.07	Program and test the system.
03.08	Develop the final systems documentation.
03.09	Conduct necessary training and file conversion to properly implement the system.
03.10	Understand industry-standard models for developing and maintaining software.
03.11	Use industry-standard systems development tools.
04.0	Perform Web Server Management activities. The student will be able to:
04.01	Perform console management in the author and user mode.

04.02	Create and navigate a custom management console.
04.03	Create new user accounts.
04.04	Implement groups into a domain.
04.05	Change the domain mode.
04.06	Manage software settings, scripts, and security settings.
04.07	Manage administrative templates.
04.08	Manage folder redirection.
04.09	Configure and administer network printers.
05.0	Support e-Business applications and product development. The student will be able to:
05.01	Identify the different components to systems development life cycle and how they are interrelated.
05.02	Identify deliverables for user project and build subprojects within lifecycle components.
05.03	Create physical structure of web-based architecture.
05.04	Create requirements for business request, develop web components necessary to satisfy request and test for acceptance.
05.05	Use web browser and web authoring tools.
05.06	Write required queries to get required answer sets.
06.0	Maintain network infrastructure. The student will be able to:
06.01	Identify web server hardware and evaluate performance.
06.02	Describe security threat countermeasures.
06.03	Identify basic components of electronic payment systems.
06.04	Identify how to create and maintain an effective web presence and brand.
06.05	Describe various Electronic Data Interchange components.
06.06	Define and explain virtual communities and web portals.
06.07	Identify challenges of a global business regarding culture, legal and financial impacts, and differing languages.
06.08	Identify the planning stages of the e-Business project.
06.09	Identify web server hardware and evaluate performance.

07.0	Perform technical requirements to support UNIX operating system. The student will be able to:
07.01	Explain basic command syntax for governing the file-system, printing and process control.
07.02	Identify and use editors.
07.03	Schedule and reprioritize processes.
07.04	Use commands to get information and communicate with remote users.
07.05	Search for strings of text in files using shell meta-characters.
07.06	Use common tools to generate reports or filter text.
07.07	Use shell scripts to control flow, input, output and jobs.
07.08	Troubleshoot system problems.
08.0	Maintain systems quality and perform testing activities. The student will be able to:
08.01	Identify the advantages and disadvantages of client-server computing.
08.02	Establish controls in a client-server framework.
08.03	Explain software testing methodology.
08.04	Describe the planning, executing and controlling of the testing process.
08.05	Perform Graphical User Interface testing.
08.06	Explain the server applications testing processes.
08.07	Explain testing in a networked application environment.
08.08	Incorporate cross-level functional testing within a data-driven framework-based environment.
08.09	Use client-server testing metrics.
08.10	Explain testing integration on the desktop.
08.11	Explain testing for web-based client-server applications.
08.12	Select and use appropriate automated test tools.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

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Florida Department of Education
Curriculum Framework

Program Title: E-Business Ventures Technical Certificate
Career Cluster: Information Technology

CCC	
CIP Number	0552120105
Program Type	College Credit Certificate (CCC)
Program Length	24 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other

Purpose

This certificate program is part of the e-Business Technology AS degree program (1552120107).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Understand issues related to e-Business.
- 02.0 Compare and contrast e-Business with traditional business.
- 03.0 Identify, classify, and demonstrate management activities for e-Business.
- 04.0 Identify legal and ethical issues for e-Business.

Florida Department of Education
Student Performance Standards

Program Title: E-Business Ventures Technical Certificate
 CIP Number: 0552120105
 Program Length: 24 credit hours
 SOC Code(s): 15-1199

This certificate program is part of the E-Business Technology AS degree program (1552120107). At the completion of this program, the student will be able to:

01.0	Understand issues related to e-Business. The student will be able to:
01.01	Explain the difference between intranet and internet and the role of each in e-Business.
01.02	Explain the history, purpose and use of the World Wide Web and how it has enabled e-Business.
01.03	Describe the rise of various e-Business models such as information and content models, broadcast/content aggregations models, interactive models, and content provider models.
01.04	Explain security issues related to electronic payment.
01.05	Explain issues of advertising, marketing and solicitation activities affecting e-Business.
02.0	Compare and contrast e-Business with traditional business. The student will be able to:
02.01	Describe the evolution of e-Business, how it changed the marketplace, and the benefits to society.
02.02	Define e-Business and its categories.
02.03	Describe how business operations have changed due to e-Business.
02.04	Explain the basic business models of electronic marketing.
02.05	Identify critical success factors for electronic marketing.
02.06	Explain the impact of the Internet on customers and markets for businesses.
02.07	Describe consumer buying behavior and organizational buying behavior.
02.08	Explain how service industries conduct business electronically.
02.09	Describe several innovative applications in the service sector.
02.10	Explain how business-to-business commerce is conducted.

02.11	Describe the application and key technologies for business- to-business e-commerce models.
02.12	Describe the relationship between the Internet, intranet and extranet.
02.13	Describe the typical electronic payment system.
02.14	Identify the various payment options in e-commerce.
02.15	Explain the strategic planning issues for e-Business.
02.16	Identify the critical success factors of an e-Business project/venture.
02.17	Discuss contractual issues and copyright infringement on the web.
02.18	Explain the global economics and its impact e-Business.
02.19	Describe the major components and impact of web-based economics.
03.0	Identify, classify and demonstrate management activities for e-Business. The student will be able to:
03.01	Define the role of the entrepreneur in business-in the United States and across the world.
03.02	Describe the entrepreneurial profile.
03.03	Discuss the role of the internet in helping small business expand their market opportunities both in the United States and abroad.
03.04	Explain the importance of strategic management to business.
03.05	Describe the components of a marketing plan and explain the benefits of preparing one.
03.06	Describe how to prepare financial statements & use them to manage the business.
03.07	Describe effective pricing strategies.
03.08	Discuss the links among pricing, image, and competition.
03.09	Explain what seed capital is and why it is so important to the entrepreneurial process.
03.10	Explain the difference in the three types of capital that small businesses require: Fixed, Working and Growth.
03.11	Explain the stages in the location decision.
03.12	Describe the location criteria and outline the basic location options for retail and service business.
03.13	Explain purchasing, quality control, vender analysis and managing inventory while using technology to gain a competitive edge.
03.14	Explain the challenges involved in the entrepreneur's role as leader and what it takes to be a successful leader.

03.15	Learn management succession and risk management strategies in family business together with ethics and social responsibility.
03.16	Describe, explain and discuss business's responsibility to employees, customers, investors and the community.
03.17	Describe management's historical role in business operations.
03.18	Compare and contrast different management philosophies.
03.19	Compare and contrast the employees' personal needs with those of the organization.
03.20	Describe methods managers can use to deal with management politics.
03.21	Describe the nature of management's legal environment for traditional and electronic environments.
03.22	Describe the planning process of managers.
03.23	Discuss the characteristics and functions of an organization chart.
03.24	Describe the act and benefits of delegation.
03.25	Summarize the components of job descriptions and specifications.
03.26	Define and describe the activities involved in making a job analysis.
03.27	Discuss potential problems in evaluating employees and methods to avoid problems.
03.28	Discuss strategies managers may use to build and sustain high morale and motivation.
03.29	Describe methods of direct and indirect compensation.
03.30	Describe various employee relations practices.
03.31	Summarize strategies to improve personal and organizational communication.
03.32	Discuss the role of information systems in the control system.
03.33	Discuss the steps in the basic decision making process.
03.34	Describe several factors that influence decision-making.
03.35	Distinguish among management functions.
03.36	Demonstrate knowledge of the relationship between authority and responsibility to task accomplishment.
03.37	Select the most effective communication systems.
03.38	Identify problems and make an appropriate decision.

04.0	Identify legal and ethical issues for e-Business. The student will be able to:
04.01	Describe the procedure to obtaining protection under each intellectual property law.
04.02	Describe and recognize material that is defamatory.
04.03	Explain the right of publicity and the right of privacy.
04.04	Explain copyright assignment and the Visual Artists Rights Act.
04.05	Discuss licensing text, photos, films, television clips, characters, and games, Domain name registration, cybersquatting and anti-cybersquatting regulations.
04.06	Describe the importance in choosing a strong trademark.
04.07	Understand basic laws that apply to e-commerce.
04.08	Explain how Article Two of the UCC that applies to the sale of goods involved in e-Business.
04.09	Discuss current US laws that regulate e-Business, such as the Uniform Computer Information Transactions Act, clickwraps, sales tax, and advertising.
04.10	Explain the meaning of linking, framing and caching.
04.11	Discuss the permission required for linking, revenue-sharing agreements, and liability issues pertaining to linking.
04.12	Discuss e-mail litigation, including anti-spam laws.
04.13	Describe licensing music for use.
04.14	Discuss copyright issues important to ISPs.
04.15	Explain other liability issues for ISPs, such as, defamation, privacy, trademark and patent.
04.16	Discuss when to use trademark protection and trade secret protection for their property.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

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Florida Department of Education
Curriculum Framework

Program Title: Business Intelligence Professional
Career Cluster: Information Technology

CCC	
CIP Number	0552130101
Program Type	College Credit Certificate (CCC)
Standard Length	20 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Others

Purpose

This certificate program is part of the Business Intelligence Specialist AS degree program (1552130100).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to instruction in documenting specifications for business reports; locating, acquiring and modeling data for analysis and output; building and generating reports; and business intelligence techniques.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Provide standard report specifications and generate standard or custom reports that summarize business, financial, or economic data for review by stakeholders.
- 02.0 Define and differentiate among data constraints, filters, exception threshold, and data organization factors important in the creation of a report.
- 03.0 Locate, acquire, and model the data for analysis and output.
- 04.0 Compare and contrast the various forms for report presentation.
- 05.0 Describe the advantages and disadvantages for various report delivery mechanisms.
- 06.0 Reassess current business intelligence or trend data in support of altered information needs.

Florida Department of Education
Student Performance Standards

Program Title: Business Intelligence Professional
 CIP Number: 0552130101
 Program Length: 20 credit hours
 SOC Code(s): 15-1199

This certificate program is part of the Business Intelligence Specialist AS or AAS degree program (1552130100). At the completion of this program, the student will be able to:

01.0	Provide standard report specifications and generate standard or custom reports that summarize business, financial, or economic data for review by stakeholders. The student will be able to:
01.01	Compare attributes and benefits of available data sources.
01.01.1	RDBMS.
01.01.2	Data warehouse and OLAP Cubes.
01.01.3	Spreadsheet.
01.01.4	XML.
01.01.5	CSV.
01.01.6	Web service.
01.01.7	Raw Data and other (KML/Shape).
01.02	Define report data elements/requirements (metadata).
01.02.1	Dimensions.
01.02.2	Type I (As is – current).
01.02.3	Type II (Historical – slowly changing).
01.02.4	Facts.
01.02.5	Base.
01.02.6	Summaries.
01.02.7	Calculated fields.
01.02.8	Periodicity.
01.02.9	Relationships/JOINs.

01.03	Describe how data is to be used.
01.03.1	Data mining.
01.03.2	Filtering.
01.03.3	Exception threshold alerts.
01.03.4	Aggregating.
01.03.5	Snapshot.
01.03.6	Dynamic.
01.03.7	Historical/archive/disposal.
01.04	Determine the form of analysis.
01.04.1	Comparative analysis.
01.04.2	Impact analysis.
01.04.3	Correlational (affinity) analysis.
01.04.4	Trending/Forecasting.
02.0	Define and differentiate among data constraints, filters, exception threshold, and data organization factors important in the creation of a report. The student will be able to:
02.01	Distinguish between data constraints and filters and their appropriate use.
02.02	Describe how each of the following data constraints relates to the creation and/or delivery of a report.
02.02.1	Size of recordset (scope & performance).
02.02.2	Time/period (end points and span).
02.02.3	Range (e.g., # of records).
02.02.4	Data element (e.g., type, size).
02.02.5	Localization (programming & display language).
02.03	Describe how each of the following types of filters may be used to refine or enhance a report.
02.03.1	Dimensions (Type I and Type II).
02.03.2	Facts (e.g., base, summaries, calculated fields).
02.04	Illustrate how the use of an exception threshold contributes to the operational effectiveness of a report.

02.04.1	Display or action dependent on threshold.
02.04.2	Triggers alert or advance warning of approaching static threshold.
02.04.3	Highlights results exceeding dynamic threshold.
02.05	Compare and contrast the following forms of data organization in terms of representation and analysis of data results.
02.05.1	GROUP BY.
02.05.2	ORDER BY (SORT).
02.05.3	Concatenation/substring.
02.05.4	KRAN.
03.0	Locate, acquire, and model the data for analysis and output. The student will be able to:
03.01	Identify the types of data that might be used to create business intelligence reports in support of the organization's business and financial strategic goals.
03.01.1	Inventory repositories.
03.01.2	Sales data.
03.01.3	Customer data.
03.01.4	Employee/staffing data.
03.01.5	Financial data.
03.01.6	Spatial data.
03.01.7	Security and Risk.
03.02	Describe the risks and potential areas of concern related to the use of external data.
03.02.1	Integrity/validity of data.
03.02.2	Legality of data availability.
03.02.3	Privacy issues of data acquired.
03.02.4	Confidentiality of acquisition.
03.03	Describe potential issues, concerns, and obstacles associated with the use of data sources.
03.03.1	Data form.

03.03.2	Data integrity.
03.03.3	Normalization.
03.03.4	Cleaning.
03.04	Describe the role and implications of standardization relative to internal and external data sources.
03.04.1	Describe the need for data typing and transformation.
03.04.2	Describe the methods by which transformation may be accomplished.
04.0	Compare and contrast the various forms for report presentation. The student will be able to:
04.01	Describe the form of data required for using a report generator.
04.02	Describe the form of data required for using a spreadsheet.
04.03	Describe the form of data required for using a database.
04.04	Describe the form of data required for using an OLAP Cube or hypercube.
04.05	Describe the attributes of a report suitable for presentation in HTML/Flash.
04.06	Describe the form of data required for using a graph.
04.07	Describe the form of data required using a dashboard interface.
05.0	Describe the advantages and disadvantages for various report delivery mechanisms. The student will be able to:
05.01	Email.
05.02	Web-based.
05.03	Mobile device.
05.04	Intranet.
05.05	Print/PDF.
05.06	Oral presentation.
06.0	Reassess current business intelligence or trend data in support of altered information needs. The student will be able to:
06.01	Identify and relate report design constraints and their relationship to data.
06.02	Evaluate current technology in terms of compatibility and capacity for meeting new or evolving information needs.

06.03 Re-construct report based on alternative parameters.

06.04 Adapt and validate report based on new requirements.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: Computer Information Data Specialist
Career Cluster: Information Technology

CCC	
CIP Number	0611050101
Program Type	College Credit Certificate (CCC)
Standard Length	9 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1121 – Computer Systems Analysts

Purpose

The purpose of this program is to prepare students for initial employment as a computer systems analyst. This program may also be used to provide supplemental training for persons previously or currently employed in these occupations.

This certificate program is part of the Computer Information Technology AS degree program (1511010307).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to microcomputer oriented operating procedures, software applications packages, and hardware in order to select the appropriate information technology equipment for a particular microcomputer-based work environment; install information technology equipment, troubleshoot information technology equipment, and support information technology users.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Install, configure, upgrade and troubleshoot computer hardware.
- 02.0 Install, configure and troubleshoot system and device driver software and implement basic security measures.
- 03.0 Create and maintain a database.
- 04.0 Demonstrate knowledge of networking technologies.

Florida Department of Education
Student Performance Standards

Program Title: Computer Information Data Specialist
 CIP Number: 0611050101
 Program Length: 9 credit hours
 SOC Code(s): 15-1121

This certificate program is part of the Computer Information Technology AS degree program (1511010307). At the completion of this program, the student will be able to:

01.0	Install, configure, upgrade and troubleshoot computer hardware. The student will be able to:
01.01	Describe the architecture and operation of a typical computer system.
01.02	Describe the use of binary numbers to represent instructions and data and the hardware implications.
01.03	Identify various coding schemes including ASCII and other data types.
01.04	Describe and identify motherboards and their components.
01.05	Describe the features and types of computer form factors, chassis, power supplies and cooling devices.
01.06	Describe and identify mass storage devices.
01.07	Distinguish between the different display devices and their characteristics.
01.08	Summarize the function and types of adapter and interface cards.
01.09	Construct and configure a computer system from individual components.
01.10	Perform file and system management tasks.
01.11	Perform the installation, configuration, optimization, maintenance, and upgrading of printers and other peripheral devices.
01.12	Troubleshoot new and existing computers and peripheral devices, and document the problems discovered and the solutions implemented.
01.13	Troubleshoot client-side network connectivity issues using appropriate tools.
01.14	Identify potential hazards and implement proper safety procedures, including electrostatic discharge (ESD) precautions and professional operational procedures, safe work environment and equipment handling.
02.0	Install, configure and troubleshoot software system and device driver software and implement basic security measures. The student will be able to:
02.01	Describe the various types of device drivers used by operating systems and the utilities used to install, configure, manage, upgrade and troubleshoot system devices.

02.02	Describe the device and driver installation process.
02.03	Identify, install, configure, and troubleshoot device drivers.
02.04	Verify digital signatures of device drivers.
02.05	Configure driver policies.
02.06	Describe the security tools and features in operating systems and how to access them to perform a security audit and update.
02.07	Install, configure and monitor firewalls to block dangerous incoming and outgoing network traffic.
02.08	Install, configure and monitor anti-virus software.
02.09	Perform anti-virus and other security scanning activities to prevent the infiltration of spyware and other malicious software.
02.10	Install, configure and monitor updates, and perform system audits.
02.11	Install, configure, upgrade, monitor and optimize security measures and policies.
02.12	Perform preventive maintenance and activity monitoring for computer and network security.
03.0	Create and maintain a database. The student will be able to:
03.01	Define what a database is and describe the components and structures of relational databases.
03.02	Explain the fundamental concepts of database design.
03.03	Design a relational database with multiple tables.
03.04	Determine the appropriate field data type and field size for fields in a table.
03.05	Create and modify tables, queries, forms and reports.
03.06	Insert, update, and delete data and records.
03.07	Create basic table relationships and relate tables in a database.
03.08	Identify the data elements by which to relate tables.
03.09	Describe foreign keys and their use when relating tables.
03.10	Interpret an entity relationship diagram for modeling a database.
03.11	Describe the purpose of SQL statements.
03.12	Define, describe and implement a query.

03.13	Write and implement basic queries formatted for specific output.
03.14	Retrieve information from a database by using query and filter tools.
03.15	Describe the use of SELECT statements including the use of various JOIN, SUBQUERIES, and conditional expressions.
03.16	Describe the advantages of using an index, and implement different types of indexes on tables.
03.17	Perform basic database maintenance.
03.18	Monitor and analyze database performance.
03.19	Backup and restore a database.
04.0	Demonstrate knowledge of networking technologies. The student will be able to:
04.01	Identify the advantages and disadvantages of networked and non-network environments.
04.02	Describe current networked environments, such as peer-to-peer and client/server.
04.03	Identify and discuss issues such as security, privacy and redundancy related to networked environments.
04.04	Identify and discuss issues related to naming conventions for domains, hosts, users, email, and network devices.
04.05	Differentiate between telecommunications and data communications.
04.06	List and define the layers in the OSI and TCP/IP network protocol models.
04.07	Identify and describe current relevant IEEE network standards.
04.08	Describe and illustrate the typical logical and physical network topologies, and explain the advantages and disadvantages of each topology.
04.09	Describe the major functions and implementation of LAN hardware protocols such as Ethernet, and identify the physical components currently in use.
04.10	Describe the LAN software protocols in current use.
04.11	Discuss the characteristics of IP addresses and MAC addresses, and mapping between protocol addressing schemes.
04.12	Differentiate between hardware used to implement different network topologies, including bus, ring and star.
04.13	Identify and describe the current cable technologies, including shielded and unshielded twisted-pair, coaxial, and fiber optic, and their features including bandwidth, performance, plenum characteristics, and interference rejection.
04.14	Describe current wireless technologies including Wi-Fi, blue tooth, satellite, microwave, radio and infrared.
04.15	Describe the advantages and disadvantages of wireless and cable technologies, and identify the environments best suited for each technology.

04.16	Describe the functions and characteristics of network connectivity hardware, included hubs, repeaters, bridges, switches, access units, routers, and gateways.
04.17	Describe the hardware needed to connect a local area network to a wide area network and the Internet.
04.18	Compare and contrast major functions and features of current network operating systems, including directory and other services.
04.19	Describe the major functions of network server hardware and software components.
04.20	Install and configure a network server, including the installation of network hardware and software.
04.21	Describe the major functions of network client hardware and software components.
04.22	Install and configure network client software on multiple computer platforms with support for multiple network protocols.
04.23	Describe the function of network storage devices and other peripherals, including NAS, SAN, RAID, tape backup, printers, telecommunications devices, scanners, copiers, imaging devices, and document center equipment.
04.24	Install and configure storage devices and other peripherals with network access.
04.25	Install, configure, update and troubleshoot network drivers for network hosts and peripherals.
04.26	Configure and troubleshoot network protocol stacks.
04.27	Describe the characteristics of the current wide area network technologies and determine the most suitable WAN technology for a given situation.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Articulation

To be transferable statewide between institutions, this program must have been reviewed, and a “transfer value” assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific articulation agreements with each other.

Florida Department of Education
Curriculum Framework

Program Title: Data Science Technology
Career Cluster: Information Technology

AS

CIP Number	1511010100
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Business Professionals of America (BPA)
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Others

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to in-depth instruction on activities performed in the acquisition of data in structured and unstructured formats, cleaning, modeling, and analysis of acquired data, and extraction of knowledge or insights using statistical processes and systems. Additional content includes identification of data sources, retrieval issues and methodologies, data security, and the use of other informational tools.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Describe the data life cycle.
- 02.0 Describe basic statistical concepts and apply statistical methods used in data science problems.
- 03.0 Describe selection, preprocessing, and transformation processes used with data sources.
- 04.0 Describe modelling, analysis, and visualization techniques applied to acquired data.
- 05.0 Describe security best practices for each phase of acquisition, analysis, and retention of data.

Florida Department of Education
Student Performance Standards

Program Title: Data Science Technology
 CIP Number: 1511010100
 Program Length: 60 credit hours
 SOC Code(s): 15-1199

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. At the completion of this program, the student will be able to:	
01.0	Describe the data life cycle. The student will be able to:
01.01	Describe ways in which data can be acquired:
01.01.1	Describe data sources and methods for acquiring data.
01.01.2	Describe how data is captured (i.e: from control systems devices or Internet of things devices, etc.).
01.01.3	Describe how acquired data is cleansed and enriched.
01.02	Describe techniques for analyzing data:
01.02.1	Describe data models.
01.02.2	Describe techniques used for data visualization.
01.02.3	Describe statistical methods which are applied to data to extract useful information.
01.03	Describe how data analysis results can be reported.
01.03.1	Describe dashboards and how they can be used to make business decisions.
01.03.2	Determine appropriate reporting formats.
02.0	Describe basic statistical concepts and apply statistical methods used in data science problems. The student will be able to:
02.01	Describe the difference between population and sample data.
02.02	Construct frequency distributions.
02.03	Use descriptive statistical methods to analyze sets of data.
02.04	Use probability rules to solve probability problems.
02.05	Solve problems involving discrete probability distributions including the binomial probability distribution.

02.06	Construct confidence intervals from sample data.
02.07	Conduct tests of hypotheses with one and two samples.
02.08	Use correlation and linear regression methods to analyze data.
03.0	Describe selection, collection, preprocessing, and transformation processes used with data sources. The student will be able to:
03.01	Describe criteria and procedures used for data selection.
03.02	Compare attributes and benefits of data sources and associated collection strategies including:
03.02.1	Structured and unstructured data.
03.02.2	RDBMS (Relational Database Management Systems).
03.02.3	Data warehouses and OLAP (Online Analytical Processing) Cubes.
03.02.4	Spreadsheets.
03.02.5	XML (eXtensible Markup Language) data.
03.02.6	CSV (Comma Separated Values) data.
03.02.7	Web data.
03.02.8	GIS (Geographical Information Systems) data.
03.02.9	Raw data.
03.03	Describe and utilize data preprocessing and normalization:
03.03.1	Describe and apply common techniques for cleaning textual, numeric, and categorical data.
03.03.2	Describe the use of probabilistic methods and decision trees for classification.
03.03.3	Describe the use and applicability of transformations used to normalize data distributions.
03.04	Describe OLTP (Online Transaction Processing) design concepts and principals.
03.05	Use data processing tools (e.g. SAS, PowerBI, Tableau, etc.) or programming languages (e.g. Python, R, Java, etc. and associated libraries) to collect and clean data from various sources.
03.06	Create a data warehouse:
03.06.1	Design an OLAP database using dimensional modeling techniques.
03.06.2	Create a data warehouse based on OLAP design.

03.06.3	Create an ETL (Extract/Transfer/Load) process to populate and update the data warehouse from OLTP database utilizing SQL Server Integration (SSIS).
04.0	Describe modelling, analysis, and visualization techniques applied to acquired data. The student will be able to:
04.01	Describe and apply the use of linear regression and decision trees in data modeling.
04.02	Develop data cubes utilizing SQL Server Reporting Services (SSRS).
04.03	Use statistical tools (e.g.: SAS, SPSS, etc.) or programming languages (e.g.: R, Python, etc. with associated libraries) to solve various statistical problems:
04.03.1	Calculate summary statistics.
04.03.2	Calculate correlation values.
04.03.3	Construct confidence intervals from sample data.
04.03.4	Construct confidence intervals from sample data.
04.03.5	Conduct tests of hypotheses with one and two samples.
04.03.6	Use correlation and linear regression methods to analyze data.
04.04	Describe the advantages of large-scale data analysis tools (e.g.: Apache Hadoop, Apache Spark, Google BigQuery, Data Torrent RTS, etc.) for solving data science problems.
04.05	Use data visualization tools (e.g. Tableau, PowerBI, SAS, etc.) or programming languages (e.g.: R, JavaScript, Python, Java, etc. with associated libraries) to create graphical representations of data models and analysis results.
04.06	Develop dashboards utilizing reporting tools (e.g.: SharePoint, Tableau, PowerBI, etc.).
05.0	Describe security best practices for each phase of acquisition, analysis, and retention of data. The student will be able to:
05.01	Demonstrate understanding of basic security principles including general security concepts, communication security, confidentiality, authentication and other cryptography concepts, and operational and organizational security.
05.02	Describe risks associated with data privacy and integrity.
05.03	Describe basic web security.
05.04	Describe security methodologies as they relate to data protection and availability.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

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Accommodations

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Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

No certificates included.

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: Cybersecurity Operations
Career Cluster: Information Technology

AS

CIP Number	1511010300
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1121 – Computer Systems Analysts 15-1122 – Information Security Analysts 15-1152 – Computer Network Support Specialists 15-1142 – Network and Computer Systems Administrators

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as, cybersecurity operations analyst, security engineer, cybersecurity operations technician, data communication analyst, intrusion and detection analyst, security architect, or secure software developer in the Information Technology career cluster; which provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of network security, installing, configuring, monitoring, and detecting network violations in the LAN/WAN environment.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate a fundamental understanding of computer networking.
- 02.0 Demonstrate understanding of networked environments, hardware, and software.
- 03.0 Demonstrate fundamental proficiency in network security essentials.
- 04.0 Demonstrate an understanding of the directory services infrastructure and installation.
- 05.0 Demonstrate an understanding of network access control systems and methodology.
- 06.0 Demonstrate understanding of routing concepts.
- 07.0 Demonstrate understanding of routing protocols.
- 08.0 Demonstrate router configuration skills.
- 09.0 Perform coding activities
- 10.0 Perform programming and scripting activities.
- 11.0 Demonstrate proficiency with Internet structure, organization, and navigation.
- 12.0 Perform web design/development activities.
- 13.0 Demonstrate proficiency in analyzing network intrusions
- 14.0 Demonstrate proficiency in incident handling and response.
- 15.0 Demonstrate an understanding of how to mitigate network vulnerabilities.
- 16.0 Legal and ethical issues relative to the information technology environment.
- 17.0 Communications skills.

Florida Department of Education
Student Performance Standards

Program Title: Cybersecurity Operations (60)
 CIP Number: 1511010300
 Program Length: 60 credit hours
 SOC Code(s): 15-1121, 15-1122, 15-1152, 15-1142

Refer to Rule 6A-14.030 (4), F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate a fundamental understanding of computer networking. The student will be able to:
01.01	Explain the use of binary numbers and perform binary arithmetic.
01.02	Describe current network environments.
01.03	Describe network communications and architecture.
01.04	Identify network components, media, connectors, applications and protocols.
01.05	Compare and contrast the OSI and TCP/IP reference models and their layers.
01.06	Identify and describe current relevant IEEE network standards.
01.07	Create an IP addressing scheme using Variable Length Subnet Masks (VLSM) and Classless Inter-Domain Routing (CIDR).
01.08	Identify and discuss issues related to networked environments, such as security, access control, fair use, privacy and redundancy.
01.09	Identify and discuss issues related to naming conventions for user IDs, email, passwords, and network hosts and devices.
01.10	Identify standard network topologies and describe the advantages and disadvantages of each topology.
01.11	Describe the major functions of LAN protocols.
01.12	Explain the functions of wireless components, standards, hardware, software, and infrastructure design.
01.13	Configure and manage the TCP/IP protocol stack.
01.14	Describe how TCP and UDP Port addresses, IP addresses, and MAC addresses function, and how they are used to deliver data across the network.
01.15	Identify emerging technologies and discuss related technical issues.
01.16	Design a local area network (LAN), including the specification of architecture, hardware and software.

01.17	Identify the advantages and use of virtual local area networks (VLANs).
01.18	Identify and explain wide area network (WAN) concepts.
01.19	Plan, configure and test a small network and establish baselines.
01.20	Describe the major functions of network server software components.
01.21	Install applications on a server and configure clients for network access.
02.0	Demonstrate understanding of networked environments, hardware, and software. The student will be able to:
02.01	Give several advantages and disadvantages of networked and non-networked environments.
02.02	Describe current network environments and network topologies.
02.03	Identify and discuss issues such as security, privacy and redundancy related to networked environments.
02.04	Identify and discuss standardization issues related to-naming conventions.
02.05	List and define layers in the OSI and TCP/IP network protocol models.
02.06	Identify and describe current relevant IEEE standards.
02.07	Discuss the nature of IP and MAC addressing.
02.08	Describe the major functions and requirements of web based server and client hardware and software components.
02.09	Identify various of specialized servers.
02.10	Recognize and describe current cable technologies.
02.11	Describe current wireless technologies.
02.12	Describe the major functions of network connectivity hardware, such as hubs, repeaters, bridges, routers, switches, and gateways.
02.13	Describe the hardware needed to connect a LAN to the Internet.
02.14	Describe the function of network storage devices and other peripherals.
02.15	Compare and contrast major functions and features of current network operating systems (including directory services).
02.16	Differentiate between telecommunications and data communications.
02.17	Compare and contrast digital communications lines and cable characteristics (e.g. ISDN, DSL, T-1, T-3).

03.0	Demonstrate fundamental proficiency in network security essentials. The student will be able to:
03.01	Describe common security threats to, and vulnerabilities of, computer systems and the corresponding best practices for mitigation.
03.02	Define and describe malicious software and techniques to protect systems from its effects.
03.03	Describe Denial of Service attacks and means to defend against them.
03.04	Identify the risks and techniques of data loss and its prevention.
03.05	Describe the principles and techniques of securing data storage and transmission.
03.06	Identify current encryption and authentication standards.
03.07	Implement security policies, including compliance and operational security.
03.08	Enable access control, identity management and security logging.
03.09	Manage client and network system security software and related updates.
03.10	Describe the functions and characteristics of firewalls.
03.11	Perform a ping sweep to identify network hosts.
03.12	Perform a port scan to probe network hosts for open TCP and UDP ports.
03.13	Describe the purpose and operation of network protocol analyzers.
03.14	Utilize a network protocol analyzer to capture and analyze network traffic for security issues.
04.0	Demonstrate an understanding of the directory services infrastructure and installation. The student will be able to:
04.01	Describe the architecture of Active Directory.
04.02	Discuss how Active Directory works.
04.03	Describe the Active Directory design, plan, and implementation processes.
04.04	Create a forest and domain structure.
04.05	Configure the Domain Name Service (DNS) in an Active Directory environment.
04.06	Raise the functional level of a forest and a domain.
04.07	Create, manage, and delegate administrative control for organizational units.

05.0	Demonstrate an understanding of network access control systems and methodology. The student will be able to:
05.01	Specify by access control mechanisms what users can do, which resources they can access, and what operations they can perform on a system.
05.02	Compare and contrast access control techniques.
05.03	Administer computer, group, and user accounts.
05.04	Manage policies, rights, permissions, and passwords for users and/or groups of users.
05.05	Demonstrate an understanding of various access control models.
05.06	Manage password, PIN selection, maintenance, and control.
05.07	Demonstrate an understanding of methods of identification and authentication.
05.08	Implement centralized/remote authentication access controls.
05.09	Implement and manage decentralized access controls such as domain and trust relationships.
05.10	Analyze methods of server attacks.
05.11	Demonstrate an understanding of the different types of intrusions and the different methods of intrusion detection.
05.12	Monitor the network using various forms of intrusion detection resources to detect attacks.
05.13	Investigate audit trails for signs of network intrusions.
05.14	Perform penetration testing to find weaknesses in the access control systems.
06.0	Demonstrate understanding of routing concepts. The student will be able to:
06.01	Describe the purpose, architecture, and operations of a router.
06.02	Identify the hardware and software components of routers.
06.03	Explain the purpose and nature of routing tables.
06.04	Describe administrative distance and routing metrics such as hop counts and cost.
06.05	Describe how a router determines a path and switches packets.
06.06	Differentiate between static and dynamic routing.
06.07	Explain the differences between class-full and classless routing.

06.08	Describe the use and operation of VLSM and CIDR.
06.09	Describe how a network converges.
07.0	Demonstrate an understanding of routing protocols. The student will be able to:
07.01	Describe the characteristics of distance vector routing protocols.
07.02	Describe the characteristics of link state routing protocols.
07.03	Describe the differences between distance vector and link state routing protocols and determine the best routing protocol to use in a given situation.
07.04	Describe the features and operation of current internal and external routing protocols.
08.0	Demonstrate router configuration skills. The student will be able to:
08.01	Configure and verify router interfaces.
08.02	Perform basic router configuration using the Command Line Interface (CLI) to inspect the operations of the router.
08.03	Design and implement a classless IP addressing scheme for a network.
08.04	Configure a router for RIP version 2 operation.
08.05	Use advanced configuration commands with routers.
08.06	Configure and modify metric on a router to improve network performance.
08.07	Configure summarization and default route settings on a router to optimize network performance
08.08	Verify and troubleshoot router operations in complex network environment.
09.0	Perform coding activities. The student will be able to:
09.01	Identify modules.
09.02	Design modules.
09.03	Code modules.
09.04	Document modules.
09.05	Test modules.
09.06	Debugging code.

09.07	Revise code.
09.08	Assemble modules.
10.0	Perform programming and scripting activities. The student will be able to:
10.01	Identify several of the most prominent current programming languages.
10.02	Characterize the stages of the system development life cycle.
10.03	Differentiate between two common strategies for problem solving.
10.04	Describe the program design and development process.
10.05	Differentiate between structured programming and object-oriented programming.
10.06	Use procedural and object-oriented constructs of programming, scripting, and/or macro languages to create and test programs.
10.07	Apply principles of good design and documentation when developing programs.
10.08	Design, review, and test specifications and algorithms.
10.09	Write program according to specifications and revise based on testing and debugging.
11.0	Demonstrate proficiency with Internet structure, organization, and navigation. The student will be able to:
11.01	Describe the origin of the Internet.
11.02	Outline the history of the Internet.
11.03	Describe Internet organization, such as the InterNIC, domains and requests for comments (RFCs).
11.04	Describe the structure of the Internet.
11.05	Differentiate between the Internet and the WWW.
11.06	Differentiate among an Intranet site, an extranet site, and an Internet site.
11.07	Describe and identify several major ethical and legal issues related to Internet use and how they affect intellectual property rights.
11.08	Describe the World Wide Web (WWW) and identify how it affects personal security and privacy and our society.
11.09	Describe and differentiate between file types and protocols.
11.10	Demonstrate the use of typical remote access mechanisms.

11.11	Describe various sections of a URL.
12.0	Perform web design/development activities. The student will be able to:
12.01	Describe and use the process of storyboarding a website.
12.02	Describe format, structure and design principles for websites.
12.03	Identify existing resources and constraints.
12.04	Create site navigation plan including directory structure.
12.05	Procure/create and incorporate standard and animated graphics into a webpage.
12.06	Design page templates to implement on final site.
12.07	Create a webpage using authoring tools.
12.08	Code page(s) using current web programming languages.
12.09	Check page for cross-browser capability and other access issues.
12.10	Upload pages and run site analysis.
12.11	Incorporate sound files onto a webpage.
12.12	Incorporate a streaming video file onto a webpage.
12.13	Incorporate a video file for download into a webpage.
12.14	Perform simple graphic modifications using a graphics utility.
12.15	Incorporate an e-mail link on a webpage.
12.16	Incorporate internal and external links on a webpage.
12.17	Incorporate file transfer capabilities on a webpage.
12.18	Incorporate handicapped-accessibility options into the website.
12.19	Create a web form and produce e-mail results.
13.0	Demonstrate proficiency in analyzing network intrusions. The student will be able to:
13.01	Describe the role of a Cybersecurity Operations Analyst in the enterprise.

13.02	Describe various software applications needed to support cybersecurity analyses.
13.03	Describe the operation of the network infrastructure
13.04	Demonstrate how to analyze network intrusion data to identify compromised hosts and vulnerabilities.
13.05	Identify various network security alerts.
13.06	Correctly analyze intrusion data to determine potential exploits.
13.07	Describe the types of log files used in security monitoring.
13.08	Demonstrate the use of websites to generate malware analysis.
14.0	Demonstrate proficiency in incident handling and response. The student will be able to:
14.01	Classify the various types of network attacks.
14.02	Manage evidentiary data in an electronic environment.
14.03	Describe the essential elements of forensic analysis.
14.04	Describe incident response models used to manage network security incidents.
15.0	Demonstrate an understanding of how to mitigate network vulnerabilities. The student will be able to:
15.01	Describe various methods to prevent malicious access to computer networks, hosts, and data.
15.02	Describe the impacts of cryptography on network security monitoring.
15.03	Describe how to investigate endpoint vulnerabilities.
16.0	Legal and ethical issues relative to the information technology environment. The student will be able to:
16.01	Discuss the types of works that are protected by intellectual property laws.
16.02	Discuss the basic elements of a contract.
16.03	Discuss email litigation, including anti-spam laws.
16.04	Discuss email use and ownership.
16.05	Describe customer and employee privacy issues and safeguards.
16.06	Develop examples of acceptable use policies.

16.07	Compare organizational codes of ethics.
16.08	Research industry standards and codes of conduct for information technology professionals.
16.09	Write a personal code of ethics.
17.0	Communications skills. The student will be able to:
17.01	Write logical and clear statements, or phrases, to accurately fill out forms/invoices commonly used in business and industry.
17.02	Read and explain graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
17.03	Deliver and follow oral and written instructions.
17.04	Answer and ask questions coherently and concisely.
17.05	Read critically by recognizing assumptions and implications and by evaluating ideas.
17.06	Demonstrate appropriate communication skills.
17.07	Prepare and deliver a technical presentation.
17.08	Observe and interpret verbal and nonverbal behavior.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda(PBL) and Business Professionals of America (BPA) are the intercurricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

Florida Department of Education
Curriculum Framework

Program Title: Computer Information Technology
Career Cluster: Information Technology

AS	
CIP Number	1511010307
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1121 – Computer Systems Analysts

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as a PC Support Technician, help desk technician, user support analyst, applications system analyst, information systems specialist, technical support analyst, computer information manager, user support supervisor, computer systems analyst, customer service representative, computer operator, computer repair technicians, computer sales person, help desk office supervisor, office systems support specialist, software tester, software trainer, user support specialist information security specialist in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to analyze microcomputer oriented operating procedures, software applications packages, and hardware in order to devise efficient methods to manage a microcomputer-based work environment; develop new systems to meet projected needs; select and install information technology equipment, troubleshoot information technology equipment, manage and support information technology users.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two specializations with one common core. It is recommended that students complete the core or demonstrate a mastery of the student performance standards contained in the core before advancing to the course(s) in the next level of specialization. The common core consists of technical core skills from the following areas: computer maintenance and support, networking fundamentals, operating systems, webpage authoring, database applications and fundamentals of project management. The total Associate in Science degree program(s) consists of 60 credit hours.

Specialization	SOC Codes	Page
Information Technology Support	15-1151	13
Information Technology Analysis	15-1121	16
Mobile Device Technology Analysis	15-1151 15-1121	17
Geographic Information System	15-1199	18

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate how to use current productivity software applications and tools including word processing, spreadsheets, database, presentation software, email, and internet browser applications.
- 02.0 Install, configure, upgrade and troubleshoot computer hardware.
- 03.0 Install, configure and troubleshoot system and device driver software and implement basic security measures.
- 04.0 Demonstrate an understanding of internet structure, organization and navigation and how to support internet access and applications.
- 05.0 Install, configure, manage, and troubleshoot an operating systems.
- 06.0 Create and maintain a database.
- 07.0 Demonstrate knowledge of networking technologies.
- 08.0 Install, configure, manage, deploy, monitor and troubleshoot a networked server environment.
- 09.0 Foundations of Project Management.
- 10.0 Perform customer service skills.

In addition, students will complete the competencies in one of the following specializations:

Information Technology Support Specialization Standards

- 11.0 Demonstrate proficiency in supporting Windows-based client and network computer systems.
- 12.0 Demonstrate proficiency in installing, configuring, deploying, and supporting desktop applications.
- 13.0 Perform help desk support activities.
- 14.0 Demonstrate proficiency in supporting Windows users.

Information Technology Analysis Specialization Standards

- 11.0 Perform systems monitoring activities.
- 12.0 Perform computer information systems analysis activities.

Mobile Device Technology Analysis Specialization Standards

- 11.0 Configure, manage and troubleshoot Windows client mobile features including configuring mobile devices, power management, disk encryption, wireless networking, VPN and remote access.
- 12.0 Configure, enable, manage and troubleshoot VPN, mobile and remote access.

Geographic Information System

- 11.0 Perform general computer application activities.
- 12.0 Demonstrate an understanding of geographic coordinate systems.
- 13.0 Perform map creation activities.
- 14.0 Perform GIS data file creation activities.

- 15.0 Perform GIS data file manipulation activities.
- 16.0 Perform GIS analysis activities.
- 17.0 Perform database operations.

Florida Department of Education
Student Performance Standards

Program Title: Computer Information Technology
 CIP Number: 1511010305
 Program Length: 60 credit hours
 SOC Code(s): 11-3021

Refer to Rule 6A-14.030 (4) F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate how to use current productivity software applications and tools including word processing, spreadsheets, database, presentation software, email, and internet browser applications. The student will be able to:
01.01	Distinguish between appropriate and inappropriate use of technology in a professional or academic setting.
01.02	Distinguish between legal and illegal file-sharing practices.
01.03	Identify the ways in which a virus can infect electronic devices.
01.04	Describe common threats to the security of electronic devices.
02.0	Install, configure, upgrade and troubleshoot computer hardware. The student will be able to:
02.01	Describe the architecture and operation of a typical computer system.
02.02	Describe the use of binary numbers to represent instructions and data and the hardware implications.
02.03	Identify various coding schemes including ASCII and other data types.
02.04	Describe and identify motherboards and their components.
02.05	Describe the features and types of computer form factors, chassis, power supplies and cooling devices.
02.06	Describe and identify mass storage devices.
02.07	Distinguish between the different display devices and their characteristics.
02.08	Summarize the function and types of adapter and interface cards.
02.09	Construct and configure a computer system from individual components.
02.10	Install, configure, optimize, and upgrade components in portable devices.
02.11	Perform file and system management tasks.

02.12	Perform the installation, configuration, optimization, maintenance, and upgrading of printers and other peripheral devices.
02.13	Troubleshoot new and existing computers and peripheral devices, and document the problems discovered and the solutions implemented.
02.14	Troubleshoot client-side network connectivity issues using appropriate tools.
02.15	Identify potential hazards and implement proper safety procedures, including electrostatic discharge (ESD) precautions and professional operational procedures, safe work environment and equipment handling.
03.0	Install, configure and troubleshoot software system and device driver software and implement basic security measures. The student will be able to:
03.01	Describe the various types of device drivers used by operating systems and the utilities used to install, configure, manage, upgrade and troubleshoot system devices.
03.02	Describe the device and driver installation process.
03.03	Identify, install, configure, and troubleshoot device drivers.
03.04	Verify digital signatures of device drivers.
03.05	Configure driver policies.
03.06	Describe the security tools and features in operating systems and how to access them to perform a security audit and update.
03.07	Install, configure and monitor firewalls to block dangerous incoming and outgoing network traffic.
03.08	Install, configure and monitor anti-virus software.
03.09	Perform anti-virus and other security scanning activities to prevent the infiltration of spyware and other malicious software.
03.10	Install, configure and monitor updates, and perform system audits.
03.11	Install, configure, upgrade, monitor and optimize security measures and policies.
03.12	Perform preventive maintenance and activity monitoring for computer and network security.
04.0	Demonstrate an understanding of internet structure, organization and navigation and how to support internet access and applications. The student will be able to:
04.01	Describe the origin, structure, and history of the Internet and the World Wide Web.
04.02	Describe Internet organizations, such as the Internic, IETF, domains and Requests for Comments (RFCs).
04.03	Define and compare web-based marketing techniques.
04.04	Describe e-commerce.
04.05	Differentiate among an intranet site, an extranet site, and an Internet site.

04.06	Characterize the role of the Internet in today's society.
04.07	Describe several major ethical issues related to Internet use.
04.08	Identify legal issues related to Internet use.
04.09	Identify how the Internet affects intellectual property rights.
04.10	Identify how the Internet affects personal security and privacy.
04.11	Describe the World Wide Web (WWW).
04.12	Demonstrate the use of transfer protocols.
04.13	Demonstrate the use of typical remote access mechanisms.
04.14	Describe components of a URL.
04.15	Use Internet tools and utilities effectively.
04.16	Install and configure an Internet browser.
04.17	Install and configure browser add-ons and plug-ins.
05.0	Install, configure, manage, and troubleshoot an operating system. The student will be able to:
05.01	Identify the fundamental principles of operating systems.
05.02	Describe the general features and uses of current operating systems.
05.03	Compare and contrast features of popular operating systems.
05.04	Identify the names, locations, purposes, and contents of major operating system files.
05.05	Use command line functions and utilities to manage the operating system, including proper syntax and switches.
05.06	Create, view, and manage disks, directories and files, and change file attributes.
05.07	Identify the major operating system utilities, their purpose, location, and options.
05.08	Install major operating systems and bring the operating system to a basic operational level.
05.09	Perform operating system upgrades.
05.10	Create an emergency boot disk with utilities utilizing basic system boot sequences and boot methods.
05.11	Optimize the operating system and major operating system subsystems.

05.12	Distinguish and interpret the meaning of common error codes and startup messages from the boot sequence and identify steps to correct the problems.
05.13	Recognize when to use common diagnostic utilities and tools.
05.14	Select and use system utilities and tools to diagnose, troubleshoot and resolve operating system problems.
05.15	Detect and resolve common operational and usability problems.
05.16	Discuss the network protocols used by operating systems.
05.17	Explain how networking is supported by various operating systems.
05.18	Configure operating systems to connect to a local area network.
05.19	Configure operating systems to connect to and use Internet resources.
05.20	Troubleshoot and diagnose basic network and Internet connectivity problems.
06.0	Create and maintain a database. The student will be able to:
06.01	Define what a database is and describe the components and structures of relational databases.
06.02	Explain the fundamental concepts of database design.
06.03	Design a relational database with multiple tables.
06.04	Determine the appropriate field data type and field size for fields in a table.
06.05	Create and modify tables, queries, forms and reports.
06.06	Insert, update, and delete data and records.
06.07	Create basic table relationships and relate tables in a database.
06.08	Identify the data elements by which to relate tables.
06.09	Describe foreign keys and their use when relating tables.
06.10	Interpret an entity relationship diagram for modeling a database.
06.11	Describe the purpose of SQL statements.
06.12	Define, describe and implement a query.
06.13	Write and implement basic queries formatted for specific output.
06.14	Retrieve information from a database by using query and filter tools.

06.15	Describe the use of SELECT statements including the use of various JOIN, SUBQUERIES, and conditional expressions.
06.16	Describe the advantages of using an index, and implement different types of indexes on tables.
06.17	Perform basic database maintenance.
06.18	Monitor and analyze database performance.
06.19	Backup and restore a database.
07.0	Demonstrate knowledge of networking technologies. The student will be able to:
07.01	Identify the advantages and disadvantages of networked and non-network environments.
07.02	Describe current networked environments, such as peer-to-peer and client/server.
07.03	Identify and discuss issues such as security, privacy and redundancy related to networked environments.
07.04	Identify and discuss issues related to naming conventions for domains, hosts, users, email, and network devices.
07.05	Differentiate between telecommunications and data communications.
07.06	List and define the layers in the OSI and TCP/IP network protocol models.
07.07	Identify and describe current relevant IEEE network standards.
07.08	Describe and illustrate the typical logical and physical network topologies, and explain the advantages and disadvantages of each topology.
07.09	Describe the major functions and implementation of LAN hardware protocols such as Ethernet, and identify the physical components currently in use.
07.10	Describe the LAN software protocols in current use.
07.11	Discuss the characteristics of IP addresses and MAC addresses, and mapping between protocol addressing schemes.
07.12	Differentiate between hardware used to implement different network topologies, including bus, ring and star.
07.13	Identify and describe the current cable technologies, including shielded and unshielded twisted-pair, coaxial, and fiber optic, and their features including bandwidth, performance, plenum characteristics, and interference rejection.
07.14	Describe current wireless technologies including Wi-Fi, blue tooth, satellite, microwave, radio and infrared.
07.15	Describe the advantages and disadvantages of wireless and cable technologies, and identify the environments best suited for each technology.
07.16	Describe the functions and characteristics of network connectivity hardware, included hubs, repeaters, bridges, switches, access units, routers, and gateways.
07.17	Describe the hardware needed to connect a local area network to a wide area network and the Internet.

07.18	Compare and contrast major functions and features of current network operating systems, including directory and other services.
07.19	Describe the major functions of network server hardware and software components.
07.20	Install and configure a network server, including the installation of network hardware and software.
07.21	Describe the major functions of network client hardware and software components.
07.22	Install and configure network client software on multiple computer platforms with support for multiple network protocols.
07.23	Describe the function of network storage devices and other peripherals, including NAS, SAN, RAID, tape backup, printers, telecommunications devices, scanners, copiers, imaging devices, and document center equipment.
07.24	Install and configure storage devices and other peripherals with network access.
07.25	Install, configure, update and troubleshoot network drivers for network hosts and peripherals.
07.26	Configure and troubleshoot network protocol stacks.
07.27	Describe the characteristics of the current wide area network technologies and determine the most suitable WAN technology for a given situation.
08.0	Install, configure, manage, deploy, monitor and troubleshoot a networked server environment. The student will be able to:
08.01	Analyze the business environment and select a server deployment and licensing method.
08.02	Describe the major steps and issues associated with server deployment and draft a server migration strategy.
08.03	Describe, install and configure the server deployment tools.
08.04	Perform data and user backup for migration to a new server environment.
08.05	Prepare, install and test a reference system including updates, device drivers, and base utilities and applications for the creation of a client image.
08.06	Configure the reference system's settings to optimize performance, security, and updates, provide network access and administrative controls, and standardize features to comply with business needs.
08.07	Create, capture, test and manage the custom image of the reference system.
08.08	Deploy the reference system to client computers in a networked environment.
08.09	Migrate current applications and user data after deployment and verify and troubleshoot deployment issues.
08.10	Configure, manage and troubleshoot device drivers, network settings, peripheral devices and printers.
08.11	Join the client to a domain and configure network policies.
08.12	Describe methods of creating and maintaining network policies.

08.13	Create, modify, and administer users and groups for clients.
08.14	Configure, manage and troubleshoot client mobile features including configuring mobile devices, power management, disk encryption, wireless networking, VPN and remote access.
08.15	Configure, manage and troubleshoot client access to the network, network resources, and the Internet.
08.16	Configure, manage and troubleshoot administrative settings including: group policies, user profiles, permissions, user account control, event viewing, forwarding and logging, task scheduler, performance monitoring, Windows updates, security settings, firewall features, and authentication.
08.17	Analyze business needs and licensing requirements in the selection of enterprise applications for deployment in networked environment.
08.18	Assess hardware requirements and compatibility with existing applications and devices.
08.19	Perform application performance and compatibility testing and troubleshooting prior to application software installation.
08.20	Install and configure business application.
08.21	Deploy single license applications on a client computer.
08.22	Troubleshoot application software installation and compatibility issues.
08.23	Describe the role of desktop support in a network environment.
08.24	Perform management, testing, and troubleshoot activities.
08.25	Document incidents and support activities.
08.26	Perform post-installation tasks, compatibility and reliability testing, resolve performance issues, and perform a security audit.
08.27	Utilize hardware and software installation tools to perform testing, maintenance and updates.
08.28	Perform support functions for clients, users and deployed applications, including end user support and training.
08.29	Configure, manage and monitor administrative features and security settings.
08.30	Document installed software, conduct license auditing, create a performance baseline, and draft a troubleshooting checklist.
09.0	Foundations of project management. The student will be able to:
09.01	Describe the steps in planning and managing a project.
09.02	Define an implementation schedule for a project.
09.03	Participate in group discussions.

09.04	Choose appropriate actions in situations that require effective time management.
09.05	Describe a project life cycle from initiation to planning through execution, acceptance, support, quality, budgeting, and closure.
09.06	Understand the factors contributing to risk management planning.
09.07	Understand the cultural, social, international, political and physical aspects of the project environment.
10.0	Perform customer service skills. The student will be able to:
10.01	Identify and recognize user's state of mind and attitude.
10.02	Determine the customer needs using system analysis strategies.
10.03	Listen to the customer and ask appropriate questions.
10.04	Maintain a professional demeanor when dealing with difficult customers.
10.05	Provide suggested solutions using knowledge base.
10.06	Project professional appearance and demeanor.
10.07	Promote company services, products, and policies when appropriate.
10.08	Use tact when dealing with customers and competitors.
10.09	Maintain professional work ethics and follow policies and procedures.
10.10	Respect customer work space/environment.
10.11	Relate all information to customer in a manner that the customer can understand.
10.12	Set realistic expectations when establishing deadlines for customer solutions.
10.13	Communicate action plan including timelines.
10.14	Recognize the existence of internal/external customers and follow appropriate guidelines for each.

Information Technology Support Specialization Standards

11.0	Demonstrate proficiency in supporting Windows-based client and network computer systems. The student will be able to:
11.01	Describe the features and characteristics of a well-deployed and operational client computer in a Windows networked environment.
11.02	Perform baseline measurements, perform security and performance audits on a client computer, and document findings.
11.03	Describe the methods of establishing, configuring and controlling group policies.
11.04	Configure and troubleshoot group policy settings for client computers in a Windows domain.
11.05	Configure, manage and troubleshoot task scheduler, event forwarding and monitoring tools on a Windows client computer.
11.06	Test, configure and schedule Windows updates, patches and service packs prior to and after network-wide deployment.
11.07	Troubleshoot Windows performance, reliability, and security issues.
11.08	Configure, manage, maintain and troubleshoot Windows security issues, including adding trusted sites, installing secure plug-ins, identifying group policy restrictions, obtaining certificates, analyzing services and programs.
11.09	Install, manage and maintain anti-malicious software, firewalls and access control.
11.10	Configure, troubleshoot and secure network protocols and services for Windows client computers.
11.11	Configure, enable, manage and troubleshoot VPN, mobile and remote access.
11.12	Troubleshoot, resolve and document network issues, including wired and wireless connectivity, name resolution issues conflicts IP address, routing problems, security breaches, domain issues and group policy problems.
11.13	Determine whether problems are a result of hardware issues, Windows issues, application failures, user errors or other reasons.
11.14	Monitor events in an enterprise network and log incidents.
12.0	Demonstrate proficiency in installing, configuring, deploying, and supporting desktop applications. The student will be able to:
12.01	Perform advanced office application functions using word processing, spreadsheet, database, presentation, email, and web applications.
12.02	Test functionality and compatibility of desktop applications and updates with operating system and the intended enterprise use.
12.03	Demonstrate the common steps to install desktop applications.
12.04	Configure and deploy desktop and enterprise applications in a networked environment.
12.05	Administer software license policies, including management of licenses and licensing restrictions, digital signing, and auditing.
12.06	Perform support functions for deployed applications.

12.07	Troubleshoot and resolve desktop application issues in a networked environment.
12.08	Describe how product standards in the IT field emerged.
12.09	Identify methods for evaluation and selection of products.
13.0	Perform help desk support activities. The student will be able to:
13.01	Describe the various functions, operations, and departments within a business organization such as accounting, payroll, human resources and marketing.
13.02	Describe the role of the IT support function within the business organization.
13.03	Describe the incident management process and help desk service best practices when handling incidents.
13.04	Apply systematic problem-solving and troubleshooting processes to typical end-user issues.
13.05	Discuss the processes for resolving customer issues.
13.06	Describe strategies for handling difficult clients and incidents.
13.07	Identify and select a variety of tools and technologies that aid in the effective management of the help desk function.
13.08	Describe the process of identifying and resolving customer needs within the context of the business enterprise.
13.09	Describe the training process of end users and effective methods of delivering training materials.
13.10	Present and follow oral and written instructions.
13.11	Participate in group discussions as an IT support specialist and trainer.
13.12	Describe the types of end user documentation and the process of developing technical instructions for end users.
13.13	Prepare, outline, and deliver a short IT training presentation.
13.14	Use appropriate communication skills, courtesy, manners, and dress in the workplace.
13.15	Customize application features to meet user needs and to comply with ADA.
14.0	Demonstrate proficiency in supporting Windows users. The student will be able to:
14.01	Configure the Windows interface and customize application features to meet user needs, including ADA accessibility.
14.02	Configure and modify default user settings in Windows and applications to maximize user performance and to comply with business policies.
14.03	Manage, maintain and backup Windows client computers according to business procedures and user needs without adversely affecting workplace activities.

14.04	Migrate user data, settings and profile to a newly deployed and configured Windows computer.
14.05	Configure, maintain and troubleshoot user account control and authentication issues, including resetting passwords, recovering encryption keys, modifying user accounts and group policies, and elevating privileges.
14.06	Determine whether a client is receiving regularly scheduled updates and resolve issues.
14.07	Configure and troubleshoot user access to network resources.
14.08	Perform a system recovery on a user computer and backup user data.
14.09	Describe methods of understanding and managing user's needs and expectations.

Information Technology Analysis Specialization Standards

11.0 Perform systems monitoring activities. The student will be able to:

11.01 Create and review back up, server, application, resolution, and security logs.

11.02 Create and review server logs.

11.03 Create and review application logs.

11.04 Create and review resolution logs.

11.05 Create and review security logs.

11.06 Track network performance.

11.07 Identify problem trends and create resolution plans.

11.08 Document statistical analysis and monitoring activities.

12.0 Perform computer information systems analysis activities. The student will be able to:

12.01 Prepare appropriate systems and analysis charts and other visual aids.

12.02 Describe the major steps in the systems development cycle.

12.03 Perform basic business related tasks using the most appropriate software applications.

12.04 Identify situations where software packages and/or custom developed packages need to be integrated with each other.

12.05 Identify situations where software packages and/or hardware need to be integrated with software/hardware available on other types of computers.

12.06 Select appropriate hardware devices to accomplish assigned tasks.

12.07 Identify appropriate vendor sources for software, hardware and auxiliary supplies.

Mobile Device Technology Analysis Specialization Standards

11.0 Configure, manage and troubleshoot Windows client mobile features including configuring mobile devices, power management, disk encryption, wireless networking, VPN and remote access. The student will be able to:

11.01 Describe mobile device technology.

11.02 Identify the security measures required for securing mobile devices.

11.03 Identify mobile device operating systems.

11.04 Distinguish between mobile device operating systems.

11.05 Setup and configure mobile devices.

11.06 Explain the basic differences between mobile devices and how they affect good application design.

11.07 Explain the differences between smart phones, tablets, phablets as it relates to good mobile app design.

12.0 Configure, enable, manage and troubleshoot VPN, mobile and remote access. The student will be able to:

12.01 Identify threats associated with VPN, mobile and remote access.

12.02 Identify the safety control of remote access.

12.03 Distinguish between safety countermeasures related to remote access.

12.04 Setup and configure VPN, mobile and remote access.

12.05 Troubleshoot technical problems with VPN, mobile and remote access.

Geographic Information System Specialization Standards

11.0 Perform general computer application activities. The student will be able to:

11.01 Select the most efficient method of file organization for a given situation.

11.02 Identify security procedures to maintain integrity of files.

11.03 Create reports using a word processing application.

11.04 Analyze numerical information using a spreadsheet application.

11.05 Create a database for storing information using a database application.

11.06 Communicate using an e-mail program.

11.07 Retrieve information from the Internet.

12.0 Demonstrate an understanding of geographic coordinate systems. The student will be able to:

12.01 Differentiate between different models for the shape of the earth.

12.02 Describe the characteristics of a global coordinate system.

12.03 Describe the characteristics of a geographic datum.

12.04 Compare and contrast different map projections.

12.05 Detail the characteristic of the Cartesian coordinate system.

12.06 Detail the UTM, UPS and State Plane coordinate systems.

13.0 Perform map creation activities. The student will be able to:

13.01 Set the appropriate geographic coordinate system for a map in the GIS application.

13.02 Add geographic data layers to a GIS application.

13.03 Manipulate data files that do not align correctly.

13.04 Symbolize each layer appropriately.

13.05 Label map features as needed.

13.06 Add map components such as legends, titles, scale bars, north arrows.

13.07 Publish the complete map in paper and electronic formats.

14.0	Perform GIS data file creation activities. The student will be able to:
14.01	Subset existing GIS data files to create new files.
14.02	Combine existing, adjacent GIS data files together to create new files.
14.03	Collect coordinate information using a GPS receiver in the correct geographical coordinate system.
14.04	Create new GIS data files using coordinate information.
14.05	Register aerial photographs or satellite images to a specific geographical coordinate system.
14.06	Create new GIS data files by digitizing on top of registered images.
15.0	Perform GIS data file manipulation activities. The student will be able to:
15.01	Create, delete and move GIS files between folders and computers.
15.02	Add metadata to GIS files.
15.03	Set coordinate system information for a GIS file.
15.04	Reproject GIS files to different coordinate systems.
15.05	Add and delete fields to a GIS database.
15.06	Manipulate values of field within the GIS database.
16.0	Perform GIS spatial analysis activities. The student will be able to:
16.01	Generalize maps by merging adjacent areas if they contain the same or similar attributes.
16.02	Overlay GIS files that cover the same area to create new files.
16.03	Create buffers around map features.
16.04	Manipulate digital elevation models (DEM's) to create slope, aspect, view shed and hill shade layers.
16.05	Create density maps from point features.
16.06	Interpolate point features to create continuous surfaces.
16.07	Generate spatial statistics on GIS files.
17.0	Perform database operations. The student will be able to:
17.01	Build a relational database.

17.02	Query, display and format data.
17.03	Save, retrieve and run queries.
17.04	Build and format reports.
17.05	Group and summarize data.
17.06	Insert, update, automatically generate and delete data.
17.07	Control transaction processing.
17.08	Create, confirm, modify and remove tables to store data.
17.09	Apply business rules to ensure data integrity.
17.10	Restrict user access to tables.
17.11	Improve query performance.
17.12	Develop programs in PL/SQL.
17.13	Insert and manipulate data with PL/SQL.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Articulation

To be transferable statewide between institutions, this program must have been reviewed, and a “transfer value” assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific articulation agreements with each other.

The following PSAV programs have been approved by the Florida State Board of Education for statewide articulation credit into this degree program.

PC Support Services (B070400) – 9 credits

The following industry certifications have been approved by the Florida State Board of Education for statewide articulation credit into this degree program.

CompTIA A+ (COMPT001) – 3 credits

CompTIA Server+ (COMPT009) – 3 credits

MCIT Certified IT Professional – Consumer Support Technician (MICRO027) – 3 credits

MCIT Professional - Enterprise Support Technician (MICRO033) – 3 credits
Microsoft Certified Desktop Support Technician (MICRO006) – 3 credits
Microsoft Certified Technology Specialist - Distributed Applications (MICRO047) – 3 credits

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Computer Information Data (0611050101) – 9 credit hours
Geographic Information System CCC (0545070213) – 21 credit hours
Help Desk Support Technician (0511010313) – 16/18 credit hours
Information Technology Analysis (0511010312) – 27/28 credit hours
Information Technology Support Specialist (0511010311) – 18/28 credit hours
Mobile Device Technology (0511010309) – 24 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: Database Technology
Career Cluster: Information Technology

AS	
CIP Number	1511010308
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1141 – Database Administrators

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as Database Administrators and Developers Analysts in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

This program focuses on specific, transferable skills and stresses understanding and demonstration of the following elements of the database management and development industry: database creation, database management, database tuning, database software development, and database recovery.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate an understanding of fundamental database concepts.
- 02.0 Demonstrate conceptual design principles.
- 03.0 Demonstrate the ability to create a database design.
- 04.0 Demonstrate an understanding of basic Data Definition Language and Data Manipulation Language SQL (Structured Query Language) syntax to create relational tables.
- 05.0 Demonstrate the ability to create, maintain, and delete sequences, indexes and synonyms and other schema objects.
- 06.0 Demonstrate the ability to query the database and optimize information retrieval.

In addition, students will complete the standards in one of the following specializations:

Microsoft Certified Database Administrator Specialization Standards

- 07.0 Demonstrate how to design and implement a data warehouse.
- 08.0 Demonstrate how to extract and transform data.
- 09.0 Demonstrate how to load data.

Oracle Certified Database Administrator Specialization Standards

- 10.0 Demonstrate how to create a database instance.
- 11.0 Demonstrate how to manage an instance of the database.
- 12.0 Demonstrate how to maintain Redo log files, and how to use the data dictionary views.
- 13.0 Demonstrate how to manage tablespaces and datafiles.
- 14.0 Demonstrate an understanding of database storage structures.
- 15.0 Demonstrate the ability to query a database.
- 16.0 Demonstrate how to manage constraints and indexes.
- 17.0 Demonstrate the ability to perform backups and recovery procedures.
- 18.0 Demonstrate an understanding of the goals and processes of performance tuning.
- 19.0 Demonstrate how to automate management tasks, create scheduled jobs, programs, and schedules.
- 20.0 Demonstrate the ability to efficiently manage space-related inefficiencies of the database.
- 21.0 Demonstrate the ability to understand a database memory management.
- 22.0 Demonstrate the ability to set up a database to be deployed globally.

Oracle Certified Database Developer Specialization Standards

- 23.0 Demonstrate the use of general SQL programming language fundamental constructs.
- 24.0 Demonstrate the use of DML simple selection statements in a SQL block.
- 25.0 Demonstrate the use of conditional control IF and CASE statements.
- 26.0 Demonstrate the use of employing iterative control loops for iterating through a set of instructions.

- 27.0 Demonstrate the use of incorporating exception handling methods.
- 28.0 Demonstrate how to design and implement functions and procedures.

Florida Department of Education
Student Performance Standards

Program Title: Database Technology
 CIP Number: 1511010308
 Program Length: 60 credit hours
 SOC Code(s): 15-1141

Refer to Rule 6A-14.030 (4) F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate an understanding of fundamental database concepts. The student will be able to:
01.01	Define data.
01.02	Define information.
01.03	Describe the process by which information is derived from data.
01.04	Describe how a database is implemented.
01.05	Distinguish between variant database models, how they differ, and the advantages to each model.
01.06	Describe the advantages (i.e., improved data consistency, quality, integrity) and disadvantages of using databases (i.e., cost and complexity).
01.07	Conducting online research to locate and identify the different database engines, models, and providers.
01.08	Define and providing examples of a database transaction.
02.0	Demonstrate conceptual design principles. The student will be able to:
02.01	Perform a use case analysis and determining the functional requirements from use case.
02.02	Identify non-functional requirements that will affect a solution’s design.
02.03	Analyze data requirements to determine data entities and attributes.
02.04	Analyze entities and attributes to determine their relationships.
02.05	Develop a conceptual model that captures the data flow and integrity constraints by using various components including:
02.05.1	Base entity type.
02.05.2	Bridging entity types.

	02.05.3	Composite attribute.
	02.05.4	Multivalued attribute.
	02.05.5	Derived attribute.
	02.05.6	Associative entity type.
	02.05.7	Relationships between entity types.
	02.05.8	Minimum and maximum cardinality constraints.
	02.05.9	Deletion rules.
03.0	Demonstrate the ability to create a database design. The student will be able to:	
	03.01	Describe all data types (e.g., CHAR, NUMBER).
	03.02	Discuss the basic tenets of proper database design by describing the impact of:
	03.02.1	Data duplication.
	03.02.2	Data redundancy.
	03.02.3	Data integrity.
	03.02.4	Implicit information storage.
	03.02.5	Referential integrity.
	03.03	Derive candidate keys by decomposition and synthesis.
	03.04	Describe and executing the general methods of design using 3NF (third-normal form) to eliminate redundancy, partial and transitive dependencies.
	03.05	Identify the primary key foreign key relationships between the entity types.
04.0	Demonstrate an understanding of basic Data Definition Language and Data Manipulation Language SQL (Structured Query Language) syntax to create relational tables. The student will be able to:	
	04.01	Describe the basic characteristics of the Standard Query Language.
	04.02	Write SQL statements to create simple tables.
	04.03	Create data integrity controls.
	04.04	Change/update table definitions.
	04.05	Insert, update, and delete data/records.

04.06	Describe referential integrity and how it is enforced.
04.07	Describe the advantages of using an index, and implementing different types of indexes on tables.
04.08	Describe how a database implements and uses indexing (i.e., B-Tree, Bitmap).
04.09	Verify the existence of an index using the data dictionary.
04.10	Describe foreign keys and their use when relating tables.
04.11	Define the purpose of a sequence and how it can be used in a database.
04.12	Create and removing a sequence.
05.0	Demonstrate the ability to create, maintain, and delete sequences, indexes and synonyms and other schema objects. The student will be able to:
05.01	Define the purpose of a sequence and how it can be used in a database.
05.02	Create and removing a sequence.
05.03	Create indexes and removing indexes.
05.04	Verify the existence of an index using the data dictionary.
06.0	Demonstrate the ability to query the database and optimize information retrieval. The student will be able to:
06.01	Identify the data elements by which to relate tables.
06.02	Retrieve row and column data from tables executing simple SELECT statements.
06.03	Identify keywords, mandatory clauses, and optional clauses in a SELECT statement.
06.04	Use character, number, and date functions in SELECT statements.
06.05	Create a search condition using mathematical comparison operators.
06.06	Use the WHERE clause to restrict the rows returned by a query.
06.07	Sort rows that are retrieved by a query, and use ampersand substitution to restrict and sort output at runtime.
06.08	Write SELECT statements to access data from more than one table using equijoins and non-equijoins.
06.09	Join a table to itself using a self-join.
06.10	View data that does not meet a join condition by using outer joins.
06.11	Generate a Cartesian product of all rows from two or more tables.

06.12 Identify the available group functions (GROUP BY, HAVING, INTERSECT).
06.13 Describe the use of the group functions.
06.14 Group data by using the GROUP BY clause.
06.15 Include or exclude grouped rows by using the HAVING clause.
06.16 Write complex SELECT statements including the use of various JOIN, SUBQUERIES, and conditional expressions.
06.17 Discuss when it is appropriate to use a subquery, and describing the types of problems that subqueries can solve.
06.18 Identify which clauses can contain subqueries.
06.19 Write single-row and multiple-row subqueries.
06.20 Nest a subquery inside another subquery.

Microsoft Certified Database Administrator Specialization Standards

07.0 Demonstrate how to design and implement a data warehouse. The student will be able to:

07.01 Design and implement dimensions.

07.02 Design and implement fact tables.

08.0 Demonstrate how to extract and transform data. The student will be able to:

08.01 Define connection managers.

08.02 Design data flow.

08.03 Implement data flow.

09.0 Demonstrate how to load data. The student will be able to:

09.01 Design control flow.

09.02 Implement control flow.

09.03 Implement data load options.

Oracle Certified Database Administrator Specialization Standards

10.0 Demonstrate how to create a database instance. The student will be able to:

10.01 Explain the steps needed to create a database.

10.02 Identify the database administrative tools.

10.03 Configure the initial settings for creating the database.

10.04 Create, start, and stop a database instance.

11.0 Demonstrate how to manage an instance of the database. The student will be able to:

11.01 Create, manage, and use the initialization files.

11.02 Identify the various states of starting an instance.

11.03 Identify the various options available to shutdown an instance.

12.0 Demonstrate how to maintain log files, and how to use the data dictionary views. The student will be able to:

12.01 Explain how the data files, log files, and archive files are linked and work together.

12.02 Maintain and manage the log files.

12.03 Obtain and archive log file information.

12.04 Identify the use and contents of the data dictionary.

12.05 Use the data dictionary to retrieve information about the database.

13.0 Demonstrate how to manage tablespaces and datafiles. The student will be able to:

13.01 Describe the storage hierarchy.

13.02 Differentiate between the logical and physical structures.

13.03 Create many types of tablespaces.

13.04 Configure and viewing storage for tablespaces and datafiles.

13.05 Use and managing undo data.

13.06 Describe and configuring diagnostic (trace) files.

14.0	Demonstrate an understanding of database storage structures. The student will be able to:
14.01	Describe and differentiating between the logical and physical structure of the database.
14.02	List the segment types and their uses.
14.03	Maintain storage structures with automatic segment – space management.
14.04	Maintain storage structures manually.
14.05	Obtain storage structure information.
15.0	Demonstrate the ability to query a database. The student will be able to:
15.01	Write basic SQL single row, datatype conversion, group, and user-defined functions.
15.02	Write filtered, sorted, and aggregated queries.
15.03	Write SQL statements using advanced queries involving joins, subqueries, and other specialized queries.
16.0	Demonstrate how to manage constraints and indexes. The student will be able to:
16.01	List the different types of indexes, their uses, and constraints.
16.02	Develop an example of each type of index.
16.03	Create index-organized tables.
16.04	Create, modify, and drop constraints.
16.05	Maintain indexes.
16.06	Identify unused indexes.
17.0	Demonstrate the ability to perform backup and recovery procedures. The student will be able to:
17.01	Describe the various types of backups.
17.02	Explain the different backup options available to the database professional.
17.03	Perform a backup.
17.04	Identify the different types of failures that occur in the database.
17.05	Perform a complete recovery on a database.
17.06	Perform an incomplete recovery on a database.
17.07	Demonstrate how to perform a recovery of non-critical files.

18.0	Demonstrate an understanding of the goals and processes of performance tuning. The student will be able to:
18.01	Describe the job roles in performance tuning.
18.02	List the steps in the tuning phases.
18.03	Explain tuning goals and service level agreements.
18.04	Describe common performance problems.
18.05	Explain the tuning methodology.
19.0	Demonstrate how to automate management tasks, use diagnostic tools, create scheduled jobs, programs, and schedules. The student will be able to:
19.01	Use database utilities to create jobs, programs, and schedule tasks.
19.02	Describe the purpose and use of the diagnostic tools that are available within the database.
19.03	Use database utilities to view information about job executions and job instances.
19.04	Use database utilities to perform automatic gathering of optimizer statistics.
19.05	Use database utilities to automatically gather object statistics to make efficient decisions about execution plans.
20.0	Demonstrate the ability to efficiently manage space-related inefficiencies of the database. The student will be able to:
20.01	Tune redo writing and archiving operations.
20.02	Set and modifying thresholds for space usage.
20.03	Manage tablespace usage to reduce space-related error conditions.
20.04	Use different storage options to improve the performance of queries.
21.0	Demonstrate the ability to understand database memory management. The student will be able to:
21.01	Explain the memory structures.
21.02	Configure memory structures for database efficiency.
22.0	Demonstrate the ability to set up a database to be deployed globally. The student will be able to:
22.01	Customize language-dependent behavior for the database and individual sessions.
22.02	Specify different linguistic sorts for queries.
22.03	Use date-time data types for different time zones.
22.04	Query data using case-sensitive and accent-insensitive searches.
22.05	Obtain globalization support configuration information.

Oracle Certified Database Developer Specialization Standards

23.0 Demonstrate the use of general SQL programming language fundamental constructs. The student will be able to:

23.01 Employ SQL language components including variables and identifiers.

23.02 Make use of data types.

23.03 Explain the use of a block, nested block, and labels.

24.0 Demonstrate the use of DML simple selection statements in a SQL block. The student will be able to:

24.01 Use the SELECT INTO syntax for variable initialization.

24.02 Use Data Manipulation Language statements in a SQL block.

24.03 Make use of a sequence in a SQL block.

24.04 Make use of the COMMIT, ROLLBACK, and SAVEPOINT commands in a SQL block.

25.0 Demonstrate the use of conditional control IF and CASE statement. The student will be able to:

25.01 Use the IF-THEN, and IF-THEN-ELSE control statements.

25.02 Use nested IF statements.

25.03 Use the CASE statement in a procedural block of code.

25.04 Use a CASE expression.

26.0 Demonstrate the use of employing iterative control loops for iterating through a set of instructions. The student will be able to:

26.01 Use simple loops with EXIT conditions.

26.02 Use simple loops with EXIT WHEN conditions.

26.03 Use WHILE loops.

26.04 Use numeric FOR loops with the IN and REVERSE option.

27.0 Demonstrate the use of incorporating exception handling methods. The student will be able to:

27.01 Explain the use of error handling methods.

27.02 Use built-in exception handling mechanisms.

27.03 Create user-defined exceptions.

28.0	Demonstrate how to design and implement functions and procedures. The student will be able to:
28.01	Create procedures.
28.02	Query the data dictionary for information on procedures.
28.03	Use IN and OUT parameters with procedures.
28.04	Create stored functions.
28.05	Invoke functions with SQL statements.

Additional Information

Laboratory Activities

Laboratory activities are an integral part of this program. These activities include instruction in the use of safety procedures, tools, equipment, materials, and processes related to these occupations. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Articulation

To be transferable statewide between institutions, this program must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific articulation agreements with each other.

The following industry certifications have been approved by the Florida State Board of Education for statewide articulation credit into this degree program.

Oracle Certified Associate (ORACL001) – 6 credits

Program Length

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The standard length of this program is 60 credit hours according to Rule 6A-14.030, F.A.C.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Microsoft Certified Database Administrator (0511020309) – 15 credit hours

Oracle Certified Database Administrator (0511020307) – 15 credit hours

Oracle Certified Database Developer (0511020308) – 15 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: Computer Programming and Analysis
Career Cluster: Information Technology

AS

CIP Number	1511020101
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1131 – Computer Programmers

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as entry level programmers, programmer specialists, computer programmers, senior programmers, chief business programmers, programmer analysts, and information systems programmers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content prepares individuals to analyze business situations and to design, develop and write computer programs; to store, locate, and retrieve specific documents, data, and information; analyze problems using logic/analysis tools, code into computer language; test, monitor, debug, document and maintain computer programs.

More than one programming language should be addressed in this degree program.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Perform data file activities.
- 02.0 Perform analysis activities.
- 03.0 Perform program design activities.
- 04.0 Perform coding activities.
- 05.0 Demonstrate fundamental proficiency in network security essentials.
- 06.0 Perform testing activities.
- 07.0 Perform user-training activities.
- 08.0 Perform implementation activities.
- 09.0 Perform user support activities.
- 10.0 Perform evaluation activities.
- 11.0 Demonstrate professional development skills.
- 12.0 Demonstrate employability skills.
- 13.0 Demonstrate general organizational computing workplace competencies.
- 14.0 Develop an algorithm that solves a problem.
- 15.0 Use development methodologies.

Florida Department of Education
Student Performance Standards

Program Title: Computer Programming and Analysis
 CIP Number: 1511020101
 Program Length: 60 credit hours
 SOC Code(s): 15-1131

Refer to Rule 6A-14.030 (4) F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Perform data file activities. The student will be able to:
01.01	Identity methods of file organization.
01.02	Select an efficient method of file organization for a given situation.
01.03	Identify security procedures to maintain integrity of files.
02.0	Perform analysis activities. The student will be able to:
02.01	Communicate with users to ascertain system requirements.
02.02	Develop information system requirements to accomplish specific task.
02.03	Analyze and document user requirements.
02.04	Evaluate alternative solutions.
02.05	Analyze and document system requirements.
02.06	Create a plan for the design phase of an information technology system.
02.07	Develop a timeline for system development.
02.08	Communicate the plan.
02.09	Develop systems specifications.
02.10	Develop systems documentation.
02.11	Evaluate system performance.
02.12	Demonstrate understanding of technical and operational feasibility issues in determining a system solution.

02.13	Demonstrate knowledge, skills, and application of information systems to accomplish specific job objectives.
03.0	Perform program design activities. The student will be able to:
03.01	Demonstrate proficiency in design of information technology systems.
03.02	Demonstrate knowledge of computer concepts and terminology.
03.03	Demonstrate understanding of computer systems architecture including components, networked environments, and operating systems.
03.04	Develop design specifications.
03.05	Select a feasible development environment.
03.06	Validate design specifications.
03.07	Document design.
03.08	Communicate design specifications.
03.09	Develop prototype.
03.10	Assist in revisions and enhancements of software systems.
04.0	Perform coding activities. The student will be able to:
04.01	Identify modules.
04.02	Design modules.
04.03	Code modules.
04.04	Document modules.
04.05	Test modules.
04.06	Debug code.
04.07	Revise code.
04.08	Assemble modules.
04.09	Demonstrate proficient use of programming development tools.
05.0	Demonstrate fundamental proficiency in network security essentials. The student will be able to:

05.01	Describe common security threats to, and vulnerabilities of, computer systems and the corresponding best practices for mitigation.
05.02	Define and describe malicious software and techniques to protect systems from its effects.
05.03	Describe Denial of Service attacks and means to defend against them.
05.04	Identify the risks and techniques of data loss and its prevention.
05.05	Describe the principles and techniques of securing data storage and transmission.
05.06	Identify current encryption and authentication standards.
05.07	Implement security policies, including compliance and operational security.
05.08	Enable access control, identity management and security logging.
05.09	Manage client and network system security software and related updates.
05.10	Describe the functions and characteristics of firewalls.
05.11	Perform a ping sweep to identify network hosts.
05.12	Perform a port scan to probe network hosts for open TCP and UDP ports.
05.13	Describe the purpose and operation of network protocol analyzers.
05.14	Utilize a network protocol analyzer to capture and analyze network traffic for security issues.
06.0	Perform testing activities. The student will be able to:
06.01	Develop test plan.
06.02	Develop test data.
06.03	Validate input(s).
06.04	Perform test(s).
06.05	Validate expected outcomes.
06.06	Determine boundary test cases.
06.07	Load-test the system.
06.08	Revise program code as necessary.

06.09	Document test results.
07.0	Perform user-training activities. The student will be able to:
07.01	Assist in development of user documentation.
07.02	Assist in development of training plan.
07.03	Demonstrate appropriate user training techniques.
08.0	Perform implementation activities. The student will be able to:
08.01	Develop an implementation plan.
08.02	Install system.
08.03	Validate system.
08.04	Troubleshoot methodologies.
08.05	Document implementation.
09.0	Perform user-support activities. The student will be able to:
09.01	Demonstrate proficient use of productivity software (word processing, spreadsheets, databases, presentation) skills.
09.02	Demonstrate appropriate communication and interpersonal skills.
09.03	Determine the customer needs using system analysis strategies.
09.04	Listen to the customer and ask appropriate questions.
09.05	Persist when dealing with difficult customers maintaining a professional demeanor.
09.06	Provide suggested information technology solutions.
09.07	Research and understand specific corporate culture.
09.08	Use tact when dealing with customer and competitors.
09.09	Maintain professional work ethics and follow policies and procedures.
09.10	Respect customer work space/environment.

09.11	Set realistic expectations when establishing deadlines for customer solutions.
09.12	Communicate action plan including timelines.
09.13	Recognize the existence of internal/external customers and follow appropriate guidelines for each.
10.0	Perform evaluation activities. The student will be able to:
10.01	Review software development plans.
10.02	Assess validity and performance of software systems.
10.03	Identify improvements to software systems.
10.04	Assist in revisions and enhancements of software systems.
10.05	Assist in project evaluation.
10.06	Recommend improvements.
10.07	Provide feedback to management, users and peer groups.
11.0	Demonstrate professional development skills. The student will be able to:
11.01	Use on-line resources related to employee job requirements.
11.02	Understand the importance of continuing development activities such as reading industry journals and magazines; attending trade shows, seminars and other continuing professional development activities; participating in professional organizations and developing professional contacts for future projects.
11.03	Understand the evolving nature of information technology systems and necessity of flexibility and willingness to implement needed changes.
11.04	Set career goals/directions.
11.05	Build mentor relationships.
12.0	Demonstrate employability skills. The student will be able to:
12.01	Demonstrate business communication skills such as producing applications, business letters and memos, and resumes.
12.02	Understand appropriate workplace dress and demeanor for specific corporate cultures.
12.03	List representative jobs and career paths for people trained in the computer programming field.
12.04	List several functions of each representative computer programming job and career path.

13.0	Demonstrate general organizational computing workplace competencies. The student will be able to:
13.01	Follow oral and written instructions.
13.02	Prepare, outline, and deliver a short oral presentation.
13.03	Utilize research skills to obtain appropriate information, graphics and other data needed.
13.04	Prepare visual material to support an oral presentation.
13.05	Demonstrate self-motivation and responsibility to complete an activity.
13.06	Choose appropriate action in situations requiring effective time management.
13.07	Identify and discuss issues contained within professional codes of conduct.
13.08	Identify and discuss software licensing, property rights, privacy, encryption and legal liability issues.
14.0	Develop an algorithm that solves a problem. The student will be able to:
14.01	List the steps in problem solving.
14.02	Write pseudocode for sequential control structures.
14.03	Write pseudocode for selection control structures.
14.04	Write pseudocode for repetition control structures.
14.05	Determine efficiency of an algorithm.
14.06	Determine the complexity of an algorithm.
15.0	Use development methodologies. The student will be able to:
15.01	Define the Waterfall methodology.
15.02	Define the Agile methodology.
15.03	Compare and contrast Waterfall and Agile methodologies.
15.04	Develop a simple application using the Waterfall methodology.
15.05	Develop a simple application using the Agile methodology.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Computer Programming Specialist (0511020103) – 18 credit hours

Computer Programmer (0511020200) – 33/36 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: Internet Services Technology
Career Cluster: Information Technology

AS	
CIP Number	1511080103
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as Internet/Intranet Technicians, Web Technicians, Internet/Intranet Administrators, Web Administrators, Internet/Intranet Developers, Internet/Intranet Masters, Web Masters, Internet support specialists, Web page designers, Web database administrators, Internet managers, Web technicians, Web site developers, Web managers, or Web architects in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to work in Internet, Intranet, and Extranet environments; installing, configuring, designing and managing Intranet and web-based resources

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate proficiency with Internet structure, organization, and navigation.
- 02.0 Demonstrate understanding of networked environments, hardware and software.
- 03.0 Perform server installation and configuration activities.
- 04.0 Understand, install and configure computer hardware.
- 05.0 Understand, install and configure computer software.
- 06.0 Perform enterprise architecture-related tasks.
- 07.0 Perform web design/development activities.
- 08.0 Perform programming and scripting activities.
- 09.0 Perform testing/troubleshooting activities.
- 10.0 Perform security activities.
- 11.0 Perform website management activities.
- 12.0 Perform e-commerce-related tasks.
- 13.0 Perform quantitative analysis activities.
- 14.0 Demonstrate professional development skills.
- 15.0 Perform Documentation and Technical reference activities.
- 16.0 Demonstrate employability skills.
- 17.0 Perform general organizational computing workplace competencies.

Florida Department of Education
Student Performance Standards

Program Title: Internet Services Technology
 CIP Number: 1511080103
 Program Length: 60 credit hours
 SOC Code(s): 15-1199

Refer to Rule 6A-14.030 (4) F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate proficiency with Internet structure, organization, and navigation. The student will be able to:
01.01	Describe the origin of the Internet.
01.02	Outline the history of the Internet.
01.03	Describe Internet organization, such as the Internic, domains and requests for comments (RFCs).
01.04	Describe the structure of the Internet.
01.05	Differentiate between the Internet and the WWW.
01.06	Define Internet push technologies, such as e-mail marketing vs. webpage banner advertising.
01.07	Differentiate among an Intranet site, an extranet site, and an Internet site.
01.08	Describe and identify several major ethical and legal issues related to Internet use and how they affect intellectual property rights.
01.09	Describe the World Wide Web (WWW) and identify how it affects personal security and privacy and our society.
01.10	Describe and differentiate between file types and protocols.
01.11	Demonstrate the use of typical remote access mechanisms.
01.12	Describe various sections of a URL.
01.13	Discuss the use of Internet tools and utilities.
02.0	Demonstrate understanding of networked environments, hardware, and software. The student will be able to:
02.01	Give several advantages and disadvantages of networked and non-networked environments.
02.02	Describe current network environments and network topologies.
02.03	Identify and discuss issues such as security, privacy and redundancy related to networked environments.

02.04	Identify and discuss standardization issues related to-naming conventions.
02.05	List and define layers in the OSI and TCP/IP network protocol models.
02.06	Identify and describe current relevant IEEE standards.
02.07	Discuss the nature of IP and MAC addressing.
02.08	Describe the major functions and requirements of web based server and client hardware and software components.
02.09	Identify a variety of specialized servers.
02.10	Recognize and describe current cable technologies.
02.11	Describe current wireless technologies.
02.12	Describe the major functions of network connectivity hardware, such as hubs, repeaters, bridges, routers, switches, and gateways.
02.13	Describe the hardware needed to connect a LAN to the Internet.
02.14	Describe the function of network storage devices and other peripherals.
02.15	Compare and contrast major functions and features of current network operating systems (including directory services).
02.16	Differentiate between telecommunications and data communications.
02.17	Compare and contrast digital communications lines and cable characteristics (e.g. ISDN, DSL, T-1, T-3).
03.0	Perform server installation and configuration activities. The student will be able to:
03.01	Evaluate, install and configure software for webpage authoring.
03.02	Install and configure drivers for NICs and network peripherals.
03.03	Configure protocol stacks.
03.04	Configure a server for multiple network protocols and frame types.
03.05	Configure a server to handle multiple languages for international applications.
03.06	Install and configure an Internet web server.
03.07	Install, configure and set up a proxy server and a gateway.
03.08	Set up a server for remote access.
03.09	Address security issues raised by the ability to access server remotely.

03.10	Discuss the functions of authentication servers, RADIUS, and VPN.
03.11	Configure e-commerce server and database.
03.12	Install and configure servers for communications.
03.13	Plan, test, and integrate server components.
04.0	Understand, install and configure computer hardware. The student will be able to:
04.01	Explain the use of binary numbers to represent instructions and data.
04.02	Describe the hardware implications of the use of binary representation of instructions and data.
04.03	Convert numbers among decimal, binary, and hexadecimal representation.
04.04	Perform binary arithmetic.
04.05	Identify various data representation schemes (e.g., ASCII, Unicode).
04.06	Discuss various data types such as signed and unsigned integers and floating point.
04.07	Identify the major hardware platforms.
04.08	Describe distinguishing features of the major hardware platforms.
04.09	Describe the functions of major hardware components of a computer system.
04.10	Recognize and correctly identify computing hardware components.
04.11	Describe emerging hardware technologies and discuss their potential impact.
04.12	Implement proper procedures for handling and safeguarding equipment.
04.13	Perform preventive maintenance tasks on microcomputer systems.
04.14	Describe procedures for proper disposal of computer components.
04.15	Set up and configure systems and peripherals.
04.16	Set up BIOS.
04.17	Install and configure storage and I/O device interfaces.
04.18	Install and configure multimedia devices and interfaces.
04.19	Install and configure network interface cards.

05.0	Understand, install and configure computer software. The student will be able to:
05.01	Describe the functions and major components (e.g., BIOS and task management) of a computer operating system.
05.02	Identify current operating systems and describe their important features.
05.03	Use an operating system for activities such as data and file management.
05.04	Identify current systems utilities and describe their functions.
05.05	Use system software to perform routine maintenance tasks such as backup, and hard drive defragmentation.
05.06	Use both stand-alone operating systems and network operating systems on different platforms.
05.07	Create, use, and maintain system configuration files.
05.08	Describe and use popular features and functions of the major categories of applications software (e.g., word processing, database, spreadsheet, presentation, email, browsers).
05.09	Use software produced by multiple vendors.
05.10	Transmit and exchange data in a multiple vendor software environment.
05.11	Install and configure operating systems on multiple platforms.
05.12	Describe procedures for uninstalling operating system software.
05.13	Install and configure system software.
05.14	Install, configure and upgrade applications software.
05.15	Configure software for accessibility by disabled individuals.
05.16	Describe conflict handling when installing, configuring and upgrading applications software.
05.17	Install and configure client software for connecting to LANs, WANs, and the Internet.
05.18	Install and configure client software for client/server and network-based applications (e.g., e-mail, videoconferencing, database).
05.19	Install internetworking applications on a server and configure clients for network access.
05.20	Describe the major functions of network client software components.
05.21	Install and configure client software on multiple hardware platforms.
05.22	Install and configure drivers for NICs and network peripherals (including printers).
05.23	Configure the client to support multiple protocols.

05.24	Install and configure network-based services such as videoconferencing, integrated voicemail/email/fax, large document storage and retrieval.
06.0	Perform enterprise architecture-related tasks. The student will be able to:
06.01	Describe the Human-Computer Interaction (HCI) factors that impact the design of a webpage and website.
06.02	Determine the purpose of establishing a website.
06.03	Identify the intended audience that will access a website.
06.04	Determine user needs including secondary applications including database needs and select appropriate applications.
06.05	Identify business processes to be automated.
06.06	Determine client specifications.
06.07	Determine design standards based on intended audience.
06.08	Define architecture specifications taking into account constraints (e.g., bandwidth).
06.09	Establish performance standards and set baseline.
06.10	Determine security standards that will meet business requirements.
06.11	Install and configure system based on planning.
07.0	Perform web design/development activities. The student will be able to:
07.01	Describe and use the process of storyboarding a website.
07.02	Describe format, structure and design principles for websites.
07.03	Evaluate web graphic utilities and creation tools, including those for animated graphics.
07.04	Identify existing resources and constraints.
07.05	Evaluate design based on current industry and in-house standards.
07.06	Create site navigation plan including directory structure.
07.07	Procure/create and incorporate standard and animated graphics into a webpage.
07.08	Obtain in-house content and determine needs for secondary content providers.
07.09	Design page templates to implement on final site.
07.10	Create a webpage using authoring tools.

07.11	Code page(s) using current web programming languages.
07.12	Check page for cross-browser capability and other access issues.
07.13	Upload pages and run site analysis.
07.14	Incorporate sound files onto a webpage.
07.15	Incorporate a streaming video file onto a webpage.
07.16	Incorporate a video file for download into a webpage.
07.17	Create an animated graphic.
07.18	Perform simple graphic modifications using a graphics utility.
07.19	Incorporate an e-mail link on a webpage.
07.20	Incorporate internal and external links on a webpage.
07.21	Incorporate tables and file transfer capabilities on a webpage.
07.22	Incorporate handicapped-accessibility options into the website.
07.23	Configure a webpage for Search Engine Optimization.
07.24	Create a web form and produce e-mail results.
07.25	Create a web database interface.
07.26	Discuss the issue of ODBC compliance.
08.0	Perform programming and scripting activities. The student will be able to:
08.01	Identify several of the most prominent current programming languages.
08.02	Characterize the stages of the system development life cycle.
08.03	Differentiate between two common strategies for problem solving.
08.04	Describe the program design and development process.
08.05	Differentiate between structured programming and object-oriented programming.
08.06	Use procedural and object-oriented constructs of programming, scripting, and/or macro languages to create and test programs.
08.07	Apply principles of good design and documentation when developing programs.

08.08	Write scripting code to handle error checking in client forms.
08.09	Write CGI programs to allow for interactions between the client and server.
08.10	Use scripting languages to create dynamic webpages.
08.11	Identify development tools and list in order of complexity of use.
08.12	Design, review, and test specifications and algorithms.
08.13	Write program according to specifications and revise based on testing and debugging.
09.0	Perform testing/troubleshooting activities. The student will be able to:
09.01	Describe the use of diagnostic test equipment.
09.02	Describe features of diagnostic software.
09.03	Use system, software, and network documentation.
09.04	Locate and use online documentation resources.
09.05	Describe effective troubleshooting strategies and techniques to resolve basic hardware, software, and network problems.
09.06	Recognize and resolve basic hardware, software configuration, and peripheral device problems.
09.07	Use effective troubleshooting strategies and techniques to resolve network problems, including network interfaces, cabling, or other network components (hubs, switches).
09.08	Describe appropriate procedures and techniques for disaster prevention and recovery (surge suppressors, UPS, use of anti-virus software, replacement equipment plans, backups of software and data, offsite storage of backup media).
09.09	Describe appropriate security procedures and practices, including physical security and protection of resources through software measures (passwords, antivirus software, data encryption).
09.10	Develop testing plan and procedures.
09.11	Develop a system baseline.
09.12	Perform capacity testing against system baseline.
09.13	Evaluate network, database and server performance based on test outcomes.
09.14	Evaluate client performance based on test outcomes.
09.15	Assess accessibility standards.
09.16	Evaluate security system.

09.17	Conduct ongoing systems analysis and revise system as needed.
09.18	Discuss obtaining final client approval for implementation and system changes.
10.0	Perform security activities. The student will be able to:
10.01	Complete a security needs evaluation.
10.02	Design security architecture.
10.03	Select security protocol.
10.04	Select and set encryption methodology.
10.05	Incorporate password protection on a webpage.
10.06	Incorporate session handling into a webpage.
10.07	Configure firewall.
11.0	Perform website management activities. The student will be able to:
11.01	Describe the process of obtaining a domain address.
11.02	Notify appropriate external search engines of the website.
11.03	Compare features of currently available site management tools.
11.04	Install and configure website management software.
11.05	Create and maintain a website using a web management tool.
11.06	Implement appropriate website security measures.
11.07	Use and evaluate the results of a website visit-recording tool.
12.0	Perform e-commerce-related tasks. The student will be able to:
12.01	Describe web e-commerce.
12.02	Analyze e-commerce models.
12.03	Develop e-commerce business and marketing plan.
12.04	Identify components and procedures necessary to process credit card transactions including any security measures.

12.05	Demonstrate an understanding of the credit card transaction process.
12.06	Implement shopping cart software.
12.07	Set up and configure online catalog to market products.
12.08	Establish transaction storage and reporting system.
12.09	Publish website.
13.0	Perform quantitative analysis activities. The student will be able to:
13.01	Determine type/tools available for analysis.
13.02	Determine traffic patterns.
13.03	Gather and analyze user data.
13.04	Make recommendations for site improvements.
14.0	Demonstrate professional development skills. The student will be able to:
14.01	Identify corporate strategies and policies.
14.02	Maintain professional contact for future projects.
14.03	Build mentor relationships.
14.04	Anticipate future industry trends.
14.05	Utilize life-long learning skills.
14.06	Review and analyze other industry productions.
14.07	Use and experiment with the technology.
14.08	Network with local professionals in the industry.
14.09	Read industry journals and magazines.
14.10	Attend seminars, workshops, and tradeshow.
15.0	Perform Documentation and Technical reference activities. The student will be able to:
15.01	Use technical vocabulary appropriately.
15.02	Locate information in technical references.

15.03	Prepare technical reports.
15.04	Describe appropriate documentation procedures and practices.
15.05	Effectively use locally maintained systems, software, and network documentation.
15.06	Produce and maintain system documentation, such as inventory, costs, installed software, and procedures.
15.07	Demonstrate proficiency with Internet structure, organization, and navigation.
15.08	Maintain visual network documentation, such as cabling diagrams.
15.09	Describe effective strategies to locate and evaluate technical information online.
15.10	Cite correctly Internet-based resources.
16.0	Demonstrate employment skills. The student will be able to:
16.01	Identify appropriate attire and grooming for a business office.
16.02	Identify sources of employment opportunities.
16.03	Discuss employer expectations regarding attendance, punctuality, initiative and teamwork.
16.04	Discuss employee rights regarding privacy, discrimination, due process and safety.
16.05	Explain the importance of having a written job description.
16.06	List representative jobs and career paths for people trained in the computer networking support area.
16.07	List several functions of each representative computer service oriented job and career path.
16.08	Complete employment forms.
16.09	Classify behaviors considered to be appropriate or inappropriate in a job interview situation.
16.10	Compose and type a follow-up letter.
16.11	Compose and type a letter of application and a resume.
16.12	Compose and type a letter of resignation.
16.13	Demonstrate job interview skills.
16.14	Identify methods for securing an employment reference.
17.0	Perform general organizational computing workplace competencies. The student will be able to:

17.01	Follow oral and written instructions.
17.02	Prepare, outline, and deliver a short oral presentation, including visual aids.
17.03	Participate in group discussion as a member and as a leader.
17.04	Obtain appropriate information from graphics, maps, or signs.
17.05	Demonstrate self-motivation and responsibility to complete an assigned task.
17.06	List the steps in solving a problem.
17.07	Choose appropriate action in situations requiring effective time management.
17.08	Identify and discuss issues contained within professional codes of conduct.
17.09	Identify and discuss property rights and licensing issues.
17.10	Identify and discuss privacy issues.
17.11	Identify and discuss encryption issues.
17.12	Identify legal liability issues.
17.13	Describe appropriate measures for planning and managing a large project.
17.14	Define an implementation schedule for a large project.
17.15	Describe appropriate measures for planning and implementing corporate wide upgrade of hardware and software.
17.16	Identify potential sources of employee/employer or employee/employer conflict and discuss possible approaches to resolve such disagreements.
17.17	Use appropriate communication skills, courtesy, manners, and dress in the workplace.
17.18	Apply principles and techniques for being a productive, contributing member of a team.
17.19	Identify and use acceptable strategies for resolving conflict in the workplace.
17.20	Apply principles and techniques for working productively with people of diverse cultures and backgrounds.
17.21	Identify techniques for stress management and prevention of job burn-out.
17.22	Use appropriate communication skills, telephone etiquette, courtesy, and manners when dealing with customers.
17.23	Communicate effectively with individuals lacking a technical background.
17.24	Identify examples of effective end-user training strategies and techniques.

Additional Information

Laboratory Activities

Laboratory activities are an integral part of this program. These activities include instruction in the use of safety procedures, tools, equipment, materials, and processes related to these occupations. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Articulation

To be transferable statewide between institutions, this program must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific articulation agreements with each other.

The following PSAV programs have been approved by the Florida State Board of Education for statewide articulation credit into this degree program.

Web Design (B070500) – 9 credits

Web Programming Services (B079200) – 9 credits

The following industry certifications have been approved by the Florida State Board of Education for statewide articulation credit into this degree program.

Adobe Certified Associate - Dreamweaver (ADOBE010) – 3 credits

Adobe Certified Associate - Flash (ADOBE011) – 3 credits

Certified Internet Web (CIW) – Associate Design Specialist (PROSO001) – 6 credits

Certified Internet Web (CIW) – Master Designer (PROSO004) – 6 credits

Microsoft Certified Professional Developer (MCPD) – ASP.NET Developer (MICRO062) – 3 credits

Microsoft Certified Professional Developer (MCPD) – Web Developer (MICRO043) – 3 credits

Program Length

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The standard length of this program is 60 credit hours according to Rule 6A-14.030, F.A.C.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Information Technology Administration (0511010307) – 18 credit hours

Web Development Specialist (0511080103) – 35/36 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: Network Systems Technology
Career Cluster: Information Technology

AS	
CIP Number	1511100112
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1122 – Information Security Analysts 15-1142 – Network and Computer Systems Administrators 15-1152 – Computer Network Support Specialists

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as cabling specialists, network control operators, data communications analysts, network technicians, computer security specialists, network specialists, network managers, network systems analysts, network systems technicians, network troubleshooters, WAN/LAN managers, or systems administrators in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to planning, installing, configuring, monitoring, troubleshooting, and managing computer networks in a LAN/WAN environment. Students will be prepared to apply conceptual, theoretical and practical knowledge to the workplace utilizing technical skills learned during the program.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of core standards and eight different tracts to permit students to specialize in network administration, network infrastructure, network virtualization, network security/cybersecurity, IP communications, digital forensics, advanced network infrastructure. Or Linux system administrator. Standards comprising each specialization area are completed in addition to the core standards. Due to the foundational nature of the core, it is recommended that students complete the core, or demonstrate a mastery of the student performance standards contained in the core, before advancing to courses comprising a specialization tract. Standards in the core prepare students with

requisite foundational knowledge and skills related to computer maintenance and support, networking fundamentals, operating systems, network security, technical communications, and project management. The total Associate in Science degree program consists of 60 credit hours.

In addition, students will complete the standards in one of the following specializations:

Specialization Track	SOC Code	Page
Network Administration	15-1142/15-1152	11
Network Infrastructure	15-1142/15-1152	16
Network Security/Cybersecurity	15-1122	21
Network Virtualization	15-1142/15-1152	22
Digital Forensics	15-1142/15-1152	25
IP Communications	15-1142/15-1152	30
Advanced Network Infrastructure	15-1142/15-1152	33
Linux System Administrator	15-1142/15-1152	39

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate proficiency in basic computer maintenance and support.
- 02.0 Demonstrate a fundamental understanding of computer networking.
- 03.0 Demonstrate an understanding of common operating system concepts and associated practices.
- 04.0 Demonstrate fundamental proficiency in network security essentials.
- 05.0 Demonstrate proficiency in technical communications and workplace protocols.
- 06.0 Demonstrate a basic understanding of project management concepts and processes.
- 07.0 Demonstrate workplace-readiness skills.

In addition, students will complete the standards in one of the following specializations:

Network Administration Specialization Standards

- 08.0 Demonstrate an understanding of the directory services infrastructure and installation.
- 09.0 Demonstrate an understanding of organizational units and related objects.
- 10.0 Demonstrate an understanding of group policy.
- 11.0 Demonstrate an understanding of implementing sites to manage Active Directory replication.
- 12.0 Demonstrate an understanding of maintaining Active Directory services availability.
- 13.0 Demonstrate how to install and deploy a server operating system.
- 14.0 Demonstrate how to provide infrastructure services
- 15.0 Demonstrate how to provide file and print services.
- 16.0 Demonstrate how to provide remote and wireless network access.
- 17.0 Demonstrate how to monitor and maintain network servers and services.
- 18.0 Demonstrate an understanding of securing data transmission and authentication.
- 19.0 Demonstrate an understanding of planning for business continuity and high availability.

Network Infrastructure Specialization Standards

- 08.0 Demonstrate understanding of routing concepts.
- 09.0 Demonstrate understanding of routing protocols.
- 10.0 Demonstrate router configuration skills.
- 11.0 Demonstrate an understanding of LAN design and concepts.
- 12.0 Demonstrate VLAN configuration skills.
- 13.0 Demonstrate an understanding of wide area networks (WAN).
- 14.0 Demonstrate WAN configuration skills.
- 15.0 Demonstrate an understanding of network security.
- 16.0 Demonstrate an understanding of remote access.

- 17.0 Demonstrate an understanding of IP addressing services.
- 18.0 Demonstrate an understanding of network maintenance, support and troubleshooting.

Network Security/Cybersecurity Specialization Standards

- 08.0 Demonstrate proficiency in securing network infrastructures and protecting data.
- 09.0 Demonstrate proficiency in performing security penetration testing.
- 10.0 Demonstrate proficiency in responding to security incidents.

Network Virtualization Specialization Standards

- 08.0 Demonstrate an understanding of virtualization concepts.
- 09.0 Install and configure the virtualization server platform.
- 10.0 Install, configure and manage virtualized clients.
- 11.0 Install, configure, and maintain a virtualized application.
- 12.0 Demonstrate proficiency in managing a virtualization infrastructure.
- 13.0 Demonstrate proficiency in securing a virtualization infrastructure.

Digital Forensics Specialization Standards

- 08.0 Demonstrate proficiency in basic and advanced security concepts.
- 09.0 Demonstrate proficiency in managing hardware involved in imaging and data collection activities.
- 10.0 Demonstrate proficiency in analyzing common file systems.
- 11.0 Demonstrate proficiency in performing computer forensics investigations.
- 12.0 Demonstrate proficiency in performing mobile device forensics.
- 13.0 Demonstrate proficiency in incident handling and response.
- 14.0 Identify key pieces of legislation and processes related to digital forensics.
- 15.0 Demonstrate an understanding of the tasks related to the casework process.

IP Communications Specialization Standards

- 08.0 Demonstrate an understanding of IP communication theory.
- 09.0 Demonstrate an understanding of digitizing voice traffic and voice compression standards.
- 10.0 Demonstrate an understanding of quality of service (QoS) requirements in a converged data and voice network.
- 11.0 Demonstrate an understanding of IP communications design.
- 12.0 Demonstrate an understanding of troubleshooting procedures for IP communications.
- 13.0 Demonstrate an understanding of utilizing advanced Voice over IP (VoIP) and data bundle solutions to provide a single network connection for phone services and high-speed Internet.
- 14.0 Demonstrate an understanding of using Statistical Analysis System (SAS) sessions to exchange data by using the TCP/IP communications access method.
- 15.0 Demonstrate how to configure VoIP fax applications for universal access servers.
- 16.0 Demonstrate an understanding of key concepts for Video over IP.

Advanced Network Infrastructure Specialization Standards

- 08.0 Demonstrate an understanding of routing concepts.
- 09.0 Demonstrate an understanding of routing protocols.
- 10.0 Demonstrate router configuration skills.
- 11.0 Demonstrate an understanding of LAN design and concepts.
- 12.0 Demonstrate VLAN configuration skills.
- 13.0 Demonstrate an understanding of network maintenance, support and troubleshooting.

Linux System Administrator Specialization Standards

- 08.0 Understand and use essential tools.
- 09.0 Operate running systems.
- 10.0 Configure local storage.
- 11.0 Create and configure file systems.
- 12.0 Deploy, configure, and maintain systems.
- 13.0 Manage users and groups.
- 14.0 Manage security.

Florida Department of Education
Student Performance Standards

Program Title: Network Systems Technology
 CIP Number: 1511100112
 Program Length: 60 credit hours
 SOC Code(s): 15-1122, 15-1142, 15-1152

Refer to Rule 6A-14.030 (4) F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate proficiency in basic computer maintenance and support. The student will be able to:
01.01	Describe the main computer components and their functions.
01.02	Describe the operation of computer systems, including input and output systems, file systems, device management, program loading and execution and data storage.
01.03	Describe and identify the safe and ethical use of computers.
01.04	Describe and identify proficiency in connecting to and safely using the Internet.
01.05	Describe emerging computer technologies and discuss their potential impact.
01.06	Implement proper procedures for handling and safeguarding equipment.
01.07	Describe procedures for proper disposal of computer components.
01.08	Install, configure, maintain and secure computer systems and peripherals following institutional protocol.
01.09	Configure and update firmware and ROM-BIOS.
01.10	Implement work order procedures.
01.11	Design and implement systems redundancy and data backups.
01.12	Describe effective troubleshooting strategies and techniques to resolve basic hardware, software, and network problems.
01.13	List the steps in problem solving.
01.14	Recognize and resolve basic computer configuration problems.
01.15	Examine and identify the parts of the Windows Registry.
02.0	Demonstrate a fundamental understanding of computer networking. The student will be able to:

02.01	Explain the use of binary numbers and perform related binary and hexadecimal arithmetic.
02.02	Describe current network environments.
02.03	Describe network communications and architecture.
02.04	Identify network components, media, connectors, applications and protocols.
02.05	Compare and contrast the OSI and TCP/IP reference models and their layers.
02.06	Identify and describe current relevant IEEE network standards.
02.07	Create an IP addressing scheme using Variable Length Subnet Masks (VLSM) and Classless Inter-Domain Routing (CIDR).
02.08	Identify and discuss issues related to networked environments, such as security, access control, fair use, privacy and redundancy.
02.09	Identify and discuss issues related to naming conventions for user IDs, email, passwords, and network hosts and devices.
02.10	Identify standard network topologies and describe the advantages and disadvantages of each topology.
02.11	Describe the major functions of LAN protocols.
02.12	Explain the functions of wireless components, standards, hardware, software, and infrastructure design.
02.13	Configure and manage the TCP/IP protocol stack.
02.14	Describe how TCP and UDP Port addresses, IP addresses, and MAC addresses function, and how they are used to deliver data across the network.
02.15	Identify emerging technologies and discuss related technical issues.
02.16	Design a local area network (LAN), including the specification of architecture, hardware and software.
02.17	Identify the advantages and use of virtual local area networks (VLANs).
02.18	Identify and explain wide area network (WAN) concepts.
02.19	Plan, configure and test a small network and establish baselines.
02.20	Describe the major functions of network server software components.
02.21	Install applications on a server and configure clients for network access.
03.0	Demonstrate an understanding of common operating system concepts and associated practices. The student will be able to:

03.01	Describe the components and functions of major operating systems.
03.02	Compare and contrast major functions and features of current network operating systems (including directory services).
03.03	Install, configure and update client and server operating systems.
03.04	Describe the purpose and uses of computer virtualization.
03.05	Manage device drivers and software for peripheral devices.
03.06	Manage the network and firewall settings of a client.
03.07	Use an operating system for activities such as data and file management.
03.08	Identify current systems utilities and describe their functions.
03.09	Use system software to perform routine maintenance tasks such as backup and hard drive defragmentation.
03.10	Create, use, maintain, backup and restore system configuration files.
03.11	Describe procedures for uninstalling operating system software.
03.12	Install and configure client software for connecting to LANs, WANs, and the Internet.
03.13	Demonstrate knowledge of basic troubleshooting methodology.
04.0	Demonstrate fundamental proficiency in network security essentials. The student will be able to:
04.01	Describe common security threats to, and vulnerabilities of, computer systems and the corresponding best practices for mitigation.
04.02	Define and describe malicious software and techniques to protect systems from its effects.
04.03	Describe Denial of Service attacks and means to defend against them.
04.04	Identify the risks and techniques of data loss and its prevention.
04.05	Describe the principles and techniques of securing data storage and transmission.
04.06	Identify current encryption and authentication standards.
04.07	Describe security policies, including compliance and operational security.
04.08	Configure access control, identity management and security logging.
04.09	Describe client and network system security software and related updates.

04.10	Describe the functions and characteristics of firewalls.
04.11	Perform a ping sweep to identify network hosts.
04.12	Perform a port scan to probe network hosts for open TCP and UDP ports.
04.13	Describe the purpose and operation of network protocol analyzers.
04.14	Utilize a network protocol analyzer to capture and analyze network traffic for security issues.
05.0	Demonstrate proficiency in technical communications and workplace protocols. The student will be able to:
05.01	Identify issues in the communication of technical information to a non-technical audience.
05.02	Create, utilize, and maintain system documentation.
05.03	Utilize online resources to locate and evaluate technical information and documentation.
05.04	Identify and discuss issues contained within professional codes of conduct.
05.05	Prepare and deliver a technical presentation.
05.06	Create and interpret technical and business communications.
05.07	Demonstrate the basic principles of teamwork and the techniques for being a productive and effective contributing member of a team.
05.08	Identify and describe acceptable strategies for resolving conflicts in the workplace.
05.09	Deliver and follow oral and written technical instructions.
05.10	Describe the roles of the network specialist in a business enterprise.
05.11	Document problems and solutions in service reports and maintain proper documentation.
05.12	Perform research on technical issues using Internet and database resources.
06.0	Demonstrate a basic understanding of project management concepts and processes. The student will be able to:
06.01	Examine the organization, planning, and controlling of projects.
06.02	Define Project Integration Management.
06.03	Describe project phases, process groups, and the full project life cycle.
06.04	Choose appropriate actions in situations that require effective time management. Understand the basic tools and techniques to plan, organize, and manage a project.

06.05	Describe a project life cycle from initiation to planning through execution, acceptance, support, quality, budgeting, and closure.
06.06	Explain the factors contributing to risk management planning.
06.07	Explain the project environment including: cultural, social, international, political and physical.
06.08	Describe the principles of identifying, developing, and managing resources.
06.09	Plan and monitor a project budget and schedule using project management tools.
06.10	Explain the technical and human aspects of project control, especially change control.
06.11	Describe the basic tools and techniques of managing project quality and risk.
06.12	Explain the contextual relationship between the project and the organization that hosts the project.
06.13	Demonstrate an understanding of the importance of working in teams, managing team members, and interacting with stakeholders.
06.14	Explain the importance of ethical considerations in every aspect of a project's operation.
07.0	Demonstrate workplace-readiness skills. The student will be able to:
07.01	Explain the value of proper communication in the classroom and workplace environment.
07.02	Participate in group discussions as a member and as a leader.
07.03	Explain the importance of self-motivation and responsibility in completing assigned tasks.
07.04	Choose appropriate actions in situations requiring effective time management.
07.05	Apply principles and techniques for being a productive, contributing member of a team.
07.06	Discuss the ethical aspects of intellectual property rights and licensing issues.
07.07	Identify and discuss issues contained within professional codes of conduct.
07.08	Describe appropriate communication skills, courtesy, manners, and dress in the workplace.

Network Administration Specialization Standards

08.0 Demonstrate an understanding of the directory services infrastructure and installation. The student will be able to:

08.01 Describe the architecture of Active Directory.

08.02 Discuss how Active Directory works.

08.03 Describe the Active Directory design, plan, and implementation processes.

08.04 Create a forest and domain structure.

08.05 Configure the Domain Name Service (DNS) in an Active Directory environment.

08.06 Raise the functional level of a forest and a domain.

08.07 Create trust relationships between domains.

08.08 Create, manage, and delegate administrative control for organizational units.

09.0 Demonstrate an understanding of organizational units and related objects. The student will be able to:

09.01 Discuss user, group, and computer accounts.

09.02 Create and manage multiple accounts.

09.03 Implement user principal name suffixes.

09.04 Move objects in Active Directory.

09.05 Plan an account strategy.

09.06 Plan an Active Directory audit strategy.

10.0 Demonstrate an understanding of group policy. The student will be able to:

10.01 Create and configure group policy objects (GPOs).

10.02 Configure group policy refresh rates and group policy settings.

10.03 Manage GPOs.

10.04 Verify and troubleshoot group policy.

10.05 Delegate administrative control of group policy.

10.06	Plan a group policy strategy for the enterprise.
10.07	Configure, deploy and maintain applications using group policy.
10.08	Monitor and maintain security policies.
10.09	Prepare and implement group policy strategy and backup/recovery of group policy objects.
11.0	Demonstrate an understanding of implementing sites to manage Active Directory replication. The student will be able to:
11.01	Discuss directory services replication.
11.02	Design and document site topology.
11.03	Manage site topology.
11.04	Troubleshoot replication failures.
11.05	Plan, create and configure a site.
11.06	Implement the global catalog in Active Directory.
11.07	Plan and determine the placement and type of domain controllers in Active Directory.
11.08	Identify the various Operations Master Roles and Global Catalog.
11.09	Plan the placement of Operations Masters and Global Catalog.
11.10	Transfer and seize Operations Master Roles.
12.0	Demonstrate an understanding of maintaining Active Directory services availability. The student will be able to:
12.01	Create an Active Directory implementation plan for a business enterprise.
12.02	Implement the Active Directory infrastructure for a business enterprise.
12.03	Describe the maintenance of the Active Directory.
12.04	Move and defragment an Active Directory database.
12.05	Backup and restore an Active Directory.
12.06	Monitor an Active Directory.

13.0	Demonstrate how to install and deploy a server operating system. The student will be able to:
13.01	Identify server operating system (OS) versions, editions, features and capabilities.
13.02	Assess server installation readiness by inventorying hardware.
13.03	Describe the methods, options and requirements for a Windows server installation and upgrade.
13.04	Perform an attended and an unattended OS installation.
13.05	Configure basic network settings.
13.06	Configure storage.
13.07	Configure operating systems licensing.
13.08	Describe, identify and choose server roles and role services.
13.09	Perform a system review and troubleshoot installation issues.
13.10	Discuss the system installation.
13.11	Automate server deployments using unattended installation tools and Windows.
13.12	Implement deployment services.
14.0	Demonstrate how to provide infrastructure services. The student will be able to:
14.01	Describe the purpose and function of Dynamic Host Configuration Protocol (DHCP).
14.02	Install, configure, and authorize the DHCP server role.
14.03	Manage, backup and restore the DHCP Database.
14.04	Configure the DHCP Relay Agent.
14.05	Describe the DNS name resolution process.
14.06	Configure DNS zones, records and replication.
14.07	Integrate DNS servers with Active Directory.
14.08	Configure name resolution for client computers.

15.0	Demonstrate how to provide file and print services. The student will be able to:
15.01	Design a file sharing strategy.
15.02	Install the file and print server roles and services.
15.03	Manage file sharing security, encryption, redundancy, and offline access.
15.04	Manage disk quotas, file screening and shadow copy services.
15.05	Backup and restore files.
15.06	Configure Distributed File System (DFS) roots, targets and replication.
15.07	Identify and install print drivers.
15.08	Manage printer security, priorities, schedules and pools.
15.09	Publish printers and file shares to Active Directory.
15.10	Monitor and troubleshoot print and file services.
16.0	Demonstrate how to provide remote and wireless network access. The student will be able to:
16.01	Compare and contrast remote access protocols, wireless standards and network authentication methods.
16.02	Configure static and dynamic routing, Network Address Translation (NAT).
16.03	Configure remote access services, protocols and policies, conditions and settings.
16.04	Configure Remote Access Dial-In User Service (RADIUS).
17.0	Demonstrate how to monitor and maintain network servers and services. The student will be able to:
17.01	Monitor and compare network and server performance data to establish and document baselines, isolate problems and optimize performance, adaptability, and scalability.
17.02	Optimize traffic flow conditions on network connections based on analysis of traffic types, characteristics and user needs.
17.03	Monitor event logs for information, errors and warnings.
17.04	Maintain system documentation and service histories.
17.05	Configure server and client settings to implement patch management strategy.
17.06	Develop strategies for remote server management using command-line and GUI tools.

18.0	Demonstrate an understanding of securing data transmission and authentication. The student will be able to:
18.01	Explain the social, ethical and technical issues regarding data integrity and confidentiality.
18.02	Secure network traffic using IPSec.
18.03	Configure network authentication.
18.04	Install, configure and manage certificate services.
18.05	Describe and deploy a network access protection strategy.
18.06	Configure firewall settings.
18.07	Identify ports and protocols and create filters for incoming and outgoing traffic.
19.0	Demonstrate an understanding of planning for business continuity and high availability. The student will be able to:
19.01	Discuss virtualization architectures.
19.02	Estimate data storage requirements.
19.03	Select a storage technology.
19.04	Plan for storage fault tolerance.
19.05	Develop strategies to ensure application and service availability.
19.06	Plan for backup and recovery of data, servers, and directory services.

Network Infrastructure Specialization Standards

08.0 Demonstrate an understanding of routing concepts. The student will be able to:

08.01 Describe the purpose, architecture, and operations of a router.

08.02 Identify the hardware and software components of routers.

08.03 Explain the purpose and nature of routing tables.

08.04 Describe administrative distance and routing metrics such as hop counts and cost.

08.05 Describe how a router determines a path and switches packets.

08.06 Differentiate between static and dynamic routing.

08.07 Explain the differences between class-full and classless routing.

08.08 Describe the use and operation of VLSM and CIDR.

08.09 Describe how a network converges.

09.0 Demonstrate an understanding of routing protocols. The student will be able to:

09.01 Describe the characteristics of distance vector routing protocols.

09.02 Describe the characteristics of link state routing protocols.

09.03 Describe the differences between distance vector and link state routing protocols and determine the best routing protocol to use in a given situation.

09.04 Describe the features and operation of current internal and external routing protocols.

10.0 Demonstrate router configuration skills. The student will be able to:

10.01 Configure and verify router interfaces.

10.02 Perform basic router configuration using the Command Line Interface (CLI) to inspect the operations of the router.

10.03 Design and implement a classless IP addressing scheme for a network.

10.04 Configure a router for RIP version 2 operation.

10.05 Use advanced configuration commands with routers.

10.06 Configure a router for OSPF routing in a network.

10.07	Fine-tune OSPF settings on a router, including the configuration of reference bandwidth, redistribution of static and default routes, and modification of OSPF intervals, in order to optimize network performance.
10.08	Verify and troubleshoot router operations in an OSPF network.
10.09	Configure and modify metric on a router to improve network performance.
10.10	Configure summarization and default route settings on a router to optimize network performance.
10.11	Verify and troubleshoot router operations in complex network environment.
11.0	Demonstrate an understanding of LAN design and concepts. The student will be able to:
11.01	Identify the layers and functions of switched network architecture.
11.02	Describe the principles and benefits of a hierarchical network design.
11.03	Explain the technology and media access control method for Ethernet networks.
11.04	Describe the issues associated with Layer 2.
11.05	Describe the operation of a LAN switch.
11.06	Describe the benefits of Virtual Local Area Networks (VLAN).
11.07	Identify and describe the different VLAN encapsulation protocols and their operation.
11.08	Describe the purpose and operation of VLAN Trunking Protocol (VTP) in the management of a switched network domain.
11.09	Describe the purpose and operation of Spanning Tree Protocol (STP), and its variants.
11.10	Describe the use of Inter-VLAN routing to connect different Networks in a switch-based network topology.
11.11	Analyze business requirements and design a LAN structure to meet those requirements.
11.12	Discuss quality-of-service considerations and switching prioritization.
12.0	Demonstrate VLAN configuration skills. The student will be able to:
12.01	Perform and verify initial LAN switch configuration tasks including remote access management, switch port modes, and trunks.
12.02	Configure, verify, and troubleshoot VLANs on a LAN switch.
12.03	Implement a VLAN Domain by configuring LAN switches for VTP network operation.
12.04	Configure a router to provide Inter-VLAN routing using multiple physical interfaces, and on a single physical interface with sub-interfaces.

12.05	Configure and troubleshoot STP and its variants on a switched network environment.
12.06	Configure and verify the bridge to optimize STP.
12.07	Establish and configure port priorities.
12.08	Troubleshoot and resolve issues with STP operations.
12.09	Manage router and switch OS software.
13.0	Demonstrate an understanding of wide area networks (WAN). The student will be able to:
13.01	Describe WAN and MAN topologies.
13.02	Differentiate between WAN and LAN topologies.
13.03	Identify and describe WAN protocols.
13.04	Describe the impact of applications (Voice Over IP, Video Over IP) on a network.
13.05	Identify major network issues associated with the Internet, intranets and extranets.
13.06	Explain the differences between the use of leased lines, packet-switched, and circuit-switched technologies.
13.07	Describe typical WAN links and discuss bandwidth considerations.
13.08	Identify and manage licensing.
14.0	Demonstrate WAN configuration skills. The student will be able to:
14.01	Configure and verify Point-to-Point WAN connection.
14.02	Configure and verify a packet switched WAN connection.
14.03	Configure and verify a basic WAN serial connection and a PPP connection between routers.
14.04	Configure and verify a PPP connection between routers.
14.05	Troubleshoot WAN implementation issue.
14.06	Implement LAN/WAN connections, including virtual private networks (VPN), and tunneling.

15.0	Demonstrate an understanding of network security. The student will be able to:
15.01	Implement basic switch security measures such as port security, trunk access, and management VLANs.
15.02	Identify current network security threats and explaining how to implement a comprehensive security policy to mitigate common threats to network devices, hosts, and applications.
15.03	Describe the functions of common security appliances and applications.
15.04	Implement recommended security practices to secure network devices.
15.05	Discuss the functions of authentication servers.
15.06	Describe the function and use of Access Control Lists (ACLs).
15.07	Verify, monitor, and troubleshoot ACLs in a network environment.
16.0	Demonstrate an understanding of remote access. The student will be able to:
16.01	Compare and contrast remote access protocols, wireless standards and network authentication methods.
16.02	Configure static and dynamic routing and Network Address Translation (NAT).
16.03	Configure remote access services, protocols and policies, conditions and settings.
16.04	Describe Remote Access Dial-In User Service (RADIUS).
16.05	Monitor and troubleshoot remote access.
17.0	Demonstrate an understanding of IP addressing services. The student will be able to:
17.01	Describe the purpose and operation of DHCP and DNS in a networked environment.
17.02	Configure, verify, and troubleshoot DHCP and DNS operation on a router.
17.03	Describe the operation and use of NAT and Port Address Translation (PAT) to provide Internet access to Private IP Address networks.
17.04	Configure, verify, and troubleshoot NAT on a router, including static translation, use of IP Address pools, and sharing a public IP address on a router interface.
17.05	Describe the purpose and operation of IPv6.
17.06	Configure, verify, and troubleshoot IPv6 routing in a network.

18.0	Demonstrate an understanding of network maintenance, support and troubleshooting. The student will be able to:
18.01	Identify, interpret and maintain network documentation, procedures and practices.
18.02	Describe effective troubleshooting strategies and techniques to resolve basic hardware, software, and network problems.
18.03	Follow standard operating procedures for troubleshooting hardware and software.
18.04	Manage, maintain and backup router and switch system and configuration files.
18.05	Recognize and resolve hardware and software configuration problems.
18.06	Identify and resolve common network problems at Layers 1, 2, 3, and 7 using a layered model approach. Describe the use and features of diagnostic test equipment.
18.07	Determine type of programs and procedures required to: baseline network performance, identify intrusion and unacceptable system use, identify performance issues, predict system failures, and optimize network availability.
18.08	Use network monitoring and management tools effectively to integrate and manage network resources.
18.09	Explain SNMP and its use in monitoring a network.
18.10	Configure network devices to send SNMP traps or alerts to network management systems.
18.11	Establish and document a network baseline.
18.12	Compare and analyze initial performance measurements with the availability of critical network devices and connections to determine the difference between abnormal behavior and proper network performance as the network grows or traffic patterns change.
18.13	Describe optimization of traffic flow conditions on network connections based on analysis of traffic types, characteristics and user needs.

Network Security/Cybersecurity Specialization Standards

08.0 Demonstrate proficiency in securing network infrastructures and protecting data. The student will be able to:

08.01 Explain the major categories of computer crimes and attacks.

08.02 Identify vulnerabilities inherent in network devices, protocols and services.

08.03 Develop institutional security policies and practices in compliance with relevant governmental standards and regulations.

08.04 Implement protective measures in securing critical information assets.

08.05 Deploy various network security related equipment including, firewalls, intrusion prevention systems, and proxies.

08.06 Secure critical network services such as Directory Services, Domain Name Service (DNS), Dynamic Host Configuration Protocol (DHCP), and File Transfer Protocol (FTP).

08.07 Secure desktop client operating systems against viruses, malware and other malicious attacks.

08.08 Detect malicious and abnormal activities through logs, intrusion detection systems and other utilities and appliances.

09.0 Demonstrate proficiency in performing security penetration testing. The student will be able to:

09.01 Identify organizational compliance with regulatory and legislative Information Assurance (IA) requirements.

09.02 Identify physical and logical weaknesses in computers and networks as well as physical weaknesses and weaknesses in policies, procedures and practices relating to the network and the organization.

09.03 Test the network perimeter defense mechanisms to ensure boundaries.

09.04 Simulate methods that intruders use to gain unauthorized access to an organization's networked systems and attempted to compromise them.

09.05 Deploy proprietary and/or open source tools to test known technical vulnerabilities in networked systems.

09.06 Determine which vulnerabilities are exploitable and the degree of information exposure or network control that the organization could expect an attacker to achieve after successfully exploiting vulnerability.

09.07 Recommend procedures to mitigate against discovered vulnerabilities and security gaps.

09.08 Prepare penetration testing deliverables including reports, documentations.

09.09 Describe the ethics of a licensed Penetration Tester.

10.0 Demonstrate proficiency in responding to security incidents. The student will be able to:

10.01 Explain contingency planning and its components.

10.02 Collect data from logs and other resources to aid in detecting security incidents.

10.03 Assemble an incident response plan.

10.04 Recover from incidents by restoring services and processes.

10.05 Manage evidentiary data in an electronic environment.

Network Virtualization Specialization Standards

08.0 Demonstrate an understanding of virtualization concepts. The student will be able to:

08.01 Describe the purpose, uses and software features of computer virtualization.

08.02 Identify and describe virtualization products, applications and services.

08.03 Identify compatibility issues among hardware and software products.

08.04 Identify the elements necessary for a Virtual Desktop Infrastructure.

08.05 Explain the benefits and considerations for virtual storage, including local host disk, iSCSI SAN, Fibre Channel SAN, and NFS SAN.

08.06 Explain storage architectures, including storage subsystems, DAS, SAN, NAS, and CAS.

08.07 Describe backup, recovery, disaster recovery, business continuity, and replication concepts.

08.08 Describe the policies and profile management which restrict and allow features.

08.09 Identify and modify desktop catalogs, groups, and a master virtual machine.

09.0 Install and configure the virtualization server platform. The student will be able to:

09.01 Install and configure the virtualization platform.

09.02 Install and configure the virtualization environment to create a new farm or join an existing farm.

09.03 Automate virtual machine and cluster deployment.

09.04 Monitor and maintain license usage requirements and trends.

09.05 Manage virtualization networking and storage.

09.06 Manage user sessions from the administrative console.

09.07 Configure network connectivity and storage for the virtualization software.

10.0 Install, configure and manage virtualized clients. The student will be able to:

10.01 Identify requirements for virtual machines according to task.

10.02 Configure the virtual environment and the virtual machine properties.

10.03 Install, configure and manage a virtual machine desktop client and a virtualized server.

10.04	Manually deploy and migrate virtual machines.
10.05	Configure and assign users to pooled virtual desktops and dedicated virtual desktops.
10.06	Convert physical machines to virtual machines.
10.07	Configure desktop resources for access by users.
10.08	Configure and monitor back up virtual machine data to shared storage.
10.09	Migrate, convert, and monitor virtual machines.
10.10	Create and update shared disks.
11.0	Install, configure, and maintain a virtualized application. The student will be able to:
11.01	Install and configure a virtualized application.
11.02	Configure virtualization applications to use a proxy.
11.03	Configure virtualized application resources for access by users.
11.04	Install and use profiling software on a virtualized application for streaming, and linking dependent profiles to allow interaction between streamed applications.
11.05	Monitor virtualization applications and implementing policies.
11.06	Migrate, convert, and monitor virtual appliances.
11.07	Test policies to verify the achievement of the desired effect.
11.08	Configure and deliver a plug-in package, and verifying that self-service applications can be added from a client device.
11.09	Install and configure provisioning services.
11.10	Optimize a provisioning services server.
11.11	Describe end user optimization techniques.
12.0	Demonstrate proficiency in managing a virtualization infrastructure. The student will be able to:
12.01	Manage user access to virtualized applications and machines in the virtualization infrastructure.
12.02	Manage the infrastructure to provide high availability and data access.
12.03	Describe administration of the virtualization environment.

12.04	Describe tools that can be used to monitor virtualization application servers and sessions.
12.05	Manage and maintain network infrastructure and storage resources.
12.06	Create and apply worker groups.
12.07	Configure and optimize load management.
12.08	Configure a resource pool for optimal performance.
12.09	Troubleshoot infrastructure problems and virtual environment issues.
12.10	Resolve application compatibility issues.
13.0	Demonstrate proficiency in securing a virtualization infrastructure. The student will be able to:
13.01	Describe the securing and maintenance of a virtualization solution.
13.02	Restrict and protect administrator access to the virtualization solution.
13.03	Ensure that the hypervisor is properly secured.
13.04	Create a plan for the security for a virtualization solution before installing, configuring and deploying it.
13.05	Secure elements of a virtualization solution and maintain their security.

Digital Forensics Specialization Standards

08.0	Demonstrate proficiency in basic and advanced security concepts. The student will be able to:
08.01	Demonstrate an understanding of cybersecurity, including its origins, trends, culture, and legal implications.
08.02	Describe the basic categories of vulnerabilities associated with cybersecurity (i.e., hardware, software, network, human, physical, organizational).
08.03	Describe the role of digital certificates and their role in IT security.
08.04	Describe network-based IDS, its capabilities, and its approaches to detection (i.e., anomaly, signature).
08.05	Describe the use of firewalls and other means of intrusion prevention.
08.06	Describe security design principles and their role in limiting points of vulnerability.
08.07	Discuss authentication methods and strategies.
08.08	Describe the processes involved in hardening a computer system or network.
08.09	Compare and contrast the forms, limitations, and vulnerabilities associated with centralized and decentralized key management schemas, including the PKI web of trust model.
08.10	Evaluate an existing security posture and identify gaps and vulnerabilities in security.
08.11	Describe the types of penetration tests (i.e., human, physical, wireless, data networks, telecommunications), the goals of each type, the metrics tested, and the value of their results.
08.12	Compare and contrast the processes of black box versus white box penetration testing, including their characteristics, limitations, and appropriateness.
08.13	Describe common testing methodologies and standards used in penetration testing.
08.14	Demonstrate proficiency in basic forensic concepts.
08.15	Describe the range of testing/evaluation and associated tools used to monitor mitigation control effectiveness.
08.16	Create a risk management framework.
08.17	Describe the purpose and scope of an Information Systems Contingency Plan (ISCP).
08.18	Identify the five main components of a contingency plan (i.e., Supporting Information, Activation and Notification, Recovery, Reconstitution, and Appendices).
08.19	Describe the purpose and scope of an IT security disaster recovery plan.
08.20	Describe the purpose and scope of an IT security business continuity plan.
08.21	Describe the four phases of forensic analysis and discuss the activities performed in each phase.

08.22	Describe the forensic and evidentiary considerations when determining containment.
08.23	Describe the types and sources of data collected for forensic analysis.
08.24	Explain the various forms of data and associated collection/retrieval tools for the application transport, IP, and link layers.
08.25	Describe the essential elements of forensic analysis.
09.0	Demonstrate proficiency in managing hardware involved in imaging and data collection activities. The student will be able to:
09.01	Discuss the different types of Motherboard Connections.
09.02	Explain the components that comprise a Motherboard and their functions.
09.03	Describe the different types of permanent storage.
09.04	Compare and contrast the different host interface standards.
09.05	Describe how Solid State storage processes differ from traditional storage.
09.06	Discuss the different types of removable media and their impacts on data collection.
09.07	Explain the concepts of RAID including the different Levels and their impacts on the imaging and collection process.
09.08	Compare and contrast the read/write process of both permanent and temporary storage devices.
09.09	Compare the standard boot process to the Forensic/controlled boot process.
10.0	Demonstrate proficiency in analyzing common file systems. The student will be able to:
10.01	Define the Master Boot Record (MBR) and discuss its purpose and any important items that it may contain.
10.02	Explain the purpose of the Boot Parameter Block (BPB) and its components.
10.03	Discuss the different File Systems available in an OS environment. Identify the strengths and weaknesses of each system.
10.04	Explain the process of file creation and deletion in an OS environment including the concept of file artifacts.
10.05	Discuss the formatting process in an OS environment.
10.06	Explain pertinent OS system files related to data storage and their functions.
10.07	Discuss how Windows handles the concept of Date and Time in relation to file management and how it differs from UNIX-like operating systems.
10.08	Define the different file systems that can be used with removable media.

10.09	Explain the concepts of Open and Closed sessions.
11.0	Demonstrate proficiency in performing computer forensics investigations. The student will be able to:
11.01	Create security incident handling and response policies.
11.02	Recover deleted, encrypted, or damaged file information as evidence for civil or criminal cases.
11.03	Deploy proprietary and/or open source tools to identify an intruder's footprints.
11.04	Coordinate incident response activities in cooperation with law enforcement agencies.
11.05	Prepare proper documentations of chain of custody, accounting for where each evidence item originated from, where it is going, and what entity has possession of the evidence.
11.06	Preserve forensic integrity of evidence so they can be admissible in court.
11.07	Describe moral and ethical standards in conducting digital forensics investigations.
12.0	Demonstrate proficiency in performing mobile device forensics. The student will be able to:
12.01	Preserve, acquire, and examine data stored on mobile devices.
12.02	Perform forensic acquisition and examination of SIM cards.
12.03	Apply forensic principles and tools to mobile and IoT devices.
12.04	Demonstrate proficiency in using open-source and proprietary mobile device forensics tools.
12.05	Compare forensic acquisition tools and validate the completeness and accuracy of results.
12.06	Describe forensic acquisition and examination of GPS navigation devices.
12.07	Utilize the results from mobile device forensics for internal investigations or in civic/criminal litigation.
13.0	Demonstrate proficiency in incident handling and response. The student will be able to:
13.01	Design an incident response plan including: assessment, communication, containment, evaluation, recovery, and documentation.
13.02	Describe information-hiding techniques.
13.03	Describe the steps required to collect, seize, and protect evidence.
13.04	Recover data from various storage devices after physical and/or logical damage.
13.05	Search and report on memory in real time with live and system forensics.

13.06	Investigate network traffic using log files, time analysis, sniffers, and other traffic analysis tools.
13.07	Explain the legal considerations to investigating emails as prescribed in the Electronic Communications Privacy Act.
13.08	Identify email tracing techniques in forensic investigations.
14.0	Identify key pieces of legislation and processes related to digital forensics. The student will be able to:
14.01	Describe the importance of creating an accurate representation of the facts.
14.02	Explain the components of the Discovery Process.
14.03	Discuss the 4 th Amendment and its impact on the digital forensics investigative process.
14.04	Identify laws and court cases related to computer forensics and their impacts on the investigation process.
14.05	Identify and explain the basic Federal Rules of Evidence.
14.06	Compare and contrast the different qualifications required to be a licensed computer forensics professional from state to state.
14.07	Define the concept of a subpoena and explain the process of how one is obtained.
14.08	Explain the steps required to acquire a search warrant.
14.09	Discuss the concept of consent and the ways that it can be granted.
14.10	Compare the legal process for civil and criminal cases.
14.11	Define the concept of expert testimony and the process involved in being classified as an expert.
14.12	Discuss appropriate courtroom behavior.
15.0	Demonstrate an understanding of the tasks related to the casework process. The student will be able to:
15.01	Explain the steps involved in maintaining the integrity of digital evidence.
15.02	Discuss the process of creating a forensics image.
15.03	Define hashing and explain its uses in ensuring image authenticity.
15.04	Describe sector slack space and its potential impact on evidence gathering.
15.05	Describe the importance of documenting the examination process.
15.06	Explain control/security access logs for images and their importance in maintaining evidence.

15.07 Describe the steps involved in preparing evidence and documents for trial.

15.08 Explain the procedures involved in creating a digital forensics investigation report including examples of report formats.

15.09 Discuss the importance of the Summation and Analysis sections of the digital investigation report.

IP Communications Specialization Standards

08.0 Demonstrate an understanding of IP communication theory. The student will be able to:

08.01 Describe the supported multivendor hardware platforms for VoIP technology, their limits, and their boundaries.

08.02 Describe how Voice Gateways function in an IP Telephony (IPT) solution.

08.03 Identify and describe the Local Area Network (LAN) switching products useable in an IPT solution.

09.0 Demonstrate an understanding of digitizing voice traffic and voice compression standards. The student will be able to:

09.01 Identify the steps required for analog to digital conversion in a VoIP network.

09.02 Identify the signaling steps required to complete a Public Switched Telephone Network (PSTN) call.

09.03 Define the function of Private Branch eXchanges (PBX) or key systems.

09.04 Configure Foreign eXchange Subscriber (FXS) and Foreign eXchange Office (FXO) interfaces on a Voice Gateway.

10.0 Demonstrate an understanding of Quality of Service (QoS) requirements in a converged data and voice network. The student will be able to:

10.01 Identify the steps required to minimize jitter, packet loss and serialization delay in a VoIP network.

10.02 Explain the function of IP precedence and different Class of Service (CoS) types.

10.03 Identify and list the types of traffic coming into the interface and defining their relative priority.

10.04 Configure a priority or custom queuing list.

11.0 Demonstrate an understanding of IP communications design. The student will be able to:

11.01 Identify the most appropriate gateway in IP communication design.

11.02 Identify and describe dial plan architecture in IP communication design.

11.03 Identify the correct route patterns, filters, and use of wild cards in VoIP design scenarios.

11.04 List available classes of services in IP communication design and their constraints.

11.05 Describe how to use digit manipulation in VoIP design.

11.06 Identify the appropriate QoS tools needed for the proper operation of voice traffic on a network.

12.0	Demonstrate an understanding of troubleshooting procedures for IP communications. The student will be able to:
12.01	Identify the appropriate method for providing redundancy in VoIP design.
12.02	Describe the tools used in troubleshooting IP communication networks.
12.03	Identify and describe the different call flows and series of events through the call traces and debug outputs when troubleshooting.
12.04	List the alarms used in IP communication troubleshooting.
13.0	Demonstrate an understanding of utilizing advanced Voice over IP (VoIP) and data bundle solutions to provide a single network connection for phone services and high-speed Internet. The student will be able to:
13.01	Identify the required bandwidth speeds needed for uninterrupted service and fast uploads and downloads.
13.02	Describe the impact of voice samples, codecs, and packet size on bandwidth.
13.03	Describe on demand use of voice/data and voice prioritization, delivered over a private/secure line.
13.04	Describe features for a VoIP and data bundle.
13.05	Describe VoIP and data bundle used to dynamically alternate between voice and Internet as call volume needs dictate.
14.0	Demonstrate an understanding of using Statistical Analysis System (SAS) sessions to exchange data by using the TCP/IP communications access method. The student will be able to:
14.01	Identify that a SAS/SHARE server ID has been added to the TCP/IP SERVICES file.
14.02	Describe how to invoke SAS sessions utilizing TCP/IP communications access method.
14.03	Describe syntax used to identify port numbers, defined in the client TCP/IP SERVICES file.
15.0	Demonstrate how to configure VoIP fax applications for universal access servers. The student will be able to:
15.01	Describe fax applications that enable universal access servers to send and receive faxes across packet-based networks using modems.
15.02	Describe universal inbox applications for fax and email and how faxes and emails can go to the same mailbox using direct inward dialing.
15.03	Describe how to broadcast a fax to multiple recipients simultaneously.
16.0	Demonstrate an understanding of key concepts for Video over IP. The student will be able to:
16.01	Describe video over IP systems using existing standards to reduce the data to a bitstream and then an IP network to carry the encapsulated data in a stream of IP packets.
16.02	Describe the quality of service requirements which must be fulfilled for use in broadcast carrying video over IP networks.
16.03	Describe bandwidth requirements, the maximum allowable packet loss rate, and approaches to achieve acceptable bandwidth such

as quantity of service, network admission control, bandwidth reservation, traffic shaping, and traffic prioritization techniques.

16.04 Describe latency variation and its effect on making synchronization more complex by making the recovery of the underlying timing of the video signal far more difficult.

Advanced Network Infrastructure Specialization Standards

08.0 Demonstrate an understanding of routing concepts. The student will be able to:

08.01 Describe the purpose, architecture, and operations of a router.

08.02 Identify the hardware and software components of routers.

08.03 Explain the purpose and nature of routing tables.

08.04 Describe administrative distance and routing metrics such as hop counts and cost.

08.05 Describe how a router determines a path and switches packets.

08.06 Differentiate between static and dynamic routing.

08.07 Explain the differences between class-full and classless routing.

08.08 Describe the use and operation of Variable Length Subnet Masks (VLSM) and Classless Inter-Domain Routing (CIDR).

08.09 Describe how a network converges.

09.0 Demonstrate an understanding of routing protocols. The student will be able to:

09.01 Describe the characteristics of distance vector routing protocols.

09.02 Describe the characteristics of link state routing protocols.

09.03 Describe the differences between distance vector and link state routing protocols, and determine the best routing protocol to use in a given situation.

09.04 Describe the features and operation of current internal and external routing protocols.

09.05 Determine network resources needed for implementing various routing protocols.

10.0 Demonstrate router configuration skills. The student will be able to:

10.01 Configure and verify router interfaces.

10.02 Perform basic router configuration and using the Command Line Interface (CLI) to inspect the operations of the router.

10.03 Design and implement a classless IP addressing scheme for a network.

10.04 Use advanced configuration commands with routers.

10.05	Configure OSPF, EIGRP, BGP, eBGP, RIPv2, and RIPv6 routing in a network.
10.06	Fine-tune OSPF settings on a router, including the configuration of reference bandwidth, redistribution of static and default routes, and modification of OSPF intervals, in order to optimize network performance.
10.07	Verify and troubleshoot router operations in an OSPF network.
10.08	Configure and modify metric on a router to improve network performance.
10.09	Configure summarization and default route settings on a router to optimize network performance.
10.10	Verify and troubleshoot router operations in complex network environment.
10.11	Create an EIGRP implementation plan.
10.12	Create an EIGRP verification plan.
10.13	Verify an EIGRP solution was implemented properly using show and debug commands.
10.14	Document and verify results for an EIGRP implementation.
11.0	Demonstrate an understanding of LAN design and concepts. The student will be able to:
11.01	Identify the layers and functions of switched network architecture.
11.02	Describe the principles and benefits of a hierarchical network design.
11.03	Explain the technology and media access control method for Ethernet networks.
11.04	Describe the issues associated with Layer 2.
11.05	Describe the operation of a LAN switch.
11.06	Describe the benefits of Virtual Local Area Networks (VLAN).
11.07	Identify and describe the different VLAN encapsulation protocols and their operation.
11.08	Describe the purpose and operation of VLAN Trunking Protocol (VTP) in the management of a switched network domain.
11.09	Describe the purpose and operation of Spanning Tree Protocol (STP), and its variants.
11.10	Describe the use of Inter-VLAN routing to connect different Networks in a switch-based network topology.
11.11	Analyze business requirements and design a LAN structure to meet those requirements.
11.12	Discuss quality-of-service considerations and switching prioritization.

11.13	Describe a VoIP support solution.
11.14	Describe a video support solution.
11.15	Configure port security features.
11.16	Configure general security features.
12.0	Demonstrate VLAN configuration skills. The student will be able to:
12.01	Perform and verify initial LAN switch configuration tasks including remote access management, switch port modes, and trunks.
12.02	Configure, verify, and troubleshoot VLANs on a LAN switch.
12.03	Implement a VLAN Domain by configuring LAN switches for VTP network operation.
12.04	Configure a Router to provide Inter-VLAN routing using multiple physical interfaces, and on a single physical interface with sub-interfaces.
12.05	Configure and troubleshoot Spanning Tree Protocol and its variants on a switched network environment.
12.06	Configure and verify the bridge to optimize STP.
12.07	Establish and configure port priorities.
12.08	Troubleshoot and resolve issues with STP operations.
12.09	Create a Layer 3 path control implementation plan based upon the results of the redistribution analysis.
12.10	Create a Layer 3 path control verification plan.
12.11	Configure Layer 3 path control.
12.12	Verify that a Layer 3 path control was implemented.
12.13	Document results of a Layer 3 path control implementation and verification plan.
12.14	Describe basic VPN technologies.
12.15	Describe branch access technologies.
12.16	Configure private VLANs.
12.17	Configure VACL and PACL.
12.18	Configure switch-to-switch connectivity for the VLAN based solution.

12.19	Configure loop prevention for the VLAN based solution.
12.20	Configure Access Ports for the VLAN based solution.
12.21	Determine network resources needed for implementing a VLAN based solution on a network.
12.22	Create a VLAN based implementation plan.
12.23	Create a VLAN based verification plan.
12.24	Verify the VLAN based solution was implemented properly using show and debug commands.
12.25	Document the verification after implementing a VLAN solution.
13.0	Demonstrate an understanding of network maintenance, support and troubleshooting. The student will be able to:
13.01	Identify, interpret and maintain network documentation, procedures and practices.
13.02	Describe effective troubleshooting strategies and techniques to resolve basic hardware, software, and network problems.
13.03	Describe standard operating procedures for troubleshooting hardware and software.
13.04	Identify procedures to manage, maintain and backup router and switch system and configuration files.
13.05	Recognize and resolve hardware and software configuration problems.
13.06	Identify and resolve common network problems at layers 1, 2, 3, and 7 using a layered model approach. Describe the use and features of diagnostic test equipment.
13.07	Determine type of programs and procedures required to: baseline network performance, identify intrusion and unacceptable system use, identify performance issues, predict system failures, and optimize network availability.
13.08	Use network monitoring and management tools effectively to integrate and manage network resources.
13.09	Explain RMON and SNMP and their use in monitoring a network.
13.10	Configure network devices to send SNMP traps or alerts to network management systems.
13.11	Establish and document a network baseline.
13.12	Compare and analyze initial performance measurements with the availability of critical network devices and connections to determine the difference between abnormal behavior and proper network performance as the network grows or traffic patterns change.
13.13	Optimize traffic flow conditions on network connections based on analysis of traffic types, characteristics and user needs.
13.14	Determine network resources needed for implementing a switch based Layer 3 solution.
13.15	Create an implementation plan for the switch based Layer 3 solution.

13.16	Create a verification plan for the switch based Layer 3 solution.
13.17	Configure routing interfaces.
13.18	Configure Layer 3 security.
13.19	Verify the switch based Layer 3 solution was implemented properly using show and debug commands.
13.20	Document the verification results after implementing a switch based Layer 3 solution.
13.21	Develop a plan to monitor and manage a network.
13.22	Perform network monitoring using IOS tools.
13.23	Perform routine IOS device maintenance.
13.24	Isolate sub-optimal internetwork operation at the correctly defined OSI Model layer.
13.25	Troubleshoot EIGRP.
13.26	Troubleshoot OSPF.
13.27	Troubleshoot eBGP.
13.28	Troubleshoot routing redistribution solution.
13.29	Troubleshoot a DHCP client and server solution.
13.30	Troubleshoot NAT.
13.31	Troubleshoot first hop redundancy protocols.
13.32	Troubleshoot IPv6 routing.
13.33	Troubleshoot IPv6 and IPv4 interoperability.
13.34	Troubleshoot switch-to-switch connectivity for the VLAN based solution.
13.35	Troubleshoot loop prevention for the VLAN based solution.
13.36	Troubleshoot access ports for the VLAN based solution.
13.37	Troubleshoot private VLANS.
13.38	Troubleshoot port security.

13.39	Troubleshoot general switch security.
13.40	Troubleshoot VACLs and PACLs.
13.41	Troubleshoot switch virtual interfaces (SVIs).
13.42	Troubleshoot switch supervisor redundancy.
13.43	Troubleshoot switch support of advanced services (i.e., Wireless, VoIP, Video).
13.44	Troubleshoot a VoIP support solution.
13.45	Troubleshoot a video support solution.
13.46	Troubleshoot Layer 3 security.
13.47	Troubleshoot issues related to ACLs used to secure access to Cisco routers.
13.48	Troubleshoot configuration issues related to accessing the AAA server for authentication purposes.
13.49	Troubleshoot security issues related to IOS services (i.e., finger, NTP, HTTP, FTP, RCP).

Linux System Administrator Specialization Standards

08.0 Understand and use essential tools. The student will be able to:

08.01 Access a shell prompt and issue commands with correct syntax.

08.02 Use input-output redirection (>, >>, |, 2>). Demonstrate the use of standard-in, standard-out, standard-error, and pipe.

08.03 Demonstrate the use of grep and regular expressions to analyze text.

08.04 Access remote systems using ssh.

08.05 Log in and switch users in multiuser targets.

08.06 Archive, compress, unpack, and uncompress files using a variety of tools.

08.07 Create and edit text files.

08.08 Create, delete, copy, and move files and directories.

08.09 Create hard and soft links.

08.10 List, set, and change standard ugo/rwx permissions.

08.11 Locate, read, and use system documentation including man, info, and files in /usr/share/doc.

09.0 Operate running systems. The student will be able to:

09.01 Boot, reboot, and shut down a system normally.

09.02 Boot systems into different targets manually.

09.03 Interrupt the boot process in order to gain access to a system.

09.04 Identify CPU/memory intensive processes, adjust process priority with renice, and kill processes.

09.05 Locate and interpret system log files and journals.

09.06 Perform various logging related activities such as configuring logging, log rotation and log reporting.

09.07 Access a virtual machine's console.

09.08 Explain the meaning and use of common metrics such as utilization values for CPU, memory, disk space, disk I/O, and network bandwidth.

09.09 Start and stop virtual machines.

09.10	Start, stop, and check the status of network services.
09.11	Securely transfer files between systems.
10.0	Configure local storage. The student will be able to:
10.01	List, create, delete partitions on MBR and GPT disks.
10.02	Create and remove physical volumes, assign physical volumes to volume groups, and create and delete logical volumes.
10.03	Configure systems to mount file systems at boot by Universally Unique ID (UUID) or label.
10.04	Create, use and remove snapshots of logical volumes.
10.05	Add new partitions and logical volumes, and swap to a system non-destructively.
11.0	Create and configure file systems. The student will be able to:
11.01	Create, mount, unmount, and using various file systems.
11.02	Mount and unmount CIFS and NFS network file systems.
11.03	Extend existing logical volumes.
11.04	Discuss set UID and GID.
11.05	Create and manage Access Control Lists (ACLs).
11.06	Diagnose and correct file permission problems.
12.0	Deploy, configure, and maintain systems. The student will be able to:
12.01	Configure networking and hostname resolution statically or dynamically.
12.02	Schedule tasks using at and cron.
12.03	Start and stop services and configure services to start automatically at boot.
12.04	Configure systems to boot into a specific target automatically.
12.05	Perform an unattended system install.
12.06	Configure a physical machine to host virtual guests.
12.07	Install Linux systems as virtual guests.

12.08	Configure systems to launch virtual machines at boot.
12.09	Configure network services to start automatically at boot.
12.10	Configure a system to use time services.
12.11	Install and update software packages from a remote repository or a local file system.
12.12	Update the kernel package appropriately to ensure a bootable system.
12.13	Modify the system bootloader.
13.0	Manage users and groups. The student will be able to:
13.01	Create, delete, and modify local and global user accounts.
13.02	Change passwords and adjust password aging for local and global user accounts.
13.03	Create, delete, and modify local and global groups and group memberships.
13.04	Configure a system to use an existing authentication service for user and group information.
14.0	Manage security. The student will be able to:
14.01	Describe security basic concepts and mechanisms, including encryption, password safety, message digests and system security requirements.
14.02	Demonstrate proper security techniques and monitoring.
14.03	Configure firewall settings using firewall-config, firewall-cmd, or iptables.
14.04	Configure key-based authentication for SSH.
14.05	Set enforcing and permissive modes for SELinux.
14.06	List and identify SELinux file and process context.
14.07	Restore default file contexts.
14.08	Use boolean settings to modify system SELinux settings.
14.09	Diagnose and address routine SELinux policy violations.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

- Network Server Administration (0511100112) – Primary/Secondary: 24/18 hours
- Network Enterprise Administration (0511100113) – Primary/Secondary: 29/26 hours
- Network Infrastructure (0511100114) – Primary/Secondary: 21/16 hours
- Advanced Network Infrastructure (0511100115) – Primary/Secondary: 36/28 hours
- Network Virtualization (0511100116) – Primary: 24/18 hours
- Advanced Network Virtualization (0511100117) – Primary/Secondary: 34/27 hours
- Network Security (0511100118) – Primary/Secondary: 30/20 hours
- Digital Forensics (0511100119) – Primary/Secondary: 32/24 hours
- IP Communications (0511100120) – Primary/Secondary: 32/21 hours
- Network Support Technician (0511100121) – Primary/Secondary: 21/16 hours

Linux System Administrator (0511100122) – Primary/Secondary: 24/21 hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: IT Security
Career Cluster: Information Technology

AS	
CIP Number	1511100307
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1122 – Information Security Analysts

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to work in Internet, intranet, extranet, and enterprise environments; installing, configuring, designing, and managing secure database and E-commerce resources

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate an understanding of computer hardware.
- 02.0 Demonstrate an understanding of networked environments, hardware, and software.
- 03.0 Install and configure secure network systems software and utilities.
- 04.0 Demonstrate proficiency with Internet structure, organization, and navigation.
- 05.0 Demonstrate an understanding of network access control systems and methodology.
- 06.0 Describe cryptography concepts, standards, and applications.
- 07.0 Perform telecommunications and network security activities.
- 08.0 Demonstrate an understanding of Database Management Systems (DBMS).
- 09.0 Perform administrative tasks related to database security.
- 10.0 Demonstrate an understanding of E-commerce.
- 11.0 Perform tasks related to E-commerce security.
- 12.0 Perform webserver and site management activities.
- 13.0 Design and implement physical security measures.
- 14.0 Perform operation and security management practices.
- 15.0 Employ applications and systems development security techniques.
- 16.0 Develop business continuity and disaster recovery plans.
- 17.0 Describe ethical issues, pertinent laws, and how to conduct investigations.
- 18.0 Perform general organizational computing workplace competencies.
- 19.0 Perform project planning and management activities.
- 20.0 Perform documentation and technical reference activities.
- 21.0 Demonstrate employability skills.
- 22.0 Demonstrate professional development skills.

Florida Department of Education
Student Performance Standards

Program Title: IT Security
 CIP Number: 1511100307
 Program Length: 60 credit hours
 SOC Code(s): 15-1122

Refer to Rule 6A-14.030 (4) F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate an understanding of computer hardware. The student will be able to:
01.01	Describe multiple numbering systems used to represent instructions and data.
01.02	Identify the architecture of major hardware platforms.
01.03	Describe the functions of major hardware components of a computer system.
01.04	Discuss the potential impact of emerging hardware technologies.
01.05	Demonstrate the ability to perform preventive maintenance tasks on microcomputer systems.
01.06	Set up and configure computer systems and peripherals.
01.07	Configure the Basic Input/Output System (BIOS) of a computer system.
01.08	Install and configure storage devices, controllers, and network interfaces.
02.0	Demonstrate an understanding of networked environments, hardware, and software. The student will be able to:
02.01	Discuss fundamental network concepts such as topology, protocols, architecture, and internetworking.
02.02	Define all layers in the Open Systems Interconnect (OSI) and Transmission Control Protocol/Internetworking Protocol (TCP/IP) network protocol models.
02.03	Discuss the nature of Internetworking Protocol (IP) addresses and Media Access Control (MAC) addresses, and mapping between protocol addressing schemes.
02.04	Describe the functions and hardware requirements for current popular network servers and services.
02.05	Describe the major functions and hardware requirements of network client hardware components.
02.06	Describe current link technologies such as twisted-pair, coaxial, fiber optic, and wireless.
02.07	Describe the major functions of network connectivity hardware.

02.08	Describe the function of network storage devices, storage area networks (SAN), and other peripherals.
03.0	Install and configure secure network systems software and utilities. The student will be able to:
03.01	Install and configure current leading system software, drivers, and service packs.
03.02	Install, configure and set up a proxy server and a gateway.
03.03	Discuss the functions of authentication protocols and Virtual Private Networks (VPNs).
03.04	Install and configure web servers and related services.
03.05	Use system software to perform routine maintenance tasks such as backup and hard drive defragmentation.
03.06	Install and configure a secure desktop client operating system (OS).
03.07	Describe modifications necessary to an OS such as modifying parameters and how to handle conflicting interrupts when installing, configuring, and upgrading application software.
03.08	Install and configure client software for network-based applications.
03.09	Install and configure current popular network services for servers.
04.0	Demonstrate proficiency with Internet structure, organization, and navigation. The student will be able to:
04.01	Describe Internet structure and administration.
04.02	Describe common Internet services and port numbers.
04.03	Demonstrate the use of internetworking protocols.
04.04	Differentiate between push and pull technologies.
04.05	Demonstrate the use of typical remote access mechanisms.
04.06	Describe the data format and proprietary nature of commonly used Internet file types.
04.07	Demonstrate use of Internet clients and services.
05.0	Demonstrate an understanding of network access control systems and methodology. The student will be able to:
05.01	Describe access control mechanisms and their impact on users, resources, and operations.
05.02	Compare and contrast access control techniques.
05.03	Administer computer, group, and user accounts.
05.04	Manage policies, rights, permissions, and passwords for users and/or groups of users.

05.05	Demonstrate an understanding of various access control models.
05.06	Manage password, PIN selection, maintenance, and control.
05.07	Demonstrate an understanding of methods of identification and authentication.
05.08	Implement centralized/remote authentication access controls.
05.09	Implement and manage decentralized access controls such as domain and trust relationships.
05.10	Analyze and explain methods of server attacks.
05.11	Demonstrate an understanding of the different types of network intrusions and the different methods of detection.
05.12	Monitor the network using various forms of intrusion detection resources to detect attacks.
05.13	Investigate audit logs for signs of network intrusions.
05.14	Find and report weaknesses in the access control system using penetration testing.
06.0	Describe cryptography concepts, standards, and applications. The student will be able to:
06.01	Demonstrate an understanding of the encryption/decryption process.
06.02	Demonstrate an understanding of the basic functions involved in key management.
06.03	Describe methods to achieve confidentiality, integrity, and availability through authentication in a network environment.
06.04	Identify the strengths and weaknesses of cryptographic algorithms and the effects of key length.
06.05	Employ cryptographic algorithms.
06.06	Implement current popular key distribution methods.
06.07	Utilize application and network-based protocols.
06.08	Describe the use of security hardware components.
07.0	Perform telecommunications and network security activities. The student will be able to:
07.01	Utilize protocol layering models.
07.02	Evaluate the security implications associated with the various physical media types.
07.03	Describe security concerns with using various network topologies.
07.04	Configure authentication protocol service(s) that provide dial-in authentication and security.
07.05	Employ network monitors and packet sniffers to identify security threats.
07.06	Implement security measures using network hardware and software.

07.07	Discuss the security vulnerabilities of the TCP/IP protocol stack.
07.08	Configure Network Layer security protocols.
07.09	Configure Transport Layer security protocols.
07.10	Configure Application Layer security protocols.
07.11	Perform connection verification using current authentication protocols.
07.12	Demonstrate an understanding of how wide area network serial line protocols work.
07.13	Implement secure data communication techniques.
07.14	Develop secure email, facsimile, and voice communication procedures to protect against network attacks.
07.15	Employ alarms and signals to alert network security administrators of intrusions.
08.0	Demonstrate an understanding of Database Management Systems (DBMS). The student will be able to:
08.01	Compare the major types of databases.
08.02	Describe relational database concepts.
08.03	Analyze the various components of a DBMS.
08.04	Install and configure database server software.
08.05	Perform database administration tasks using the Structured Query Language (SQL).
08.06	Demonstrate an understanding of transaction processing and concurrency control.
08.07	Perform database backup and recovery operations.
09.0	Perform administrative tasks related to database security. The student will be able to:
09.01	Develop database security guidelines.
09.02	Monitor database security systems.
09.03	Manage web database security.
09.04	Verify security compliance.
09.05	Secure backup processes.
09.06	Verify backup processes.
09.07	Describe techniques to ensure database integrity and security.

10.0	Demonstrate an understanding of E-commerce. The student will be able to:
10.01	Describe E-commerce and its impact on business and society.
10.02	Differentiate between the various E-commerce business models.
10.03	Discuss the steps necessary to maintain transaction integrity.
10.04	Identify components and procedures necessary to process credit card transactions.
10.05	Describe applicability of and compliance with Payment Card Industry Data Security Standards (PCI-DSS).
11.0	Perform tasks related to E-commerce security. The student will be able to:
11.01	Manage digital certificates.
11.02	Maintain integrity in transaction storage and reporting systems.
11.03	Protect Personal Identifiable Information (PII) in transaction processes.
11.04	Describe inventory control measures.
11.05	Maintain security related to electronic communication.
11.06	Describe methods used to review third-party transaction processing.
11.07	Evaluate E-commerce platform vulnerabilities.
12.0	Perform webserver and site management activities. The student will be able to:
12.01	Describe the process of obtaining an Internet domain name and mapping it to an Internet Protocol (IP) address.
12.02	Compare features of current website management tools.
12.03	Configure current web server software.
12.04	Use current web server software to maintain secure websites.
12.05	Use website access tracking and analysis tools to evaluate the security of a web server.
13.0	Design and implement physical security measures. The student will be able to:
13.01	Identify physical threats and vulnerabilities to an enterprise's resources.
13.02	Specify possible countermeasures to physically protect an enterprise's resources.
13.03	Develop a list of physical facility requirements to secure the premises.

13.04	Evaluate the feasibility of various technical controls to secure physical resources.
14.0	Perform operation and security management practices. The student will be able to:
14.01	Perform personnel administrative security operations.
14.02	Implement client and network system security software on an enterprise-wide basis.
14.03	Perform and verify backups of critical information.
14.04	Identify methods to protect the privacy of personal data.
14.05	Demonstrate proper handling of sensitive information and media.
14.06	Demonstrate an understanding of different control types.
14.07	Determine what enterprise resources require protection.
14.08	Compare the advantages and disadvantages of internal versus external audits.
14.09	Perform compliance checks on user adherence to security policies.
14.10	Identify different types of enterprise-wide monitoring tools and techniques.
14.11	Utilize enterprise-wide monitoring tools and techniques.
14.12	Implement countermeasures to defend against threats.
14.13	Perform penetration testing activities.
14.14	Describe principles of risk management and asset valuation.
14.15	Monitor enterprise-wide information for potential liabilities.
14.16	Manage software licenses and enforce compliance within the organization.
15.0	Employ applications and systems development security techniques. The student will be able to:
15.01	Describe the stages of the system development life cycle.
15.02	Describe security implications of structured programming techniques.
15.03	Analyze the controls that are included within systems and applications software and those used in the development of agents, applets, software, databases, data warehouses and knowledge-based systems.
15.04	Implement features to ensure data and application integrity, security and availability.

15.05	Analyze distributed environment application issues.
15.06	Analyze local environment application issues.
15.07	Analyze key database and data warehousing issues.
15.08	Develop multilevel security schemes for databases and data warehouses.
15.09	Compare different forms of data/information storage.
15.10	Describe different aspects of application and database security control architectures.
15.11	Compare and contrast elevated privileges and user modes of operation.
15.12	Identify various levels of application integrity.
15.13	Describe the impact that malicious code plays in software development.
15.14	Formulate countermeasures to defend against or detect malicious code.
15.15	Establish a secure development environment.
16.0	Develop business continuity and disaster recovery plans. The student will be able to:
16.01	Perform a business impact assessment.
16.02	Specify the necessary capabilities of alternative business sites.
16.03	Develop business continuity, disaster containment, and recovery plans.
16.04	Identify the impact of scheduled facility maintenance on enterprise systems.
16.05	Develop a testing program for business continuity/disaster recovery plans.
16.06	Develop a training program for personnel regarding business continuity/disaster recovery plans.
17.0	Describe ethical issues, pertinent laws, and how to conduct investigations. The student will be able to:
17.01	Explain the major categories and types of laws as they relate to information security.
17.02	Describe institutional policies and practices regarding data privacy and intellectual property rights.
17.03	Describe abnormal and suspicious activity as it relates to information security.
17.04	Identify potential data security threats.
17.05	Describe legal institutional policies and practices to protect against purposeful violations of data integrity.

17.06	Identify the major categories of computer crimes and attacks.
17.07	Describe institutional policies and practices to conduct an investigation of security violations.
17.08	Explain major ethical and legal issues related to Internet and system use.
18.0	Perform general organizational computing workplace competencies. The student will be able to:
18.01	Deliver and follow oral and written technical instructions.
18.02	Prepare and deliver a technical presentation.
18.03	Participate in group discussions as a member and as a leader.
18.04	Explain the importance of self-motivation and responsibility in completing assigned tasks.
18.05	List the steps in problem solving.
18.06	Identify and discuss issues contained within professional codes of conduct.
18.07	Explain ethical aspects of intellectual property rights and licensing issues.
18.08	Identify potential sources of employee/employer or employee/employer conflict and discuss possible approaches to resolve such disagreements.
18.09	Identify appropriate workplace behavior.
18.10	Identify principles and techniques for being a productive, contributing member of a team.
18.11	Identify acceptable strategies for resolving conflict in the workplace.
18.12	Describe principles and techniques for working productively with people of diverse cultures and backgrounds.
18.13	Identify techniques for stress management and prevention of job burnout.
18.14	Identify appropriate communication skills and etiquette.
19.0	Perform project planning and management activities. The student will be able to:
19.01	List effective time management skills.
19.02	Describe appropriate measures for planning and managing a large project.
19.03	Create an implementation schedule for a large project.
19.04	Describe appropriate measures for planning and implementing upgrades of hardware and software.
19.05	Identify examples of effective end-user training strategies and techniques.

20.0	Perform documentation and technical reference activities. The student will be able to:
20.01	Demonstrate technical writing skills.
20.02	Identify information in printed and online technical references.
20.03	Prepare documentation to track assets, security-related activities, and incidents.
21.0	Demonstrate employability skills. The student will be able to:
21.01	Identify sources of employment opportunities.
21.02	Identify employer expectations regarding attendance, punctuality, initiative and teamwork.
21.03	Describe employee rights regarding privacy, discrimination, due process and safety.
21.04	Identify the key requirements of a written job description.
21.05	Identify methods for securing employment references.
21.06	Compose a cover letter and a resume.
21.07	Complete an employment application.
21.08	Classify behaviors considered appropriate or inappropriate in a job interview situation.
21.09	Demonstrate job interview skills.
21.10	Compose a follow-up letter.
21.11	Compose a letter of resignation.
22.0	Demonstrate professional development skills. The student will be able to:
22.01	Identify corporate strategies and policies for professional development.
22.02	Describe the importance of participating in professional organizations and maintaining professional contacts.
22.03	Explain the importance of mentor relationships.
22.04	Identify industry trends.
22.05	Describe options for continuing education.
22.06	Identify industry journals, magazines and digital media.

22.07 Describe the importance of attending seminars, workshops, and tradeshow.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

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Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Database & E-commerce Security CCC (0511100311) – 18 credit hours.

Standards for the above certificate programs are contained in separate curriculum frameworks.

**Florida Department of Education
Curriculum Framework**

Program Title: **Cybersecurity**
Career Cluster: **Information Technology**

AS	
CIP Number	1511100308
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1212 Information Security Analysts 15-1231 Computer Network Support Specialists 15-1211 Computer System Analysts

Purpose

The program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as, cybersecurity analyst, security engineer, cybersecurity technician, data communication analyst, intrusion and detection analyst, security architect, or secure software developer in the Information Technology career cluster: provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of web-based programming, web databases, network security, installing, configuring, monitoring and securing networks in the LAN/WAN environment.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate a fundamental understanding of computer networking.
- 02.0 Demonstrate understanding of networked environments, hardware, and software.
- 03.0 Demonstrate fundamental proficiency in network security essentials.
- 04.0 Demonstrate an understanding of network access control systems and methodology.
- 05.0 Perform coding activities.
- 06.0 Perform testing activities.
- 07.0 Demonstrate proficiency with Internet structure, organization, and navigation.
- 08.0 Perform web design/development activities.
- 09.0 Perform programming and scripting activities.
- 10.0 Perform security activities.
- 11.0 Legal and ethical issues relative to the information technology environment.
- 12.0 Communications skills.

Florida Department of Education
Student Performance Standards

Program Title: Cybersecurity
 CIP Number: 1511100308
 Program Length: 60 credit hours
 SOC Code(s): 15-1212, 15-1231, 15-1211

Refer to Rule 6A-14.030 (4), F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate a fundamental understanding of computer networking. The student will be able to:
01.01	Explain the use of binary numbers and perform binary arithmetic.
01.02	Describe current network environments.
01.03	Describe network communications and architecture.
01.04	Identify network components, media, connectors, applications and protocols.
01.05	Compare and contrast the OSI and TCP/IP reference models and their layers.
01.06	Identify and describe current relevant IEEE network standards.
01.07	Create an IP addressing scheme using Variable Length Subnet Masks (VLSM) and Classless Inter-Domain Routing (CIDR).
01.08	Identify and discuss issues related to networked environments, such as security, access control, fair use, privacy and redundancy.
01.09	Identify and discuss issues related to naming conventions for user IDs, email, passwords, and network hosts and devices.
01.10	Identify standard network topologies and describe the advantages and disadvantages of each topology.
01.11	Describe the major functions of LAN protocols.
01.12	Explain the functions of wireless components, standards, hardware, software, and infrastructure design.
01.13	Configure and manage the TCP/IP protocol stack.
01.14	Describe how TCP and UDP Port addresses, IP addresses, and MAC addresses function, and how they are used to deliver data across the network.
01.15	Identify emerging technologies and discuss related technical issues.
01.16	Design a local area network (LAN), including the specification of architecture, hardware and software.

01.17	Identify the advantages and use of virtual local area networks (VLANs).
01.18	Identify and explain wide area network (WAN) concepts.
01.19	Plan, configure and test a small network and establish baselines.
01.20	Describe the major functions of network server software components.
01.21	Install applications on a server and configure clients for network access.
02.0	Demonstrate understanding of networked environments, hardware, and software. The student will be able to:
02.01	Give several advantages and disadvantages of networked and non-networked environments.
02.02	Describe current network environments and network topologies.
02.03	Identify and discuss issues such as security, privacy and redundancy related to networked environments.
02.04	Identify and discuss standardization issues related to-naming conventions.
02.05	List and define layers in the OSI and TCP/IP network protocol models.
02.06	Identify and describe current relevant IEEE standards.
02.07	Discuss the nature of IP and MAC addressing.
02.08	Describe the major functions and requirements of web based server and client hardware and software components.
02.09	Identify various specialized servers.
02.10	Recognize and describe current cable technologies.
02.11	Describe current wireless technologies.
02.12	Describe the major functions of network connectivity hardware, such as hubs, repeaters, bridges, routers, switches, and gateways.
02.13	Describe the hardware needed to connect a LAN to the Internet.
02.14	Describe the function of network storage devices and other peripherals.
02.15	Compare and contrast major functions and features of current network operating systems (including directory services).
02.16	Differentiate between telecommunications and data communications.
02.17	Compare and contrast digital communications lines and cable characteristics (e.g. ISDN, DSL, T-1, T-3).

03.0	Demonstrate fundamental proficiency in network security essentials. The student will be able to:
03.01	Describe common security threats to, and vulnerabilities of, computer systems and the corresponding best practices for mitigation.
03.02	Define and describe malicious software and techniques to protect systems from its effects.
03.03	Describe Denial of Service attacks and means to defend against them.
03.04	Identify the risks and techniques of data loss and its prevention.
03.05	Describe the principles and techniques of securing data storage and transmission.
03.06	Identify current encryption and authentication standards.
03.07	Implement security policies, including compliance and operational security.
03.08	Enable access control, identity management and security logging.
03.09	Manage client and network system security software and related updates.
03.10	Describe the functions and characteristics of firewalls.
03.11	Perform a ping sweep to identify network hosts.
03.12	Perform a port scan to probe network hosts for open TCP and UDP ports.
03.13	Describe the purpose and operation of network protocol analyzers.
03.14	Utilize a network protocol analyzer to capture and analyze network traffic for security issues.
04.0	Demonstrate an understanding of network access control systems and methodology. The student will be able to:
04.01	Specify by access control mechanisms what users can do, which resources they can access, and what operations they can perform on a system.
04.02	Compare and contrast access control techniques.
04.03	Administer computer, group, and user accounts.
04.04	Manage policies, rights, permissions, and passwords for users and/or groups of users.
04.05	Demonstrate an understanding of various access control models.
04.06	Manage password, PIN selection, maintenance, and control.
04.07	Demonstrate an understanding of methods of identification and authentication.

04.08	Implement centralized/remote authentication access controls.
04.09	Implement and manage decentralized access controls such as domain and trust relationships.
04.10	Analyze methods of server attacks.
04.11	Demonstrate an understanding of the different types of intrusions and the different methods of intrusion detection.
04.12	Monitor the network using various forms of intrusion detection resources to detect attacks.
04.13	Investigate audit trails for signs of network intrusions.
04.14	Perform penetration testing to find weaknesses in the access control systems.
05.0	Perform coding activities. The student will be able to:
05.01	Identify modules.
05.02	Design modules.
05.03	Code modules.
05.04	Document modules.
05.05	Test modules.
05.06	Debugging code.
05.07	Revise code.
05.08	Assemble modules.
05.09	Demonstrate proficient use of programming development tools.
05.10	Identify and use best practices to secure program code.
06.0	Perform testing activities. The student will be able to:
06.01	Develop test plan.
06.02	Develop test data.
06.03	Validate input(s).
06.04	Perform test(s).

06.05	Validate expected outcomes.
06.06	Determine boundary test cases.
06.07	Load-test the system.
06.08	Revise program code as necessary.
06.09	Document test results.
07.0	Demonstrate proficiency with Internet structure, organization, and navigation. The student will be able to:
07.01	Describe the origin of the Internet.
07.02	Outline the history of the Internet.
07.03	Describe Internet organization, such as the InterNIC, domains and requests for comments (RFCs).
07.04	Describe the structure of the Internet.
07.05	Differentiate between the Internet and the WWW.
07.06	Define Internet push technologies, such as e-mail marketing vs. webpage banner advertising.
07.07	Differentiate among an Intranet site, an extranet site, and an Internet site.
07.08	Describe and identify several major ethical and legal issues related to Internet use and how they affect intellectual property rights.
07.09	Describe the World Wide Web (WWW) and identify how it affects personal security and privacy and our society.
07.10	Describe and differentiate between file types and protocols.
07.11	Demonstrate the use of typical remote access mechanisms.
07.12	Describe various sections of a URL.
07.13	Discuss the use of Internet tools and utilities.
08.0	Perform web design/development activities. The student will be able to:
08.01	Describe and use the process of storyboarding a website.
08.02	Describe format, structure and design principles for websites.
08.03	Evaluate web graphic utilities and creation tools, including those for animated graphics.

08.04 Identify existing resources and constraints.
08.05 Evaluate design based on current industry and in-house standards.
08.06 Create site navigation plan including directory structure.
08.07 Procure/create and incorporate standard and animated graphics into a webpage.
08.08 Obtain in-house content and determine needs for secondary content providers.
08.09 Design page templates to implement on final site.
08.10 Create a webpage using authoring tools.
08.11 Code page(s) using current web programming languages.
08.12 Check page for cross-browser capability and other access issues.
08.13 Upload pages and run site analysis.
08.14 Incorporate sound files onto a webpage.
08.15 Incorporate a streaming video file onto a webpage.
08.16 Incorporate a video file for download into a webpage.
08.17 Create an animated graphic.
08.18 Perform simple graphic modifications using a graphics utility.
08.19 Incorporate an e-mail link on a webpage.
08.20 Incorporate internal and external links on a webpage.
08.21 Incorporate tables and file transfer capabilities on a webpage.
08.22 Incorporate handicapped-accessibility options into the website.
08.23 Configure a webpage for Search Engine Optimization.
08.24 Create a web form and produce e-mail results.
08.25 Create a web database interface.
08.26 Discuss the issue of ODBC compliance.

09.0	Perform programming and scripting activities. The student will be able to:
09.01	Identify several of the most prominent current programming languages.
09.02	Characterize the stages of the system development life cycle.
09.03	Differentiate between two common strategies for problem solving.
09.04	Describe the program design and development process.
09.05	Differentiate between structured programming and object-oriented programming.
09.06	Use procedural and object-oriented constructs of programming, scripting, and/or macro languages to create and test programs.
09.07	Apply principles of good design and documentation when developing programs.
09.08	Write scripting code to handle error checking in client forms.
09.09	Write CGI programs to allow for interactions between the client and server.
09.10	Use scripting languages to create dynamic webpages.
09.11	Identify development tools and list in order of complexity of use.
09.12	Design, review, and test specifications and algorithms.
09.13	Write program according to specifications and revise based on testing and debugging.
10.0	Perform security activities. The student will be able to:
10.01	Complete a security needs evaluation.
10.02	Design security architecture.
10.03	Select security protocol.
10.04	Select and set encryption methodology.
10.05	Incorporate password protection on a webpage.
10.06	Incorporate session handling into a webpage.
10.07	Configure firewall.

11.0	Legal and ethical issues relative to the information technology environment. The student will be able to:
11.01	Discuss the types of works that are protected by intellectual property laws.
11.02	Discuss the basic elements of a contract.
11.03	Discuss email litigation, including anti-spam laws.
11.04	Discuss email use and ownership.
11.05	Describe customer and employee privacy issues and safeguards.
11.06	Develop examples of acceptable use policies.
11.07	Compare organizational codes of ethics.
11.08	Research industry standards and codes of conduct for information technology professionals.
11.09	Write a personal code of ethics.
12.0	Communications skills. The student will be able to:
12.01	Write logical and clear statements, or phrases, to accurately fill out forms/invoices commonly used in business and industry.
12.02	Read and explain graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
12.03	Deliver and follow oral and written instructions.
12.04	Answer and ask questions coherently and concisely.
12.05	Read critically by recognizing assumptions and implications and by evaluating ideas.
12.06	Demonstrate appropriate communication skills.
12.07	Prepare and deliver a technical presentation.
12.08	Observe and interpret verbal and nonverbal behavior.
12.09	Compose and critique business documents, memorandums, business letters, requests, answer requests, claims/adjustments, and letters using correct English grammar and punctuation.
12.10	Demonstrate effective use of electronic communication.
12.11	Summarize the skills involved in being an effective listener.
12.12	Demonstrate ability to work and communicate effectively in multicultural and diverse environments.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) is the intercurricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

**Florida Department of Education
Curriculum Framework**

Program Title: Technology Project Management
Career Cluster: Information Technology

AS	
CIP Number	1511100509
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as project managers and professionals incorporating IT project management strategies in their business activities in the Information Technology career cluster; provides technical skill proficiency, and competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to balance of business and technology components and allows the student to gain additional skills in the area of Project Management.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstration in, and implementation of the main areas of information technology.
- 02.0 Interactive IT tools covering media, graphics, communications, word processing, spreadsheets, and presentation software skills.
- 03.0 Information Technology activities.
- 04.0 Project costs and budgeting.
- 05.0 Human resources management activities.
- 06.0 Fundamentals of project management.
- 07.0 Full project life cycle and various project management processes.
- 08.0 Define stakeholder expectations and initiate a project successfully.
- 09.0 Create a comprehensive project plan.
- 10.0 Work in teams, manage team members, and interact with stakeholders.
- 11.0 Plan and monitor project budget and schedule.
- 12.0 Basic tools and techniques of managing project quality and risk.
- 13.0 Principles of identifying, developing, and managing resources.
- 14.0 Navigating a project experiencing scope, resource, and scheduling constraints through effective communication.
- 15.0 Technical and human aspects of project control, with a focus on change control.
- 16.0 Contextual relationship between the project and the organization that hosts the project.
- 17.0 Ethical considerations in every aspect of a project's operations.
- 18.0 Employability skills.
- 19.0 Communications skills.

Florida Department of Education
Student Performance Standards

Program Title: Technology Project Management
 CIP Number: 1511100509
 Program Length: 60 credit hours
 SOC Code(s): 15-1199

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. At the completion of this program, the student will be able to:

01.0	01.0	Demonstration in, and implementation of the main areas of information technology. The student will be able to:
	01.01	Identify, use and connect hardware components and devices.
	01.02	Demonstrate the proper use and maintenance of PC hardware.
	01.03	Install & configure laptops and other mobile devices.
	01.04	Explain types of networks and connections including TCP/IP, WIFI and SOHO.
	01.05	Troubleshoot device and network issues.
	01.06	Identify and protect against security vulnerabilities for devices and their network connections.
	01.07	Install and support Windows OS.
	01.08	Understand Mac OS, Linux and mobile OS.
	01.09	Follow best practices for safety, environmental impacts, and communication and professionalism.
02.0		Interactive IT tools covering media, graphics, communications, word processing, spreadsheets, and presentation software skills. The student will be able to:
	02.01	Describe various interactive media tools and define their purpose & function.
	02.02	Demonstrate knowledge in opening, running and/or creating video clips and sound clips.
	02.03	Demonstrate knowledge of word processing software to create and modify documents in a collaborative environment.
	02.04	Demonstrate knowledge of spreadsheet software to create and modify workbooks to manipulate and analyze data.
	02.05	Demonstrate knowledge of presentation software to create and modify interactive presentations.
	02.06	Demonstrate the ability to work in an electronic collaborative environment.

02.07	Demonstrate proficiency with project management software.
03.0	Information Technology activities. The student will be able to:
03.01	Discuss common applications of computers and information systems.
03.02	Define a computer system, and describe its components.
03.03	Define a database and a database management system.
03.04	Discuss the legal and ethical issues related to information technology.
03.05	Discuss issues related to IS security crimes.
03.06	Explain important networking concepts and applications of a data communication system.
03.07	Explore the systems development life cycle (SDLC) as a method for developing information systems.
03.08	Describe new trends in software, networking, virtualization and cloud computing.
04.0	Project Costs and Budgeting. The student will be able to:
04.01	Demonstrate an understanding of the basic accounting principles and practices.
04.02	Demonstrate an understanding of budgeting.
04.03	Demonstrate an understanding of costing.
04.04	Identify fundamental financial analysis concepts.
04.05	Describe financial analysis tools.
04.06	Understand and interpret financial reports.
05.0	Human resources management activities. The student will be able to:
05.01	Describe the importance of human resources.
05.02	Describe the components of the job requirement and analysis process.
05.03	Describe the important elements of effective human resource planning.
05.04	Apply leadership techniques and defend the use of appropriate practices for motivating teams and developing leadership abilities.
06.0	Fundamentals of project management. The student will be able to:

06.01	Describe the importance of PM in the context of various organizational cultures and strategies, and summarize the typical components of the PM system and the processes that are considered essential to any project.
06.02	Select and describe an appropriate PM strategy for a new project that can meet stakeholder expectations in a given organizational context.
07.0	Full project life cycle and various project management processes. The student will be able to:
07.01	List and describe the project phases that make up a typical project, and summarize PM processes that occur within each.
07.02	Describe the typical PM process documentation and PM deliverables that are produced by project managers in each project phase.
08.0	Define stakeholder expectations and initiate a project successfully. The student will be able to:
08.01	Given an organizational context, project objectives, and recommended strategy, develop a sequence of categorized PM processes and activities that will meet stakeholder expectations.
08.02	Create, or identify, a project charter and its primary components, including writing a concise statement of business needs that the project will address.
09.0	Create a comprehensive project plan. The student will be able to:
09.01	Develop a PM plan that documents the actions necessary to define, coordinate, and measure all project activities, and to ensure control and management of costs and changes to the project.
09.02	Describe the components of the project plan and the interactions of the various processes of the project plan with other processes in the PM system.
10.0	Work in teams, manage team members, and interact with stakeholders. The student will be able to:
10.01	Select appropriate communication tools and methods to communicate with identified stakeholders, including commonly used templates for communication activities such as status reporting, issues tracking, change control, and project reviews.
10.02	Understand sources of conflict and, given a specific challenge, apply a problem-solving process that focuses on confronting and resolving the problem.
11.0	Plan and monitor project budget and schedule. The student will be able to:
11.01	Identify necessary labor and material resources, including contracted resources, and estimate how many units of each are required to meet project expectations.
11.02	Describe the fundamental types of time- and cost-estimating approaches and how these are best related to the time line of the project, becoming more specific as more information is known about project requirements, risks, and activities.
12.0	Basic tools and techniques of managing project quality and risk. The student will be able to:
12.01	Given a specific project context and plan, identify potential project risks and/or opportunities, evaluate each according to criteria for impact on the project, and document them in a prioritized risk register.
12.02	Demonstrate knowledge of the core quality processes and explain the role of each process in planning and managing projects.
13.0	Principles of identifying, developing, and managing resources. The student will be able to:
13.01	Demonstrate how teams are assigned and formed, and describe the stages of team development.

13.02	Enhance team capability after assessing personal strengths and weaknesses, and develop skills to manage a team and lead others.
14.0	Navigating a project experiencing scope, resource, and scheduling constraints through effective communication. The student will be able to:
14.01	Demonstrate ability to optimize the project schedule by allocating resources to the critical path.
14.02	Demonstrate ability to optimize schedules to maximize efficiency.
15.0	Technical and human aspects of project control, with a focus on change control. The student will be able to:
15.01	Demonstrate knowledge of how changes to project scope may affect the project's schedule, cost, and quality, and how to evaluate the impact and recommend a solution that produces the desired project product.
15.02	Describe how to monitor and control variances as they pertain to project cost, schedule, scope, and quality, and how to formally communicate such variances to the stakeholder.
16.0	Contextual relationship between the project and the organization that hosts the project. The student will be able to:
16.01	Describe how to manage a project in a matrix organizational structure, and illustrate how to successfully deliver a project when the PM might not be sufficiently empowered.
16.02	Demonstrate knowledge of key linkages between organizational and project-level issues, including decision making, motivation, and project roles.
16.03	Demonstrate knowledge and skills in procurement, supply-chain management, finance, cost management, and other business aspects of projects.
17.0	Ethical considerations in every aspect of a project's operations. The student will be able to:
17.01	Given a case study scenario involving ethical considerations, demonstrate how a project can be executed according to the standards of the organization hosting the project.
17.02	Demonstrate knowledge of situations involving unethical project activities, and best practices for whistle blowing and ethical decision making.
18.0	Employability skills. The student will be able to:
18.01	Conduct a job search.
18.02	Secure information about a job.
18.03	List and obtain documents that may be required when applying for a job and preparing for an interview.
18.04	Complete a job application form.
18.05	Demonstrate competence in job interview techniques.
18.06	Identify or demonstrate appropriate responses to criticism.
18.07	Identify and describe acceptable work habits.
18.08	Demonstrate knowledge of how to make appropriate job changes during the course of a career.

19.0	Communications skills. The student will be able to:
19.01	Write logical and clear statements, or phrases, to accurately fill out forms/invoices commonly used in business and industry.
19.02	Read and explain graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
19.03	Deliver and follow oral and written instructions.
19.04	Answer and ask questions coherently and concisely.
19.05	Read critically by recognizing assumptions and implications and by evaluating ideas.
19.06	Demonstrate appropriate communication skills.
19.07	Prepare and deliver a technical presentation.
19.08	Observe and interpret verbal and nonverbal behavior.
19.09	Compose and critique business documents, memorandums, business letters, requests, answer requests, claims/adjustments, and letters using correct English grammar and punctuation.
19.10	Demonstrate effective use of electronic communication.
19.11	Summarize the skills involved in being an effective listener.
19.12	Demonstrate ability to work and communicate effectively in multicultural and diverse environments.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Articulation

To be transferable statewide between institutions, this program must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific articulation agreements with each other.

The following industry certifications have been approved by the Florida State Board of Education for statewide articulation credit into this degree program.

CompTIA Project+ (COMPT007) – 3 credits

Program Length

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The standard length of this program is 60 credit hours according to Rule 6A-14.030, F.A.C.

**Florida Department of Education
Curriculum Framework**

Program Title: Enterprise Resource Planning (ERP) Software Specialist
Career Cluster: Information Technology

AS	
CIP Number	1511100510
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	11-3021 – Computer and Information Systems Managers

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as an ERP specialist, ERP developer, ERP Systems Integration technician, ERP administrator, ERP database specialist, ERP designer, or ERP planner in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to enterprise resource software environments such as SAP, Oracle, PeopleSoft, MAPICS, Great Plains, and others.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate an understanding of Enterprise Resource Planning (ERP) and Electronic Business fundamentals.
- 02.0 Demonstrate proficiency in developing Enterprise Resource Planning (ERP) systems solutions.
- 03.0 Demonstrate proficiency in Enterprise Resource Planning (ERP) technical functional requirements.
- 04.0 Demonstrate proficiency in Enterprise Resource Planning (ERP) project planning.
- 05.0 Demonstrate proficiency in Enterprise Resource Planning (ERP) project coordination.
- 06.0 Demonstrate proficiency in developing Enterprise Resource Planning (ERP) customer business function requirements.
- 07.0 Demonstrate competence in communications with Enterprise Resource Planning (ERP) customers.
- 08.0 Demonstrate proficiency in business and management processes.
- 09.0 Demonstrate proficiency with high-level computer programming languages as related to Enterprise Resource Planning (ERP) software.
- 10.0 Perform general organizational computing workplace competencies.
- 11.0 Demonstrate employability skills.
- 12.0 Demonstrate effective communication skills.
- 13.0 Demonstrate professional development skills.

Florida Department of Education
Student Performance Standards

Program Title: Enterprise Resource Planning (ERP) Software Specialist
 CIP Number: 1511100510
 Program Length: 60 credit hours
 SOC Code(s): 11-3021

Refer to Rule 6A-14.030 (4) F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate an understanding of Enterprise Resource Planning (ERP) and electronic business fundamentals. The student will be able to:
01.01	Identify characteristics of the American enterprise system, electronic business (e-commerce), and ERP systems.
01.02	List the types of large-scale business environments that ERP systems support.
01.03	Understand ERP terminology.
01.04	Describe how ERP uses a collection of software applications to manage the entire organization.
01.05	Describe how ERP systems integrate sales, manufacturing, logistics, accounting and other enterprise business functions.
01.06	Describe how ERP systems share common database and business analysis tools.
01.07	Describe how e-commerce has changed society.
01.08	Differentiate between the various e-commerce and ERP business models.
01.09	Identify e-commerce market sectors.
01.10	List factors that contribute to economic growth and impact supply and demand.
01.11	Identify characteristics of different types of business ownership.
02.0	Demonstrate proficiency in developing Enterprise Resource Planning (ERP) systems solutions. The student will be able to:
02.01	Research available enterprise solutions.
02.02	Review evaluations of comparable ERP software programs and vendors.
02.03	Compare collected data.
02.04	Participate in demonstrations of ERP software programs.

02.05	Assess hardware requirements.
02.06	Assess software requirements.
02.07	Analyze solution integration activities.
02.08	Establish benchmarking and sizing criteria.
02.09	Assist in identifying overall costs.
02.10	Understand the difference and relationship between ERP and Customer Relation Management (CRM) software.
02.11	List and compare implementation costs.
02.12	List and compare training costs.
03.0	Demonstrate proficiency in Enterprise Resource Planning (ERP) technical functional requirements. The student will be able to:
03.01	Demonstrate understanding of issues related to shared data and integrated databases.
03.02	Design relational databases.
03.03	Develop relational databases.
03.04	Utilize database toolset – GUI.
03.05	Exhibit working knowledge of query language.
03.06	Develop an application that interfaces with a database.
03.07	Create simple interfaces for data conversion between sources and systems.
03.08	Design and develop interface between ERP modules and systems.
03.09	Develop simple programs and cloud applications using ERP development tools.
03.10	Create usable reports with writing tools and languages related to applicable ERP systems.
03.11	Identify different operating system architectures.
03.12	Identify networking protocols' benefits and limitations.
03.13	Implement modifications to programs and systems to address security for mobile systems and data sharing including end point protection and site based security.
03.14	Develop basic site-based and end point security policies.

03.15	Exhibit proficiency in the concepts of distributed applications and hosting web applications or utilizing cloud resources.
04.0	Demonstrate proficiency in Enterprise Resource Planning (ERP) project planning. The student will be able to:
04.01	Describe project planning fundamentals and concepts including feasibility studies.
04.02	Identify project stakeholders.
04.03	Determine stakeholder needs.
04.04	Determine stakeholder training requirements.
04.05	Identify potential stakeholder conflicts of interest.
04.06	Define the scope of a project.
04.07	Create project timelines.
04.08	Establish rules of communication between project stakeholders.
04.09	Create approval plans.
04.10	Create conflict resolution plans.
04.11	Define and sequence tasks.
04.12	Identify technology-related risks.
04.13	Establish project hardware and software dependencies.
04.14	Identify and assign project resources and materials (e.g., Vendor RFPs).
04.15	Budget resources.
04.16	Identify training needs.
04.17	Document project plan.
04.18	Construct an implementation schedule for a large project.
05.0	Demonstrate proficiency in Enterprise Resource Planning (ERP) project coordination. The student will be able to:
05.01	Use workflow software tools including scheduling, budgeting and project management.
05.02	Identify and manage project resources.
05.03	Identify and manage project risks.

05.04	Collaborate with team members.
05.05	Facilitate project changes.
05.06	Participate in project implementation activities.
05.07	Perform a detailed project SWOT (Strengths Weakness Opportunities Threats) analysis.
05.08	Describe the scale and impact of the project on the organization.
05.09	Identify how business process integration will change the relationships between traditional functional departments within the organization.
05.10	Describe any role re-define ment by function within the organization.
05.11	Describe the cost and time parameters of the project an implementation schedule for a large project.
06.0	Demonstrate proficiency in developing Enterprise Resource Planning (ERP) customers' business function requirements. The student will be able to:
06.01	Identify, document, and compile stakeholder requirement.
06.02	Define the scope, objectives, and parameters of the project.
06.03	Interview users and analyze their workflow systems and procedures.
06.04	Identify integration points by department and process.
06.05	Describe the function and supporting activities for Joint Application Development (JAD) meeting.
06.06	Describe the overall impact the project will have on the organization.
06.07	Assist in identifying potential problem areas.
06.08	Assist with user training.
06.09	Identify solutions and methods to fulfill requirements.
07.0	Demonstrate competence in communications with Enterprise Resource Planning (ERP) customers. The student will be able to:
07.01	Summarize and document project overview.
07.02	Create ERP design modules.
07.03	Write program test scripts.
07.04	Present design models.
07.05	Coordinate activities and resources with all relevant departments.

07.06	Use current technologies to provide in person and virtual to schedule meetings.
07.07	Create progress reports.
07.08	Use presentation technology to provide in person and virtual presentation.
07.09	Use presentation technology to provide in person and virtual training.
07.10	Deliver and explain procedure to stakeholders.
07.11	Act as a training intermediary for stakeholders.
07.12	Identify and define long-term implications of system changes.
07.13	Explain the difference between outsourcing and in-house support.
07.14	Apply effective customer relations.
07.15	Use current technologies to provide in person and virtual communications to keep the customer informed.
07.16	Demonstrate proper follow-up techniques.
08.0	Demonstrate proficiency in business and management processes. The student will be able to:
08.01	Define the three types of organizations, government, for profit and not for profit.
08.02	Describe basic functions within the typical business organization.
08.03	Describe various forms of management hierarchies and organizational design.
08.04	Identify the responsibilities and duties of managers by level or function within the organization.
08.05	Contrast the operations and organizational forms of small, medium and large organizations.
08.06	Describe the role and impact of Information Technology in modern business management.
08.07	Explain the interrelationships between business processes including marketing, production, finance, human resources.
08.08	Identify software packages that support the business processes used by large enterprises.
08.09	Describe the general accounting process.
08.10	Interpret and use financial reports, budgets, and basic financial analysis techniques.
08.11	Use productivity software to create spreadsheets, documents, reports, schedules, databases, and Internet communication.
08.12	Describe the importance of the role of human capital in modern business management.

08.13	Describe the functions of human resource management.
08.14	List the basic components of business contracts.
08.15	Identify ROI (Return on Investment).
09.0	Demonstrate proficiency with high-level computer programming languages as related to Enterprise Resource Planning (ERP) software. The student will be able to:
09.01	Describe the appropriate programming languages applicable to ERP software and how they differ.
09.02	Apply structured programming for a high-level program as related to ERP software.
09.03	Write a program in a high-level language as related to ERP software.
09.04	Identify and define associated system level concepts.
09.05	Describe how enterprise computing is used to support ERP.
10.0	Perform general organizational computing workplace competencies. The student will be able to:
10.01	Follow oral and written instructions.
10.02	Prepare, outline, and deliver a short oral presentation.
10.03	Prepare visual material to support an oral presentation.
10.04	Interpret appropriate information from graphics, maps, or signs.
10.05	Participate in group discussions as a member and as a leader.
10.06	Apply effective time-management skills.
10.07	Demonstrate self-motivation and responsibility to complete an assigned task.
10.08	Identify legal and ethical issues within privacy, legal liability and security.
10.09	Apply principles and techniques for being a productive, contributing member of a team.
10.10	Identify and use acceptable strategies for resolving conflict in the workplace.
10.11	Identify techniques for stress management and prevention of job burnout.
11.0	Demonstrate employability skills. The student will be able to:
11.01	Describe different job search methods, including online and traditional.
11.02	Conduct a job search.

11.03	Identify documents, which may be required when applying for a job interview.
11.04	Complete a job application form correctly.
11.05	Demonstrate competence in job interview techniques.
11.06	Identify acceptable work habits.
11.07	Demonstrate knowledge of the "Florida Right-To-Know Law" as recorded in Florida Statutes Chapter 442.
12.0	Demonstrate effective communication skills. The student will be able to:
12.01	Create documents or online tools commonly used in business and industry (e.g., RFP, GANTT chart, MS Project).
12.02	Read and understand graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
12.03	Demonstrate appropriate business etiquette skills.
13.0	Demonstrate professional development skills. The student will be able to:
13.01	Identify corporate strategies and policies.
13.02	Build mentor relationships.
13.03	Identify industry trends and developments.
13.04	Continue formal education.
13.05	Network with industry professionals.
13.06	Read industry journals and magazines.
13.07	Attend seminars, workshops, and tradeshow.
13.08	Obtain industry and field certifications as required for career advancement.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

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Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: Game Development Design
Career Cluster: Information Technology

AS

CIP Number	1550041100
Program Type	College Credit
Standard Length	60 credit hours
CTSO	PBL
SOC Codes (all applicable)	15-1131 – Computer Programmers 15-1132 -- Software Developers, Applications 15-1199 – Computer Occupations, All Others

Purpose

The purpose of this program is to teach students the fundamentals of Game Development as a viable career option. The program will also give students an opportunity to evaluate their potential as animators and game designers. Coursework covers all aspects of animation, character design, motion capture, production & editing, and various multi-media skills needed for success.

The content includes but is not limited to practical experiences in modeling and simulation conceptualization, design, storyboarding, development methodologies, essential programming techniques, prototype development, production processes and implementation challenges. Science, Computer Programming, Math, 2D and 3D Art are embedded throughout the program to emphasize the relationship between these areas and the field of Modeling and Simulation.

The content includes but is not limited to rendering three-dimensional forms into two-dimensional drawings, digital art and design, narrative storytelling, storyboarding, basic computer animation skills, 3D animation modeling, rendering and character animation, character design, development, rigging and animation, motion graphics, designing and implementing computer animation projects, and producing a 3D animated short film, Gaming and Animation, Robotics and/or Geospatial/Geographic Information Systems Technology.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate an understanding of the game development industry.
- 02.0 Identify the tools used in game development.
- 03.0 Describe the game development process.
- 04.0 Create simple 3D game environments.
- 05.0 Analyze the different uses of textures.
- 06.0 Design game levels using creation tools and editors.
- 07.0 Code, compile, and execute programs.
- 08.0 Demonstrate knowledge of object oriented programming and design concepts.
- 09.0 Design and develop interfaces for games.
- 10.0 Develop 3D programs.
- 11.0 Demonstrate an understanding of network programming for game development.
- 12.0 Embed artificial intelligence (AI) methods and algorithms to create and modify games.
- 13.0 Evaluate artificial intelligence (AI) Path Planning.
- 14.0 Apply principles of stimulus-response agents.
- 15.0 Utilize agent architectures.
- 16.0 Create decision making systems.
- 17.0 Create and modify game tree systems.
- 18.0 Apply neural networks.
- 19.0 Utilize genetic algorithms.
- 20.0 Create virtual reality environments.
- 21.0 Create a complete working animated game or film.

Florida Department of Education
Student Performance Standards

Program Title: Game Development Design
CIP Number: 1550041100
Program Length: 60 Credit Hours
SOC Code(s): 15-1131, 15-1132 and 15-1199

Refer to Rule 6A-14.030 (4) F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate an understanding of the game development industry. The student will be able to:
01.01	Evaluate game concepts.
01.02	Compare different game concepts.
01.03	Compose a game concept document.
01.04	Present and justifying the game concept.
01.05	Identify and compare the different genres of games.
02.0	Identify the tools used in game development. The student will be able to:
02.01	Identify different computer programming languages used for game development.
02.02	Review different development environments for game development.
02.03	Study automation software for game and software development.
03.0	Describe the game development process. The student will be able to:
03.01	Distinguish the different stages of the game development process.
03.02	Create a generic plan for developing a game.
04.0	Create simple 3D game environments. The student will be able to:
04.01	Reproduce simple objects in different coordinate systems.
04.02	Manipulate screen coordinates to create new game levels.
04.03	Convert and export objects and levels between different 3D environments.

04.04	Create simple shapes and structures that can be exported to games or game editors.
04.05	Modify an existing level in a game using editing tools.
04.06	Create a level that can be ported to an existing game engine or editor.
04.07	Create conditional statements and loops for games.
04.08	Modify sprites to add simple motion to games.
04.09	Develop a simple 2D side scrolling game using a game development software kit.
05.0	Analyze the different uses of textures. The student will be able to:
05.01	Create texture maps for objects in games.
05.02	Modify existing texture maps to work with new designs.
05.03	Apply new textures for changing the look and feel of existing game levels.
05.04	Distinguish between the different types of texture mapping.
06.0	Design game levels using creation tools and editors. The student will be able to:
06.01	Distinguish the different level building tools.
06.02	Examine the game development process and application to help design new tools for building levels.
06.03	Distinguish the different types of levels in terms of fun factor.
06.04	Discuss how to decrease and increase the difficulty for players in each type of game level.
06.05	Create a new level for an existing game that is going to address all the issues of difficulty.
06.06	Create building blocks for game level editors and existing engines.
06.07	Create program that will be able to convert and export levels into game engines and level editors.
06.08	Modify existing items to make them exportable into game engines and level editors.
07.0	Code, compile, and execute programs. The student will be able to:
07.01	Write pseudocode and flow charts.
07.02	Apply the techniques of functional decomposition to break a programming design problem into smaller pieces.

07.03	Write code documentation.
07.04	Create programs that use all data types (float points, integers, long, double, Boolean, characters, and strings) and operators.
07.05	Create programs that use all existing operators.
07.06	Explain the properties of a variable, such as its name, value, scope, persistence, and size.
07.07	Create programs that use if, else if, and else statements to evaluate conditions.
07.08	Create programs that use logical operators (and, not, or), functions, conditional statements, structured and unstructured data types, and loops.
07.09	Write programs that use classes, data abstraction, encapsulation and polymorphism.
07.10	Test and design tests of software solutions.
07.11	Debug program code.
08.0	Demonstrate knowledge of object oriented programming and design concepts. The student will be able to:
08.01	Apply principles of object oriented programming (OOP).
09.0	Design and develop interfaces for games. The student will be able to:
09.01	Analyze existing games and applications for interface usability and intuitiveness.
09.02	Compare the requirements and limitations of games and application interfaces.
09.03	Compare the requirements and limitations of PC games and console games interfaces.
09.04	Use existing libraries to create new interfaces.
09.05	Create reusable libraries for new interfaces.
09.06	Create new interfaces for existing applications.
09.07	Create new interfaces for PC and console games.
09.08	Analyze existing input devices with respect to usability for different game genres.
09.09	Analyze the restriction created by using different hardware for input such as, but not limited to: mouse's, trackballs, joysticks, and game pads.
09.10	Write small games that use different input interfaces such as: mice, trackballs, joysticks, and game pads.
09.11	Analyze existing output devices with respect to usability for different game genres.

09.12	Analyze the restrictions created by using different hardware for output such as, but not limited to: touch screens, 3D glasses, sound, and motion simulation devices.
09.13	Write small games that use different output interfaces such as: touch screens, 3D glasses, sound, and motion simulation devices.
09.14	Analyze the programming and interface limitations of the console.
09.15	Analyze different libraries and development tools for different game consoles.
09.16	Write code that takes advantage of the console hardware for improving performance.
09.17	Use existing programming libraries to communicate with hardware.
09.18	Create new reusable programming libraries and classes for handling hardware input and output.
09.19	Research past interface hardware.
09.20	Analyze the failures of past computer input/output hardware.
09.21	Research current developments in interface hardware.
09.22	Research trends regarding the future of interfaces and game consoles.
10.0	Develop 3D programs. The student will be able to:
10.01	Use popular existing 3D libraries to draw, move, rotate, scale, and render 2D and 3D graphics.
10.02	Create 3D data files for storing simple 3D objects.
10.03	Discuss articles about techniques and methods of programming 3D graphics.
10.04	Create a design document for their final project using 3D graphics.
10.05	Create programs that will read in 3D items from data files and display the items in 3D on the screen.
10.06	Create their own 3D items to display in the program they write.
10.07	Convert real coordinates to virtual and screen coordinates.
10.08	Discuss different notation for 3D coordinate systems in games.
10.09	Create a 3D world with multiple 3D items and moving cameras.
10.10	Scale and skew all the 3D items in the 3D virtual world relative to their location to the camera to create realism.
10.11	Apply hidden surface removal algorithms.

10.12	Develop the 3D rendering pipeline.
10.13	Summarize articles about new and current 3D rendering hardware on the market.
10.14	Distinguish 3D rendering software and hardware available for developing games.
10.15	Modify programs that do texture mapping.
10.16	Develop 3D texture mapped objects.
10.17	Apply their own texture maps to objects they create.
10.18	Use texture mapping in the final project a 3D game.
10.19	Extract 3D objects in from a file.
10.20	Create 3D objects in a file.
10.21	Use C++ structures to store 3D objects in memory.
10.22	Use C++ classes to store 3D objects in memory.
10.23	Use data files and classes/structures to store 3D objects in the final project.
10.24	Create 3D objects that have curved surfaces and adding them to their 3D world of objects.
10.25	Discuss papers on different ways to program curved surfaces.
10.26	Use curved surfaces in the final project.
10.27	Create a design document for a 3D game that they are going to develop.
10.28	Create a 3D game that uses multiple 3D objects and textures.
10.29	Modify and writing programming that uses matrices multiplication for moving rotating, scaling objects in 3D.
10.30	Use matrix multiplication for converting from the real coordinate system to screen coordinates.
11.0	Demonstrate an understanding of network programming for game development. The student will be able to:
11.01	Summarize research papers on multi-player game development, client/server and peer-to-peer networking.
11.02	Explain the future of networking and multi-player game development.
11.03	Create a presentation on a game networking topic for the class.

11.04	Modify existing programs that use different protocols to communicate between computers.
11.05	Use existing network programming libraries for creating a network messaging program.
11.06	Create simple games that use the TCP and IPX protocols to communicate between computers.
11.07	Distinguish different types of ISP provider connections.
11.08	Examine the limitations of game development for certain types of ISP connections.
11.09	Distinguish all of the layers of the OSI Model in terms of what is the function of each layer and how they work together.
11.10	Summarize each of the layers of the OSI model.
11.11	Relate the application layer and game development.
11.12	Modify existing programs that use the application layer.
11.13	Diagram the application layer of the OSI model.
11.14	Modify existing programs that use peer-to-peer application programming.
11.15	Write peer-to-peer based programs and games.
11.16	Modify existing programs that use the client server model for network application.
11.17	Install the DirectX Standard Development Kit (SDK) and its programming libraries.
11.18	Modify existing programs that uses the DirectX's DirectPlay for network and game applications. Writing small games that use DirectX's DirectPlay to communicate over the network for their final project.
11.19	Identify lobby based games and application.
11.20	Explain code for lobby initialization and startup.
11.21	Retrieve connection information for lobby based games and applications.
11.22	Modify existing program that uses the sockets for application communication.
11.23	Write sockets base programs for game communication.
11.24	Use built in C++ libraries for creating a simple network based game.
11.25	Examine new network technologies for game development.

11.26	Summarize articles by giving a class presentation on future of networking and game development.
12.0	Embed artificial intelligence (AI) methods and algorithms to create and modify games. The student will be able to:
12.01	Examine the origins of artificial intelligence for games, and the first games to use artificial intelligence.
12.02	Analyze how AI is used in games.
12.03	Distinguish the different methods used to create AI for games.
12.04	Modify existing AI methods for games.
12.05	Create new AI methods games.
12.06	Discuss at what level of programming AI starts.
13.0	Evaluate artificial intelligence (AI) Path Planning. The student will be able to:
13.01	Research path planning.
13.02	Discuss the advantages and disadvantages of path planning.
13.03	Modify existing path planning code to change the behavior of the game's computer controlled characters.
13.04	Enhance existing games by creating computer controlled characters.
14.0	Apply principles of stimulus-response agents. The student will be able to:
14.01	Modify code for different stimulus-response agent.
14.02	Create computer controlled characters using stimulus-response agents.
14.03	Combine aspects of stimulus-response agents systems with other artificial intelligence methods to create new systems for computer controlled characters.
14.04	Modify code for different stimulus-response agents.
14.05	Create computer controlled characters using stimulus-response agents.
14.06	Combine aspects of stimulus-response agents systems with other artificial intelligence methods to create new systems for computer controlled characters.
15.0	Utilize agent architectures. The student will be able to:
15.01	Modify code for different agent architectures.

15.02	Create computer controlled characters using agent architectures.
15.03	Combine aspects of agent architectures systems with other AI methods to create new systems for computer controlled characters.
16.0	Create decision making systems. The student will be able to:
16.01	Modify code for different decision making systems.
16.02	Create computer controlled characters using decision making systems.
16.03	Combine aspects of decision-making systems with other AI methods to create new systems for computer controlled characters.
17.0	Create and modify game tree systems. The student will be able to:
18.0	Apply neural networks. The student will be able to:
18.01	Modify code for artificial neural networks (ANNs).
18.02	Create computer controlled characters using ANNs.
18.03	Combine aspects of neural networks systems with other AI methods to create new systems for computer controlled characters.
19.0	Utilize genetic algorithms. The student will be able to:
19.01	Modify code for genetic algorithms systems.
19.02	Create computer controlled characters using genetic algorithms.
19.03	Combine aspects of genetic algorithms systems with other AI methods to create new systems for computer controlled characters.
20.0	Create virtual reality environments. The student will be able to:
20.01	Modify programs that use different graphics libraries.
20.02	Use different graphics libraries in the final project and programming assignments.
20.03	Develop libraries to use with 3D software development.
20.04	Modify existing programs that use sound and music to add realism in game development.
20.05	Modify sound systems to add direction and distance to sound effects.
20.06	Use sound effects in programming assignments.
20.07	Distinguish different sound file formats with respects to quality, and size.

20.08	Use sound effects and music in the final project.
20.09	Modify existing programs that use different types of input devices in game development.
20.10	Use different input devices in the final project and programming assignments.
20.11	Use forced feedback devices for input.
20.12	Summarize papers on the future of input devices.
20.13	Create 3D transparent objects.
20.14	Summarize papers on alpha blending programming methods.
20.15	Use transparency or fog in the final project.
20.16	Distinguish partial systems in terms of their uses such as fire and explosions.
20.17	Modify and write programs that use partial systems for special effects.
20.18	Apply physics to particle systems for realism.
20.19	Distinguish different methods for creating shadows.
20.20	Experiment with different lighting effects.
20.21	Modify 3D programs to include lighting and shadow effects in a 3D world.
20.22	Apply light and shadow effects in games to add realism.
20.23	Create light sources and shadows in the final project.
20.24	Modify existing programs that use reflection and refraction.
20.25	Develop programs that use light reflection and refraction.
20.26	Use light reflection and refraction in the final project.
20.27	Modify programs that use texture mapping.
20.28	Create 3D texture-mapped surfaces.
20.29	Use texture mapping in the final project.
20.30	Modify programs that use collision detection and reaction.

20.31	Compare different collision detection algorithms in terms of CPU usage and accuracy.
20.32	Use collision detection in the final project.
20.33	Discuss advantages of different collision methods.
20.34	Modify programs that use visible-surface determination.
20.35	Apply different algorithms for visible-surface determination to determine their effect on the performance of games and the game engines.
20.36	Modify programs that use hidden line removal.
20.37	Apply different algorithms for hidden line removal to determine their effects on the performance on games and the game engines.
20.38	Apply basic physics to a 3D game environment.
20.39	Create simplified calculations to mimic real life physics.
20.40	Manipulate physics functions to be applied to existing data structures that store the 3D world.
21.0	Create a complete working animated game or film. The student will be able to:
21.01	Distinguish game development projects.
21.02	Discuss case studies on game development projects.
21.03	Evaluate different types of projects in game development.
21.04	Create a game proposal document for a game development project.
21.05	Present and justifying the final completed project to the class.
21.06	Distinguish different team structures used in game development.
21.07	Work on a team project to develop a game from start to finish.
21.08	Discuss case studies on team game development structures.
21.09	Develop a game in teams from start to finish.
21.10	Subdivide a game development project into parts.
21.11	Research different game development processes.
21.12	Apply one of the existing processes to develop a game from start to finish.

21.13	Justify the game development process that was chosen for the project.
21.14	Distinguish the stages of game development.
21.15	Develop a game from start to end and working through all the stages of game development.
21.16	Create a fully working game using all the skills gained in the game programming courses.
21.17	Use all aspects of game programming development including graphics, sound, networking, software analysis, level building and design.
21.18	Create a timeline, and meeting deadlines on their project.
21.19	Use professional scheduling tools to communicate with the project team.
21.20	Prepare progress reports.
21.21	Use existing code from previous projects and publicly available code.
21.22	Give credits or request permission to use codes.

Additional Information

Laboratory Activities

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Florida Department of Education
Curriculum Framework

Program Title: E-Business Technology
Career Cluster: Information Technology

AS

CIP Number	1552120107
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Others

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in E-Business such as computer specialists, database technicians, security specialists, web content specialists, developers, technical, systems, and network analysts, web security specialists, and Internet technical support specialists in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

This program focuses on a balance of business and technology components and allows the student to gain additional skills in one of four areas of specialization: Business, Technology, Software, and Security.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate comprehension and communication skills.
- 02.0 Demonstrate professional development skills.
- 03.0 Perform documentation and technical reference activities.
- 04.0 Demonstrate employment skills.
- 05.0 Perform general organizational workplace competencies.
- 06.0 Demonstrate knowledge of legal and ethical issues.
- 07.0 Perform project management activities.
- 08.0 Understand issues related to e-Business.
- 09.0 Understand local area networks.
- 10.0 Demonstrate proficiency in microcomputer operating systems and software.
- 11.0 Perform web authoring activities.
- 12.0 Conduct systems analysis and design.
- 13.0 Understand database management systems.
- 14.0 Compare and contrast e-Business with traditional business.
- 15.0 Identify, classify and demonstrate management activities for e-Business.
- 16.0 Identify legal and ethical issues for e-Business.
- 17.0 Accounting and finance activities.
- 18.0 Perform marketing activities for e-Business.

In addition to the above core outcomes, the student will successfully complete the outcomes in at least one of the following specializations:

Security Specialization

- 19.0 Design, develop and implement physical, network, host, application, and user security systems for e-Business.
- 20.0 Maintain and monitor security policies.

Software Specialization

- 19.0 Use various programming software applications, languages and protocols for e-Business environment.
- 20.0 Develop software applications for e-Business environment.

Technology Specialization

- 19.0 Perform web Server Management activities.
- 20.0 Support e-Business applications and product development.
- 21.0 Maintain network infrastructure.

- 22.0 Design, integrate and deploy e-Business systems.
- 23.0 Perform technical requirements to support UNIX operating system.
- 24.0 Maintain systems quality and perform testing activities.

Business Specialization

- 19.0 Perform management activities to support human resources in e-Business environment.
- 20.0 Perform activities to enhance supply chain management in e-Business.
- 21.0 Use various models and strategies for e-Business.
- 22.0 Perform customer service techniques for e-Business.
- 23.0 Perform selling techniques for e-Business.

Florida Department of Education
Student Performance Standards

Program Title: E-Business Technology
CIP Number: 1552120100
Program Length: 60 credit hours
SOC Code(s): 15-1199

Refer to Rule 6A-14.030 (4) F.A.C., for the minimum amount of general education coursework required in the Associate of Science (AS) degree. At the completion of this program, the student will be able to:

01.0	Demonstrate comprehension and communication skills. The student will be able to:
01.01	Read and discuss work from different professional journals related to the course content.
01.02	Use reference sources such as books, magazines, and electronic databases to gather and critically evaluate materials.
01.03	Prepare, outline and deliver an oral report with appropriate materials.
01.04	Participate in group discussions as a member and as a leader.
01.05	Follow written and oral technical instructions.
01.06	Read and understand graphs, charts, diagrams and tables commonly used in this industry/occupation.
02.0	Demonstrate professional development skills. The student will be able to:
02.01	Identify corporate strategies and policies.
02.02	Maintain professional contact for future projects.
02.03	Facilitate mentor relationships.
02.04	Network with local professionals in the industry.
02.05	Understand the importance of attending seminars, workshops, and tradeshow.
03.0	Perform documentation and technical reference activities. The student will be able to:
03.01	Use technical vocabulary appropriately.
03.02	Locate information in technical references.
03.03	Prepare technical reports.

03.04	Describe appropriate documentation procedures and practices.
03.05	Produce and maintain system documentation.
03.06	Perform documentation and technical reference activities.
03.07	Cite correctly Internet-based resources using proper format.
03.08	Research industry trends on the Internet.
04.0	Demonstrate employment skills. The student will be able to:
04.01	Identify appropriate attire and grooming for a business office.
04.02	Conduct a job search.
04.03	Demonstrate job interview skills.
04.04	Identify methods for securing an employment references.
04.05	Identify and discuss issues contained within professional codes of conduct.
04.06	Use appropriate communication skills, courtesy, manners, and dress in the workplace.
04.07	Identify acceptable work habits.
04.08	Identify and use acceptable strategies for resolving conflict in the workplace.
04.09	Identify and demonstrate appropriate responses to criticism from employers, supervisor, or other employees.
04.10	Apply principles and techniques for working productively with people of diverse cultures and backgrounds.
04.11	Identify techniques for stress management and prevention of job burn-out.
04.12	Use appropriate communication skills, telephone etiquette, courtesy, and manners when dealing with customers.
04.13	Demonstrate knowledge of how to make appropriate job changes.
05.0	Perform general organizational workplace competencies. The student will be able to:
05.01	Follow oral and written instructions.
05.02	Prepare, outline, and deliver a short oral presentation.
05.03	Participate in group discussion as a member and as a leader.

05.04	Prepare visual material to support an oral presentation.
05.05	List the steps in problem solving.
05.06	Choose appropriate action in situations requiring effective time management.
05.07	Apply principles and techniques for being a productive, contributing member of a team.
05.08	Communicate effectively with individuals lacking a technical background.
05.09	Identify clear detailed technical oral instructions.
05.10	Identify examples of effective strategies to fulfill end user needs training strategies and techniques.
05.11	Identify strategies to build mutual trust, respect, and cooperation among team members.
05.12	Apply techniques for organizing and planning of time and resources to complete an assigned task.
05.13	Apply active listening techniques in interpersonal communications.
05.14	Identify strategies to improve and maximize productivity in the workplace.
05.15	Brainstorm techniques such as brainstorming to generate ideas and suggestions to achieve a task.
05.16	Analyze alternatives and compare costs and benefits in determining the best solution.
06.0	Demonstrate knowledge of legal and ethical issues. The student will be able to:
06.01	Correctly cite or attribute sources.
06.02	Use copyrighted materials appropriately.
06.03	Identify the types of works that are protected by intellectual property laws.
06.04	Discuss the basic elements of a contract.
06.05	Explain laws regarding e-mail litigation, including anti-spam laws.
06.06	Discuss e-mail use and ownership.
06.07	Describe customer and employee privacy issues and safeguards.
06.08	Develop examples of acceptable use policies.
06.09	Compare organizational codes of ethics.
06.10	Research and write a personal code of ethics.

07.0	Perform project management activities. The student will be able to:
07.01	Describe the role of project management (PM) within the organization.
07.02	Identify the strengths and weaknesses of various project life cycle designs.
07.03	Demonstrate the importance of project scope management.
07.04	Compare and contrast project selection methods.
07.05	Build a Work Breakdown Structure (WBS), Gantt chart, and Pert Chart and describe those different elements.
07.06	Compare and contrast types of cost estimates.
07.07	Examine cost control and earned value analysis.
07.08	Examine organizational planning, staff acquisition, and team development.
07.09	Examine risk identification, quantification, response development, and response control.
07.10	Compare and contrast project tracking and project reporting.
07.11	Understand change control and configuration control.
07.12	Understand subcontracting and outsourcing.
07.13	Discuss and analyze project management case studies.
08.0	Understand issues related to e-Business. The student will be able to:
08.01	Explain the difference between intranet and the Internet and the role of each in e-Business.
08.02	Explain the history, purpose and use of the World Wide Web and how it has enabled e-Business.
08.03	Describe the rise of various e-Business models.
08.04	Explain security issues related to electronic payment.
08.05	Explain issues of advertising, marketing and solicitation activities affecting e-Business.
09.0	Understand local area networks. The student will be able to:
09.01	Identify and explain the main purpose of various communication hardware devices, communication media, and protocols.
09.02	Describe various network topologies.

09.03	Differentiate between the OSI reference model and the TCP/IP protocol architecture.
09.04	Differentiate between analog and digital signals.
09.05	Describe various transmission media and how devices such as modems work.
09.06	Explain collision occurrences and detection.
09.07	Explain the factors and techniques for data transportation.
10.0	Demonstrate proficiency in microcomputer operating systems and software. The student will be able to:
10.01	Describe the historical development of computer operating software.
10.02	Describe the major hardware and related software of microcomputers.
10.03	Describe the various operating systems.
10.04	Explain system and application architectures.
10.05	Describe various media and file formats.
10.06	Use various software applications, including word processors, spreadsheets, databases, presentation software, and appointment scheduling applications.
10.07	Identify the major programming languages used in business data processing.
11.0	Perform web authoring activities to support e-Business. The student will be able to:
11.01	Identify and describe the components of an HTML document.
11.02	Create lists in an HTML document.
11.03	Recognize the various layouts used in website design.
11.04	Use storyboarding to design a comprehensive website.
11.05	Create links between HTML documents within a website and to external HTML documents.
11.06	Create tables.
11.07	Add images to webpages.
11.08	Use CSS to customize webpage styles.
11.09	Create image maps.

11.10	Identify elements of HTML fill-in forms.
11.11	Describe the various CGI scripting languages used in a website.
11.12	Identify and use client side programming technologies.
12.0	Conduct systems analysis and design. The student will be able to:
12.01	Perform a detailed systems investigation and analysis of the project.
12.02	Design the input and output for the system.
12.03	Design the data files for the systems.
12.04	Design the processing flow of the system.
12.05	Design a system to insure that only valid data is accepted and processed, completely and accurately.
12.06	Establish a project plan for the development and implementation of the systems.
12.07	Program and test the system.
12.08	Develop the final systems documentation.
12.09	Conduct necessary training and file conversion to properly implement the system.
12.10	Understand industry-standard models for developing and maintaining software.
12.11	Be able to use industry-standard project tools.
13.0	Understand database management systems. The student will be able to:
13.01	Understand the role of databases and how databases influence e-Business decisions.
13.02	List the advantages and disadvantages of using databases.
13.03	Understand the importance of data modeling as an analysis and communication tool.
13.04	Describe the elements of a data model.
13.05	Model the data requirements for sample e-Business problems.
13.06	Understand the principles associated with the relational model.
13.07	Understand the relationship between functional dependencies and keys.

13.08	Determine the Normal form of a relation and execute the steps necessary to put the relation into the proper normal form.
13.09	Define and contrast logical and physical keys.
13.10	Understand the advantages and disadvantages of indexes.
13.11	Understand the basic operators of relational algebra as a basis for retrieving data from relational databases.
13.12	Create and use Structured Query Language (SQL) to retrieve data from a database.
14.0	Compare and contrast e-Business with traditional business models. The student will be able to:
14.01	Define and describe the evolution of e-Business.
14.02	Describe how business operations have changed due to e-Business.
14.03	Explain the basic business models of electronic marketing.
14.04	Identify critical success factors for electronic marketing.
14.05	Explain the impact of the Internet on customers and markets for businesses.
14.06	Describe consumer buying behavior and organizational buying behavior.
14.07	Explain how service industries conduct business electronically.
14.08	Describe several innovative applications in the service sector.
14.09	Identify the various payment options in e-commerce.
14.10	Explain the strategic planning issues for e-Business.
14.11	Identify the critical success factors of an e-Business project/venture.
14.12	Describe the major components and impact of web-based economics.
15.0	Identify, classify and demonstrate management activities for e-Business. The student will be able to:
15.01	Define the role of the entrepreneur in global business.
15.02	Describe the entrepreneurial profile.
15.03	Discuss the role of the internet in helping small business expand their market.
15.04	Explain the importance of strategic management to business.

15.05	Describe the components of a marketing plan and explain the benefits of preparing one.
15.06	Describe how to prepare financial statements and use them to manage the business.
15.07	Describe effective pricing strategies.
15.08	Discuss the links among pricing, image, and competition.
15.09	Explain what seed capital is and why it is so important to the entrepreneurial process.
15.10	Explain the difference in the three types of capital that small businesses require: Fixed, Working and Growth.
15.11	Explain the stages in the location decision.
15.12	Describe the location criteria and outline the basic location options for retail and service business.
15.13	Explain purchasing, quality control, vendor analysis and managing inventory while using technology to gain a competitive edge.
15.14	Explain the challenges involved in the entrepreneur's role as leader and what it takes to be a successful leader.
15.15	Learn management succession and risk management strategies in family business together with ethics and social responsibility.
15.16	Describe, explain and discuss business's responsibility to employees, customers, investors and the community.
15.17	Describe management's historical role in business operations.
15.18	Compare and contrast different management philosophies.
15.19	Compare and contrast the employees' personal needs with those of the organization.
15.20	Describe methods managers can use to deal with management politics.
15.21	Describe the nature of management's legal environment for traditional and electronic environments.
15.22	Describe the planning process of managers.
15.23	Discuss the characteristics and functions of an organization chart.
15.24	Describe the act and benefits of delegation.
15.25	Summarize the components of job descriptions and specifications.
15.26	Define and describe the activities involved in making a job analysis.
15.27	Discuss potential problems in evaluating employees and methods to avoid problems.

15.28	Discuss strategies managers may use to build and sustain high morale and motivation.
15.29	Describe methods of direct and indirect compensation.
15.30	Describe various employee relations practices.
15.31	Summarize strategies to improve personal and organizational communication.
15.32	Discuss the role of information systems in the control system.
15.33	Discuss the steps in the basic decision making process.
15.34	Describe several factors that influence decision-making.
15.35	Distinguish among management functions.
15.36	Demonstrate knowledge of the relationship between authority and responsibility to task accomplishment.
15.37	Select the most effective communication systems.
15.38	Identify problems and make an appropriate decision.
16.0	Identify legal and ethical issues for e-Business. The student will be able to:
16.01	Describe the procedure to obtaining protection under intellectual property law.
16.02	Describe and recognize material that is defamatory.
16.03	Explain the right of publicity and the right of privacy.
16.04	Explain copyright assignment and the Visual Artists Rights Act.
16.05	Discuss licensing and registration issues.
16.06	Describe the importance in choosing a strong trademark.
16.07	Understand basic laws that apply to e-commerce.
16.08	Discuss the permission required for linking, revenue-sharing agreements, and liability issues pertaining to linking.
16.09	Explain other liability issues for ISPs.
16.10	Differentiate trademark protection and trade secret protection.

17.0	Accounting and finance activities. The student will be able to:
17.01	Identify and understand accounting and financial concepts.
17.02	Describe and use financial analysis tools.
17.03	Perform standard accounting and bookkeeping functions.
17.04	Understand the impact and implications of federal auditing guidelines.
18.0	Perform marketing activities for e-Business. The student will be able to:
18.01	Discuss what marketing is and why it is important to organizations and individuals.
18.02	Describe the key decisions in the development of corporate strategy.
18.03	Recognize the outcomes of consumers' decisions to purchase or not to purchase and how these affect marketing success.
18.04	Define and explain market segmentation, target markets, and product differentiation and positioning.
18.05	Describe the issues involved in product and brand positioning.
18.06	Differentiate between consumer and business products.
18.07	Describe the way marketing research is used in the new-product development process.
18.08	Identify many of the influences on marketers' pricing decisions.
18.09	Explain how consumers form perceptions of quality and value.
18.10	Explain the functions and key activities of marketing channels.
18.11	Distinguish between direct and indirect marketing channels.
18.12	Explain the key elements of the marketing communications process.
18.13	Describe the key activities in sales management.
18.14	Explain the difference between e-Business, e-commerce, and e-marketing.

Security Specialization

19.0 Design, develop and implement physical, network, host, application and user security systems for e-Business. The student will be able to:

19.01 Explain use and purpose of security policies.

19.02 Conduct a security audit.

19.03 Control access to systems, resources and data.

19.04 Explain and manage system security in common operating systems.

19.05 Describe concepts of web servers and their role in the network.

19.06 Design, implement and maintain a web server.

19.07 Explain how documents and files are stored on a web server.

19.08 Describe different methods for projecting future traffic on a web server.

19.09 Identify the necessary steps to ensure reliability and response of the server.

19.10 Describe and implement the process for effectively organizing a website.

19.11 Implement search engine optimization techniques.

19.12 Set up the web server so that dynamic content can be provided to users of the website.

19.13 Analyze server log files to determine trends in web server utilization.

19.14 Identify vulnerabilities in Internet protocols and counter-measures for securing them.

19.15 Properly configure and describe the operation of naming and directory services.

19.16 Describe the operation of authentication and auditing services protocols and how to effectively secure them.

19.17 Describe the operation of administrative services protocols and how to effectively secure them.

19.18 Describe the operation of the IP Security protocol.

20.0 Maintain and monitor security policies. The student will be able to:

20.01 Identify basic network security.

20.02 Describe purpose and use of packet sniffing, firewalls and proxies.

20.03	Define web server security.
20.04	Protect against the risks of directory browsing.
20.05	Assess client security issues.
20.06	Install and configure network security tools.
20.07	Describe authentication and identification schemes.
20.08	Define secure software.
20.09	Describe the use and purpose of encryption.
20.10	Define the advantages of Secure Socket Layer (SSL).
20.11	Define certificate authority.
20.12	Identify basic aspects of intrusion detection and steps to protect the web server from these threats.
20.13	Describe cryptographic attack models.
20.14	Describe the secret key and public key encryption methodology.
20.15	Use hashing techniques.
20.16	Use digital signatures in a network environment.
20.17	Use authentication processes in heterogeneous environments.
20.18	Create secure environment through defensive programming.
20.19	Explain the basic elements of Security Testing and Auditing.
20.20	Describe the capabilities of effective signature filter techniques.
20.21	Explain the importance of architectural design detection of intrusions.
20.22	Define and utilize various network based Intrusion Detection Solutions (IDS).
20.23	Explain intrusion detection and denial of service.
20.24	Issue and manage digital certificates.

Software Specialization

19.0	Use various programming software applications, languages and protocols for e-Business environment. The student will be able to:
19.01	Describe Internet Protocols.
19.02	Explain how applets differ from applications in terms of program form, operating context, and how they are started.
19.03	Describe and use single- and multi-dimensional arrays.
19.04	Create classes that use inheritance aspects of the object-oriented paradigm.
19.05	Describe the error handling constructs.
19.06	Write a program that reads and writes text files.
19.07	Understand the hierarchy of classes designed for aggregate data.
19.08	Identify deprecated classes, and explain how to migrate.
19.09	Explain and use event handling in a GUI.
19.10	Differentiate between client-side scripting and server-side scripting.
19.11	Manipulate the objects contained in the Document Object Model (DOM).
19.12	Use variables, constants, and arithmetic operators to create valid arithmetic expressions.
19.13	Dynamically alter the sequence of code execution.
19.14	Use built-in functions as well as create custom functions, subroutines, and procedures within software using scripting languages.
19.15	Create server pages using languages.
19.16	Write programs in a language that implement network connection objects.
19.17	Create and use server-side include files.
19.18	Understand appropriate use of and demonstrate ability to incorporate and utilize cookies in e-Business software.
19.19	Integrate standard object model components with server pages.
19.20	Create webpage using data from a database.
19.21	Implement programs that use local or remote databases with standard protocols.

19.22	Use a scripting language on the server side of a distributed program.
19.23	Use a scripting language on the client side of a distributed program.
19.24	Implement levels of security in distributed software applications.
19.25	Read simple UML diagrams, and create UML documents that model programs.
19.26	Use built-in objects for error handling, file creation, and dictionary access in e-Business software.
19.27	Understand the use of client-side operating system tools.
19.28	Produce software that can interface with operating system services used to broadcast messages within a domain.
19.29	Utilize appropriate operating system interfaces to redirect output.
19.30	Describe various name space models.
19.31	Register and query a service.
19.32	Use transport service providers and name space service providers.
19.33	Explain and implement XML-related technologies.
19.34	Explain and use the different elements that make code easier to read.
19.35	Explain and use the different data types available in scripting languages.
19.36	Explain and use standard control structures such as repetition, selection, and sequence in the appropriate programming language.
19.37	Output data from scripting language.
19.38	Explain the benefits of using subroutines and libraries in code.
19.39	Debug code from scripting languages.
19.40	Explain basic Internet and server-side scripting security issues and common techniques to fix them.
19.41	Use a scripting language to create and manage form data submitted over the Internet.
19.42	Examine the use of shopping carts on the Internet and how scripting languages can be used in these applications.
19.43	Examine the use of auctions via the Internet and scripting languages.
19.44	Understand industry standard program design techniques.

19.45	Develop the logic for a program using both flowcharting and pseudo code.
19.46	Develop looping and nested looping logic.
19.47	Develop the logic of: three-level control break program, an extract program, an edit program, a file matching and an update program.
20.0	Develop software applications for e-Business environment. The student will be able to:
20.01	Design software applications that are accessible by a variety of wireless and wired devices.
20.02	Explain alternatives to create dynamic content.
20.03	Integrate the push model of information delivery.
20.04	Use operating system services such as a personal web server for database development.
20.05	Explain server security and permissions.
20.06	Evaluate the advantages/disadvantages of different server platforms.
20.07	Explain scripting concepts and syntax.
20.08	Connect common databases using standard protocols.
20.09	Display data from a database using a web interface.
20.10	Write and modify a database record using a web interface.
20.11	Enable web security features.
20.12	Design and implement a basic shopping cart application.

Technology Specialization

19.0 Perform web server management activities. The student will be able to:

19.01 Perform console management in the author and user mode.

19.02 Create and navigate a custom management console.

19.03 Create new user accounts.

19.04 Implement groups into a domain.

19.05 Change the domain mode.

19.06 Manage software settings, scripts, and security settings.

19.07 Manage administrative templates.

19.08 Manage folder redirection.

19.09 Configure and administer network printers.

20.0 Support e-Business applications and product development. The student will be able to:

20.01 Identify the different components to systems development life cycle and how they are interrelated.

20.02 Identify deliverables for user project and build subprojects within lifecycle components.

20.03 Create physical structure of web-based architecture.

20.04 Create requirements for business request, develop web components necessary to satisfy request and test for acceptance.

20.05 Use web browser and web authoring tools.

20.06 Write required queries to get required answer sets.

21.0 Maintain network infrastructure. The student will be able to:

21.01 Identify web server hardware and discuss performance evaluation.

21.02 Describe security threat countermeasures, including anti-virus software and encryption.

21.03 Identify basic components of electronic payment systems.

21.04 Identify how to create and maintain an effective web presence and brand.

21.05	Describe various Electronic Data Interchange components.
21.06	Define and explain virtual communities and web portals.
21.07	Identify challenges of a global business regarding culture, legal and financial impacts, and differing languages.
21.08	Identify the planning stages of the e-Business project.
22.0	Design, integrate and deploy e-Business systems. The student will be able to:
22.01	Describe the lifecycle of an e-Business.
22.02	Explain website information architecture design principles.
22.03	Identify e-Business systems development strategies.
22.04	Explain integration with LDAP, Messaging, and Collaboration.
22.05	Identify and describe the use of Meta Directories, Content Syndication, Single Sign-on, and Search Engines.
22.06	Identify deployment strategies and Middleware.
22.07	Identify Application Server Systems Architectures.
22.08	Explain Transaction Processing (TP) monitor systems architecture.
22.09	Identify integration solutions.
23.0	Perform technical requirements to support UNIX operating system. The student will be able to:
23.01	Explain basic command syntax for approximately 100 common shell commands governing the file-system, printing and process control.
23.02	Identify and use the editors.
23.03	Schedule and reprioritize processes.
23.04	Use commands to get information and communicate with remote users.
23.05	Search for strings of text in files using shell meta-characters.
23.06	Use common tools to generate reports or filter text.
23.07	Use shell scripts to control flow, input, output and jobs.
23.08	Troubleshoot system problems.

24.0	Maintain systems quality and perform testing activities. The student will be able to:
24.01	Identify the advantages and disadvantages of client-server computing.
24.02	Establish controls in a client-server framework.
24.03	Explain software testing methodology.
24.04	Describe the planning, executing and controlling of the testing process.
24.05	Perform Graphical User Interface testing.
24.06	Explain the server applications testing processes.
24.07	Explain testing in a networked application environment.
24.08	Incorporate cross-level functional testing within a data-driven framework-based environment.
24.09	Use client-server testing metrics.
24.10	Explain testing integration on the desktop.
24.11	Explain testing for web-based client-server applications.
24.12	Select and use appropriate automated test tools.

Business Specialization

19.0 Perform management activities to support human resources in an e-Business environment. The student will be able to:

- 19.01 Identify career choice in human resources.
- 19.02 Describe the components of the job requirement and analysis process.
- 19.03 Describe the important elements of effective human resource planning.
- 19.04 Discuss the performance appraisal and the uses of the performance appraisal.
- 19.05 Compare training options available to organizations.
- 19.06 Discuss strategies to improve organizational performance.
- 19.07 Describe various ways of compensating employees.
- 19.08 Summarize the legal regulations of compensation systems.
- 19.09 Explain the importance of retaining employees.
- 19.10 Discuss the importance of safety and health laws and standards.
- 19.11 Describe how to create a safe and healthy work environment.
- 19.12 Describe labor relations and collective bargaining.

20.0 Perform activities to enhance supply chain management. The student will be able to:

- 20.01 Explain the electronic environment of the supply chain.
- 20.02 Explain the importance of information in an integrated supply chain.
- 20.03 Explain the technological applications for supply chain management.
- 20.04 Discuss how to engineer or reengineer the supply chain for optimal materials planning and handling.
- 20.05 Explain how relationships are important to the supply chain.
- 20.06 Explain the importance of suppliers in the supply chain.
- 20.07 Describe how to resolve conflicts in the supply chain.
- 20.08 Explain the laws and regulations regarding "order taking".
- 20.09 Describe the components involved in an international supply chain management system.

21.0	Use various models and strategies for e-Business. The student will be able to:
21.01	Explain the components, linkages, and evaluation of Business Models and their relationship with e-Business.
21.02	Describe the competitive environment and how it can affect an Internet business.
21.03	Describe the current strengths, weaknesses, opportunities, and threats to Internet business.
21.04	Describe the limitations to transactions over the Internet.
21.05	Describe the process of valuing and financing an Internet start-up.
21.06	Describe macro environments and the impact on performance.
21.07	Explain the differences between incumbents and new entrants.
22.0	Perform customer service techniques for e-Business. The student will be able to:
22.01	Define customer service.
22.02	Discuss solutions to overcoming obstacles in customer service.
22.03	Define service culture in organizations.
22.04	Describe management's role in customer service formulation.
22.05	Describe employee empowerment and its importance in providing good customer service.
22.06	Explain the role of communicating in customer service.
22.07	Determine strategies for working with various customer behaviors.
23.0	Perform selling techniques for e-Business. The student will be able to:
23.01	Describe the relationship of personal selling to market-driven economies.
23.02	Identify career opportunities in the field of selling.
23.03	Explain the importance of relationship skills in personal selling.
23.04	Explain the importance of projecting a positive self-image.
23.05	Discuss communication-style bias and how it influences the relationship process.
23.06	Identify reasons why salespeople and customers benefit from thorough product knowledge.

23.07	List major sources of product information.
23.08	Discuss the evolving role of strategic selling.
23.09	Discuss the factors that influence people to make buying decisions.
23.10	Explain how to plan a sales presentation.
23.11	List criterion for qualifying and organizing prospects.
23.12	List guidelines for effective demonstrations.
23.13	Outline general strategies for negotiating buyer resistance.
23.14	Describe the proper attitude to display toward closing the sale.
23.15	List guidelines for closing the sale.
23.16	Explain how customer service can stimulate repeat business and referrals.
23.17	Describe how to properly handle activities that are part of the customer service program.
23.18	Describe the functions of a sales manager.
23.19	Explain how to manage time wisely.
23.20	List factors that influence the ethical conduct of sales personnel.
23.21	List and describe the functions of telemarketing.

Additional Information

Laboratory Activities

Laboratory activities are an integral part of this program. These activities include instruction in the use of safety procedures, tools, equipment, materials, and processes related to these occupations. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the appropriate career and technical student organizations for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Articulation

To be transferable statewide between institutions, this program must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific articulation agreements with each other.

The following industry certifications have been approved by the Florida State Board of Education for statewide articulation credit into this degree program.

Certified Internet Web (CIW) – E-Commerce Designer (PROSO003) – 3 credits
CompTIA Security+ (COMPT003) – 3 credits

Program Length

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The standard length of this program is 63 credit hours according to Rule 6A-14.030, F.A.C.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

- E-Business Security Technical Certificate (0552120102) – 24 credit hours
- E-Business Software Technical Certificate (0552120103) – 21 credit hours
- E-Business Technical Certificate (0552120101) – 24 credit hours
- E-Business Technology Technical Certificate (0552120104) – 21 credit hours
- E-Business Ventures Technical Certificate (0552120105) – 24 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: Business Intelligence Specialist (Data Science Technician)
Career Cluster: Information Technology

AS	
CIP Number	1552130101
Program Type	College Credit
Standard Length	60 credit hours
CTSO	Phi Beta Lambda, BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Others

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to in-depth instruction on the activities performed data analysis; factors, issues, and constraints relating to the creation of reports; requirements for documenting specifications; identifying data sources and retrieval issues and methodologies; report delivery mechanisms; report modification and maintenance; data governance; quality control tests; data and report integrity; and the use of data science tools.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Define and describe the process of data analysis.
- 02.0 Describe the concepts of data science and how they are applied to data analysis.
- 03.0 Describe the implications of business intelligence analysis on an organization's strategic marketing, organizational, and business plans.
- 04.0 Provide standard report specifications and generate standard or custom reports that summarize business, financial, or economic data for review by stakeholders.
- 05.0 Describe Security concerns associated with Data Science.
- 06.0 Define and differentiate among data constraints, filters, exception threshold, and data organization factors important in the creation of a report.
- 07.0 Locate, acquire, and model the data for analysis and output.
- 08.0 Compare and contrast the various forms for report presentation.
- 09.0 Describe the advantages and disadvantages for various report delivery mechanisms.
- 10.0 Reassess current business intelligence or trend data in support of altered information needs.
- 11.0 Analyze technology trends to identify markets for future product development or to improve sales of existing products.
- 12.0 Conduct or coordinate tests to ensure data analysis is consistent with defined needs.
- 13.0 Formulate and/or adhere to data governance policies and processes.
- 14.0 Identify and analyze industry or geographic trends with business strategy implications.
- 15.0 Describe best practices for change management to ensure data and report integrity and continuity.
- 16.0 Apply quality control standards and measures.
- 17.0 Compare and contrast the attributes and appropriateness of data analysis tools.
- 18.0 Describe the transformation and statistical functions used in Data Science.

Florida Department of Education
Student Performance Standards

Program Title: Business Intelligence Specialist
 CIP Number: 1552130101
 Program Length: 60 credit hours
 SOC Code(s): 15-1199

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. At the completion of this program, the student will be able to:

01.0	Define and describe the process of data analysis. The student will be able to:
01.01	Describe the requirements of analysis planning.
01.01.1	Define the goals of the desired requirements.
01.01.2	Select an appropriate analysis strategy.
01.02	Describe the activities and goals of the design phase.
01.02.1	Determine appropriate reporting format.
01.02.2	Select appropriate reporting tool/form.
01.02.3	Describe appropriate delivery mechanism.
01.02.4	Define data criteria and constraints.
01.02.5	Delineate report data definitions.
01.03	Describe the activities and goals of the development phase.
01.03.1	Identify available data sources and formats.
01.03.2	Acquire data.
01.03.3	Analyze data.
01.03.4	Create report.
01.04	Describe the activities and goals of the evaluation phase.
01.04.1	Define analytics/metrics suitable for evaluating accuracy and validity of results.
01.04.2	Evaluate report output to assess whether intelligence is consistent with defined goals.

01.04.3	Assess report performance and usability.
01.05	Describe the activities and goals of the deployment and maintenance phase.
01.05.1	Perform data reconciliation.
01.05.2	Conduct periodic validation of reports with appropriate audiences and end-users.
01.05.3	Track daily/weekly/monthly usage of data/reports.
01.05.4	Determine proper “phasing out” thresholds for existing reports based on usage, data validity, and report reliability.
01.05.5	Determine proper data archiving thresholds.
02.0	Describe the concepts of data science and how they are applied to data analysis. The student will be able to:
02.01	Define the role of data analysis in the decision-making process.
02.02	Describe the domains of application of data science.
02.03	Describe the sources of data and information used in the analysis of data.
02.04	Describe the role and significance of data modeling, data warehousing, and data mining in data science.
02.05	Describe the risks associated with data analysis (e.g., data validity, integrity, inappropriate analytics/metrics).
03.0	Describe the implications of business intelligence analysis on an organization’s strategic marketing, organizational, and business plans. The student will be able to:
03.01	Explain how business intelligence is used in creating, validating, and strengthening an organization’s strategic marketing plan.
03.02	Explain how an organization’s internal processes, infrastructure, processes, and communication are impacted by the deployment of business intelligence.
03.03	Explain how data science is used to facilitate an organization’s decision-making process.
04.0	Provide standard report specifications and generate standard or custom reports that summarize business, financial, or economic data for review by stakeholders. The student will be able to:
04.01	Compare attributes and benefits of available data sources.
04.01.1	RDBMS.
04.01.2	Data warehouse and OLAP Cubes.
04.01.3	Spreadsheet.
04.01.4	XML.

04.01.5	CSV.
04.01.6	Web service.
04.01.7	Raw Data and other (KML/Shape).
04.02	Define report data elements/requirements (metadata).
04.02.1	Dimensions.
04.02.2	Type I (As is – current).
04.02.3	Type II (Historical – slowly changing).
04.02.4	Facts.
04.02.5	Base.
04.02.6	Summaries.
04.02.7	Calculated fields.
04.02.8	Periodicity.
04.02.9	Relationships/JOINS.
04.03	Describe how data is to be used.
04.03.1	Data mining.
04.03.2	Filtering.
04.03.3	Exception threshold alerts.
04.03.4	Aggregating.
04.03.5	Snapshot.
04.03.6	Dynamic.
04.03.7	Historical/archive/disposal.
04.04	Determine the form of analysis.
04.04.1	Comparative analysis.
04.04.2	Impact analysis.

04.04.3	Correlational (affinity) analysis.
04.04.4	Trending/Forecasting.
05.0	Describe Security concerns associated with Data Science. The student will be able to:
05.01	Security Event and Event Management (SIEM).
05.02	Threat detection and mitigation.
05.03	Computer and network forensics.
05.04	Security metrics.
05.05	Fraud and loss analytics.
05.06	Analysis of market.
05.07	Risk measurement.
05.08	Challenges.
05.09	Applications.
06.0	Define and differentiate among data constraints, filters, exception threshold, and data organization factors important in the creation of a report. The student will be able to:
06.01	Distinguish between data constraints and filters and their appropriate use.
06.02	Describe how each of the following data constraints relates to the creation and/or delivery of a report.
06.02.1	Size of recordset (scope & performance).
06.02.2	Time/period (end points and span).
06.02.3	Range (e.g., # of records).
06.02.4	Data element (e.g., type, size).
06.02.5	Localization (programming & display language).
06.03	Describe how each of the following types of filters may be used to refine or enhance a report.
06.03.1	Dimensions (Type I and Type II).
06.03.2	Facts (e.g., base, summaries, calculated fields).

06.04	Illustrate how the use of an exception threshold contributes to the operational effectiveness of a report.
06.04.1	Display or action dependent on threshold.
06.04.2	Triggers alert or advance warning of approaching static threshold.
06.04.3	Highlights results exceeding dynamic threshold.
06.05	Compare and contrast the following forms of data organization in terms of representation and analysis of data results.
06.05.1	GROUP BY.
06.05.2	ORDER BY (SORT).
06.05.3	Concatenation/substring.
06.05.4	KRAN.
07.0	Locate, acquire, and model the data for analysis and output. The student will be able to:
07.01	Identify the types of data that might be used to create business intelligence reports in support of the organization's business and financial strategic goals.
07.01.1	Inventory repositories.
07.01.2	Sales data.
07.01.3	Customer data.
07.01.4	Employee/staffing data.
07.01.5	Financial data.
07.01.6	Spatial data
07.01.7	Security and Risk
07.02	Describe the risks and potential areas of concern related to the use of external data.
07.02.1	Integrity/validity of data.
07.02.2	Legality of data availability.
07.02.3	Privacy issues of data acquired.
07.02.4	Confidentiality of acquisition.
07.03	Describe potential issues, concerns, and obstacles associated with the use of data sources.

07.03.1	Data form.
07.03.2	Data integrity.
07.03.3	Normalization.
07.03.4	Cleaning.
07.04	Describe the role and implications of standardization relative to internal and external data sources.
07.04.1	Describe the need for data typing and transformation.
07.04.2	Describe the methods by which transformation may be accomplished.
08.0	Compare and contrast the various forms for report presentation. The student will be able to:
08.01	Describe the form of data required for using a report generator.
08.02	Describe the form of data required for using a spreadsheet.
08.03	Describe the form of data required for using a database.
08.04	Describe the form of data required for using an OLAP Cube or hypercube.
08.05	Describe the attributes of a report suitable for presentation in HTML/Flash.
08.06	Describe the form of data required for using a graph.
08.07	Describe the form of data required using a dashboard interface.
09.0	Describe the advantages and disadvantages for various report delivery mechanisms. The student will be able to:
09.01	Email.
09.02	Web-based.
09.03	Mobile device.
09.04	Intranet.
09.05	Print/PDF.
09.06	Oral presentation.
10.0	Reassess current business intelligence or trend data in support of altered information needs. The student will be able to:
10.01	Identify and relate report design constraints and their relationship to data.

10.02	Evaluate current technology in terms of compatibility and capacity for meeting new or evolving information needs.
10.03	Re-construct report based on alternative parameters.
10.04	Adapt and validate report based on new requirements.
11.0	Analyze technology trends to identify markets for future product development or to improve sales of existing products. The student will be able to:
11.01	Evaluate new technologies and products for applicability, capability, and capacity for current and future information needs.
11.02	Create a proposal for introducing new, or adapting existing, business intelligence technology, including pricing, benefits summary, cost/benefit analysis, life cycle implications, and implementation plan.
12.0	Conduct or coordinate tests to ensure data analysis is consistent with defined needs. The student will be able to:
12.01	Evaluate that reports meet requirements.
12.02	Test metrics for accuracy and validity.
12.03	Peer review.
12.04	Use performance testing.
12.05	Use performance tuning.
13.0	Formulate and/or adhere to data governance policies and processes. The student will be able to:
13.01	Understand how information is disseminated to end-users.
13.02	Adhere to policies, tool use, and processes related to data governance.
14.0	Identify and analyze industry or geographic trends with business strategy implications. The student will be able to:
14.01	Compare and contrast key performance indicators appropriate to the industry.
14.02	Define metrics to support analysis of targeted KPIs.
14.03	Understand how the monitoring and analysis of key performance indicators strengthen or support the organization's goals and strategies.
15.0	Describe best practices for change management to ensure data and report integrity and continuity. The student will be able to:
15.01	Authorize/permissions schema.
15.02	Use internal controls.
15.03	Impact analysis.

15.04	Use Redundancy/archival policy.
15.05	Assess readiness for change.
15.06	Communicate changes.
15.07	Separate duties (e.g., design, implementation, testing).
16.0	Apply quality control standards and measures. The student will be able to:
16.01	Check data quality.
16.02	Report quality.
16.03	Analytic/metric quality.
16.04	Check quality assurance.
17.0	Compare and contrast the attributes and appropriateness of data analysis tools. The student will be able to:
17.01	Compare and contrast enterprise-based/integrated data science tools including, but not limited to, SAS, SAP, COGNOS, Hadoop, Cloudera.
17.02	Compare and contrast native/client-based tools used in business intelligence analysis, including spreadsheets and SQL-compliant applications.
18.0	Describe the transformation and statistical functions used in Data Science. The student will be able to:
18.01	Describe and apply the programming languages used in data science.
18.02	Select an appropriate programming language and any desirable packages and apply the necessary transformation and statistical functions required to solve a problem.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Business Intelligence Professional (0552130101) – 20 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: Business Computer Programming
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	B070320
CIP Number	0511020202
Grade Level	30, 31
Standard Length	1200 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in computer programming positions.

The content includes but is not limited to converting problems into detailed plans; writing code into computer language; testing, monitoring, debugging, documenting, and maintaining computer programs; and designing programs for specific uses and machines.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of five occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0041	Computer Programmer Assistant	BUS ED 1 @2 COMPU SCI 6 COMP PROG 7G	300 hours	15-1131
C	CTS0042	Junior Programmer		300 hours	15-1131
D	CTS0043	Junior Programmer II		300 hours	15-1131
E	CTS0044	Computer Programmer		150 hours	15-1131

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development.
- 16.0 Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types.
- 17.0 Distinguish between iterative and non-iterative program control structures.
- 18.0 Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages.
- 19.0 Describe the processes, methods, and conventions for software development and maintenance.
- 20.0 Explain the types, uses, and limitations of testing for ensuring quality control.
- 21.0 Create a program design document using Unified Modeling Language (UML) or other common design tool.
- 22.0 Describe information security risks, threats, and strategies associated with software development.
- 23.0 Design a computer program to meet specific physical, operational, and interaction criteria.
- 24.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
- 25.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
- 26.0 Create a unit test plan, implement the plan, and report the results of testing.
- 27.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 28.0 Solve problems using critical thinking skills, creativity and innovation.
- 29.0 Use information technology tools.
- 30.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 31.0 Describe the importance of professional ethics and legal responsibilities.

- 32.0 Participate in work-based learning experiences.
- 33.0 Identify functions of information processing.
- 34.0 Identify functions of computers.
- 35.0 Test programs.
- 36.0 Plan program design.
- 37.0 Code programs.
- 38.0 Perform program maintenance.
- 39.0 Evaluate assigned business computer programming tasks.
- 40.0 Develop an awareness of software quality assurance.
- 41.0 Implement enhanced program structures.
- 42.0 Develop an understanding of programming techniques and concepts.
- 43.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 44.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 45.0 Explain the importance of employability skill and entrepreneurship skills.
- 46.0 Test programs.
- 47.0 Plan program design.
- 48.0 Code programs.
- 49.0 Perform program maintenance.
- 50.0 Create and maintain documentation.
- 51.0 Evaluate assigned business computer programming tasks.
- 52.0 Demonstrate an understanding of operating systems, environments, and platforms.
- 53.0 Develop an awareness of software quality assurance.
- 54.0 Implement enhanced program structures.
- 55.0 Develop an understanding of programming techniques and concepts.
- 56.0 Test programs.
- 57.0 Plan program design.
- 58.0 Code programs.
- 59.0 Perform program maintenance.
- 60.0 Implement enhanced program structures.

Florida Department of Education
Student Performance Standards

Program Title: Business Computer Programming
Career Certificate Program Number: B070320

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: CTS0041
Occupational Completion Point: B
Computer Programmer Assistant – 300 Hours – SOC Code 15-1131

15.0	Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development. The student will be able to:
15.01	Describe the evolution of programming and programming careers.
15.02	Identify tasks performed by programmers.
15.03	Describe how businesses use computer programming to solve business problems.
15.04	Investigate job opportunities in the programming field.
15.05	Explain different specializations and the related training in the computer programming field.
15.06	Explain the need for continuing education and training of computer programmers.
15.07	Explain enterprise software systems and how they impact business.
15.08	Describe ethical responsibilities of computer programmers.
15.09	Describe the role of customer support to software program quality.
15.10	Identify credentials and certifications that may improve employability for a computer programmer.
15.11	Identify devices, tools, and other environments for which programmers may develop software.
16.0	Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types. The student will be able to:
16.01	Identify the characteristics (e.g., size, limits) and uses of different numerical and non-numerical data types.
16.02	Explain the types and uses of variables in programs.
16.03	Determine the best data type to use for given programming problems.
16.04	Identify the types of operations that can be performed on different data types.
16.05	Evaluate arithmetic and logical expressions using appropriate operator precedence.
16.06	Explain how computers store different data types in memory.
16.07	Demonstrate the difference between "data" and "information".
16.08	Use different number systems to represent data.
16.09	Explain how national and international standards (i.e., ASCII, UNICODE) are used to represent non-numerical data.
16.10	Use Boolean logic to perform logical operations.

17.0	Distinguish between iterative and non-iterative program control structures. The student will be able to:
17.01	Explain non-iterative programming structures (e.g., if, if/else) and their uses.
17.02	Explain iterative programming structures (e.g., while, do/while) and their uses.
18.0	Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages. The student will be able to:
18.01	Identify the characteristics, uses, and limits of low-level programming languages.
18.02	Identify the characteristics, uses, and limits of high-level programming languages.
18.03	Identify the characteristics, uses, and limits of rapid development programming languages.
18.04	Describe object-oriented concepts.
18.05	Explain the characteristics of procedural and object-oriented programming languages.
18.06	Compare and contrast programming languages that are compiled (e.g., C++), interpreted (e.g., Basic, HTML), and translated (e.g., Java).
19.0	Describe the processes, methods, and conventions for software development and maintenance. The student will be able to:
19.01	Describe and explain tools used in software development.
19.02	Describe the stages of the program life cycle.
19.03	Compare and contrast alternative methods of program development (e.g., rapid prototyping, waterfall).
19.04	List and explain the steps in the program development cycle.
19.05	Describe different types of documentation used in the program development cycle (e.g., requirements document, program design documents, test plans).
19.06	Describe the on-going need for program maintenance.
19.07	Describe different methods companies use to facilitate program updates for enhancements and defects (e.g., how customers receive patches, updates, new versions, upgrades).
19.08	Describe different methods used to facilitate version control and change management.
20.0	Explain the types, uses, and limitations of testing for ensuring quality control. The student will be able to:
20.01	Explain the uses and limits of testing in ensuring program quality.
20.02	Explain testing performed at different stages of the program development cycle (e.g., unit testing, system testing, user acceptance testing).
20.03	Describe data and the use of test plans/scripts to be used in program testing.

20.04	Describe and identify types of programming errors (e.g., syntactical, logic, usability, requirements mismatch).
20.05	Identify the data to be used for boundary conditions.
20.06	Explain different types of testing (e.g., usability, automated, regression) and testing tools.
21.0	Create a program design document using Unified Modeling Language (UML) or other common design tool. The student will be able to:
21.01	Describe different design methodologies and their uses (e.g., object-oriented design, structured design, rapid application development).
21.02	Describe tools for developing a program design (e.g., UML, flowcharts, design documents, pseudocode).
21.03	Explain the role of existing libraries and packages in facilitating programmer productivity.
21.04	Participate and contribute to a design review of a program design developed using a common program design tool (e.g., UML, flowcharts, design documents, pseudocode).
21.05	Write a program design document using UML or other standard design methodology.
21.06	Define input and output for a program module using UML or other standard design methodology.
22.0	Describe information security risks, threats, and strategies associated with software development. The student will be able to:
22.01	Explain the security risks to personal and business computer users.
22.02	Identify different types of threats to computer systems.
22.03	Identify methods to protect against different threats to computer systems.
22.04	Understand the importance of a disaster/emergency response plan.
22.05	Identify alternative methods for data storage and backup (e.g., mirroring, fail-over, high availability, types of backups).
23.0	Design a computer program to meet specific physical, operational, and interaction criteria. The student will be able to:
23.01	Choose appropriate data types depending on the needs of the program.
23.02	Define appropriate user interface prompts for clarity and usability (e.g., user guidance for data ranges, data types).
23.03	Design and develop program that are designed for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
23.04	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
23.05	Identify the tools required to develop a program (e.g., editors, compilers, linkers, integrated development environments, application programming interfaces (APIs), libraries).
24.0	Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types. The student will be able to:

24.01	Use appropriate naming conventions to define program variables and modules (methods, functions).
24.02	Use a program editor to write the source code for a program.
24.03	Write programs that use selection structures (e.g., if, if/else).
24.04	Write programs that use repetition structures (e.g., while, do/while).
24.05	Write programs that use nested structures.
24.06	Use internal documentation (e.g., single-line and multi-line comments, program headers, module descriptions, and meaningful variable, function/module names) to document a program according to accepted standards.
24.07	Compile and run programs.
24.08	Write programs that use standard arithmetic operators with different numerical data types.
24.09	Write programs that use standard logic operators.
24.10	Write programs that use a variety of common data types.
24.11	Write programs that perform data conversion between standard data types.
24.12	Write programs that define, use, search, and sort arrays.
24.13	Write programs that use user-defined data types.
24.14	Demonstrate understanding and use of appropriate variable scope.
25.0	Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input. The student will be able to:
25.01	Write programs that perform user input and output.
25.02	Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
25.03	Write program modules such as functions, subroutines, or methods.
25.04	Write program modules that accept arguments.
25.05	Write program modules that return values.
25.06	Write program modules that validate arguments and return error codes.
25.07	Write interactive programs.
25.08	Write programs that use standard libraries to enhance program function.
25.09	Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common

	programming standards.
26.0	Create a unit test plan, implement the plan, and report the results of testing. The student will be able to:
26.01	Write a unit test plan that identifies the input data and expected results for program tests.
26.02	Test and debug programs, including programs written by others.
26.03	Write a test report that identifies the results of testing.
26.04	Trace through the function of a program to ensure valid operation.
26.05	Identify the system resources used by the program (e.g., memory, disk space, execution time, external devices).
26.06	Create a disaster/emergency response plan for a computer system.
27.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
27.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
27.02	Locate, organize and reference written information from various sources.
27.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
27.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
27.05	Apply active listening skills to obtain and clarify information.
27.06	Develop and interpret tables and charts to support written and oral communications.
27.07	Exhibit public relations skills that aid in achieving customer satisfaction.
28.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
28.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
28.02	Employ critical thinking and interpersonal skills to resolve conflicts.
28.03	Identify and document workplace performance goals and monitor progress toward those goals.
28.04	Conduct technical research to gather information necessary for decision-making.
29.0	Use information technology tools. The student will be able to:
29.01	Use personal information management (PIM) applications to increase workplace efficiency.
29.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
29.03	Employ computer operations applications to access, create, manage, integrate, and store information.

29.04	Employ collaborative/groupware applications to facilitate group work.
30.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
30.01	Employ leadership skills to accomplish organizational goals and objectives.
30.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
30.03	Conduct and participate in meetings to accomplish work tasks.
31.0	Describe the importance of professional ethics and legal responsibilities. The student will be able to:
31.01	Evaluate and justify decisions based on ethical reasoning.
31.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
31.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.

Course Number: CTS0042
Occupational Completion Point: C
Junior Programmer – 300 Hours – SOC Code 15-1131

32.0 Participate in work-based learning experiences. The student will be able to:

32.01 Participate in work-based learning experiences in a computer programming environment.

32.02 Compare and contrast programming languages used in a computer programming environment.

32.03 Discuss the management/supervisory skills needed in a computer programming environment.

33.0 Identify functions of information processing. The student will be able to:

33.01 Identify the advantages and disadvantages of blocking and buffering when accessing data on tape and disk storage.

33.02 Choose appropriate storage of numeric values to insure precision needed for calculations (e.g., integer, fixed-point, floating-point).

34.0 Identify functions of computers. The student will be able to:

34.01 Identify the advantages and disadvantages of virtual memory.

35.0 Test programs. The student will be able to:

35.01 Develop a plan for system integration testing.

36.0 Plan program design. The student will be able to:

36.01 Plan interfaces for systems integration.

37.0 Code programs. The student will be able to:

37.01 Access external files in a client/server environment.

38.0 Perform program maintenance. The student will be able to:

38.01 Modify or create new programs for vendor supplied applications.

38.02 Use a computer system with current commercial-end application software to solve problems within an organizational environment.

39.0 Evaluate assigned business computer programming tasks. The student will be able to:

39.01 Utilize and apply project and time management tools to control systems development.

39.02 Analyze computer resources necessary to run a program.

40.0 Develop an awareness of software quality assurance. The student will be able to:

40.01	Evaluate performance, functionality, and validity of various software packages.
41.0	Implement enhanced program structures. The student will be able to:
41.01	Write programs to import/export data from external sources.
41.02	Write routines that incorporate “help” text.
41.03	Write interactive programs.
41.04	Design screen layouts for use in interactive programs.
42.0	Develop an understanding of programming techniques and concepts. The student will be able to:
42.01	Identify object-oriented concepts and provide examples of objects in an object-oriented language.
42.02	Describe development methodologies, programming and system languages, database technologies, and data communication.
43.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. The student will be able to:
43.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
43.02	Explain emergency procedures to follow in response to workplace accidents.
43.03	Create a disaster and/or emergency response plan.
44.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
44.01	Employ leadership skills to accomplish organizational goals and objectives.
44.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
44.03	Conduct and participate in meetings to accomplish work tasks.
44.04	Employ mentoring skills to inspire and teach others.
45.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:
45.01	Identify and demonstrate positive work behaviors needed to be employable.
45.02	Develop personal career plan that includes goals, objectives, and strategies.
45.03	Examine licensing, certification, and industry credentialing requirements.
45.04	Maintain a career portfolio to document knowledge, skills, and experience.
45.05	Evaluate and compare employment opportunities that match career goals.

45.06 Identify and exhibit traits for retaining employment.

45.07 Identify opportunities and research requirements for career advancement.

45.08 Research the benefits of ongoing professional development.

45.09 Examine and describe entrepreneurship opportunities as a career planning option.

Course Number: CTS0043
Occupational Completion Point: D
Junior Programmer II – 300 Hours – SOC Code 15-1131

46.0 Test programs. The student will be able to:

46.01 Develop a plan for testing programs.

46.02 Develop a plan for system integration testing.

46.03 Develop data for use in program testing.

46.04 Perform debugging activities.

46.05 Distinguish among the different types of program and design errors.

46.06 Evaluate program test results.

46.07 Execute programs and subroutines as they relate to the total application.

46.08 Use trace routines of compilers to assist in program debugging.

46.09 Compile and run programs.

47.0 Plan program design. The student will be able to:

47.01 Formulate a plan to determine program specifications individually or in groups.

47.02 Use a graphical representation or pseudo code to represent the structure in a program or subroutine.

47.03 Design programs to solve problems using problem-solving strategies.

47.04 Prepare proper input/output layout specifications.

47.05 Examine existing utility programs and subroutines for use with other programs.

47.06 Manually trace the execution of programs and verify that programs follow the logic of their design as documented.

48.0 Code programs. The student will be able to:

48.01 Utilize reference manuals.

48.02 Write programs according to recognized programming standards.

48.03 Write internal documentation statements as needed in the program source code.

48.04 Code programs in high-level languages for business applications.

48.05	Write code that accesses sequential, indexed sequential, random, and direct files.
48.06	Code programs using logical statements (e.g., If-Then-Else, Do...While).
48.07	Enter and modify source code using a program language editor.
48.08	Code routines within programs that validate input data.
48.09	Use the rounding function in calculations within programs.
49.0	Perform program maintenance. The student will be able to:
49.01	Review requested modification of programs and establish a plan of action.
49.02	Design needed modifications in conformance with established standards.
49.03	Code, test, and debug modifications prior to updating production code.
49.04	Update production programs and documentation with changes.
49.05	Analyze output to identify and annotate errors or enhancements.
49.06	Modify or create new programs for vendor supplied applications.
49.07	Use a computer system with current commercial-end application software to solve problems within an organizational environment.
50.0	Create and maintain documentation. The student will be able to:
50.01	Write documentation to assist operators and end-users.
50.02	Follow established documentation standards.
50.03	Update existing documentation to reflect program changes.
51.0	Evaluate assigned business computer programming tasks. The student will be able to:
51.01	Utilize and apply project and time management tools to control systems development.
51.02	Analyze computer resources necessary to run a program.
52.0	Demonstrate an understanding of operating systems, environments, and platforms. The student will be able to:
52.01	Assess and analyze the functions of different operating systems.
52.02	Assess and analyze the program development and execution utilities of relevant operating systems.
53.0	Develop an awareness of software quality assurance. The student will be able to:
53.01	Evaluate performance, functionality, and validity of various software packages.

54.0	Implement enhanced program structures. The student will be able to:
54.01	Write programs that incorporate multi-level subtotals and page breaks.
54.02	Write programs that include tables or arrays and routines for data entry and lookup.
54.03	Write routines to sort arrays.
54.04	Write programs that sort records in files.
54.05	Write programs to create and maintain a master file.
54.06	Write programs to process transactions.
54.07	Write programs to import/export/convert data from external sources.
54.08	Write programs that use iteration.
54.09	Write routines that incorporate "help" text.
54.10	Write programs that read and write sequential files.
54.11	Write programs that read and write indexed-sequential files.
54.12	Write programs that read and write random files.
54.13	Write interactive programs.
54.14	Design screen layouts for use in interactive programs.
54.15	Write programs using object-oriented languages.
55.0	Develop an understanding of programming techniques and concepts. The student will be able to:
55.01	Describe development methodologies, programming and system languages, database technologies, and data communication.

Course Number: CTS0044
Occupational Completion Point: E
Computer Programmer – 150 Hours – SOC Code 15-1131

56.0 Test programs. The student will be able to:

56.01 Develop a plan for testing programs.

56.02 Develop a plan for system integration testing.

56.03 Develop data for use in program testing.

56.04 Perform debugging activities.

56.05 Distinguish among the different types of program and design errors.

56.06 Evaluate program test results.

56.07 Execute programs and subroutines as they relate to the total application.

56.08 Use trace routines of compilers to assist in program debugging.

57.0 Plan program design. The student will be able to:

57.01 Formulate a plan to determine program specifications individually or in groups.

57.02 Use a graphical representation or pseudo code to represent the structure in a program or subroutine.

57.03 Design programs to solve problems using problem-solving strategies.

57.04 Prepare proper input/output layout specifications.

57.05 Examine existing utility programs and subroutines for use with other programs.

57.06 Manually trace the execution of programs and verify that programs follow the logic of their design as documented.

58.0 Code programs. The student will be able to:

58.01 Utilize reference manuals.

58.02 Write programs according to recognized programming standards.

58.03 Write internal documentation statements as needed in the program source code.

58.04 Code programs in high-level languages for business applications.

58.05 Write code that accesses sequential, indexed sequential, random, and direct files.

58.06	Code programs using logical statements (e.g., If-Then-Else, Do-While).
58.07	Enter and modify source code using a program language editor.
58.08	Code routines within programs that validate input data.
58.09	Use the rounding function in calculations within programs.
59.0	Perform program maintenance. The student will be able to:
59.01	Review requested modification of programs and establish a plan of action.
59.02	Design needed modifications in conformance with established standards.
59.03	Code, test, and debug modifications prior to updating production code.
59.04	Update production programs and documentation with changes.
59.05	Analyze output to identify and annotate errors or enhancements.
60.0	Implement enhanced program structures. The student will be able to:
60.01	Write programs that include tables or arrays and routines for data entry and lookup.
60.02	Write programs that use iteration.
60.03	Write routines that incorporate “help” text.
60.04	Write programs that read and write sequential files.
60.05	Write programs that read and write indexed-sequential files.
60.06	Write programs that read and write random files.
60.07	Write interactive programs.
60.08	Design screen layouts for use in interactive programs.
60.09	Write programs using object-oriented languages.
60.10	Write programs that include data structures (e.g., stacks, queues, trees, linked lists).
60.11	Write programs that are event-driven.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Network Support Services
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	B078000
CIP Number	0511090102
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1142 – Network and Computer Systems Administrators 15-1143 – Computer Network Architects
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in network support services positions in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment.

The content includes but is not limited to instruction in computer literacy; software application support; basic hardware configuration and troubleshooting; networking technologies, troubleshooting, security, and administration; and customer service and human relations skills.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of seven occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	EEV0504	Computer Support Assistant	BUS ED 1 @2 COMPU SCI 6 COMP SVC 7G CYBER TECH 7G INFO TECH 7G	150 hours	15-1151
C	CTS0022	Network Support Help Desk Assistant		150 hours	15-1142
D	CTS0023	Network Support Administrator		150 hours	15-1142
E	CTS0024	Senior Network Administrator		150 hours	15-1143
F	CTS0029	Wireless Network Administrator		150 hours	15-1143
G	EEV0317	Data Communications Analyst		150 hours	15-1143

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 16.0 Identify, install, configure, and upgrade desktop and server computer modules and peripherals, following established basic procedures for system assembly and disassembly of field replaceable modules.
- 17.0 Diagnose and troubleshoot common module problems and system malfunctions of computer software, hardware, peripherals, and other office equipment.
- 18.0 Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace.
- 19.0 Identify specific terminology, facts, ways and means of dealing with classifications, categories and principles of motherboards, processors and memory in desktop and server computer systems.
- 20.0 Demonstrate knowledge of basic types of printers, basic concepts, printer components, how they work, how they print onto a page, paper path, care and service techniques, and common problems.
- 21.0 Identify and describe basic network concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring network interface cards, and knowledge of the ramifications of repairs when a computer is networked.
- 22.0 Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, remote access, or direct contact.
- 23.0 Demonstrate proficiency using graphical user interface (GUI) operating systems.

- 24.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 25.0 Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, remote access, or direct contact.
- 26.0 Understand, describe, and explain internet connections.
- 27.0 Define networking terminology.
- 28.0 Explain how to connect copper media, optical media, and wireless media.
- 29.0 Perform tasks related to the network cable testing and cable making.
- 30.0 Define network topologies, devices and connections.
- 31.0 Define Ethernet fundamentals and operations.
- 32.0 Define and explain the functions of bridges and switches.
- 33.0 Explain the mathematical concepts and protocols behind the internet.
- 34.0 Define and explain the difference between routed and routing protocols.
- 35.0 Recognize, define, and explain functions of the transport layer.
- 36.0 Explain, define, and identify the components of a WAN and router.
- 37.0 Describe and identify an operating system for a router.
- 38.0 Explain how to establish connections between neighboring routers.
- 39.0 Identify and explain the router boot sequence and file system.
- 40.0 Identify and explain static and dynamic routing protocols.
- 41.0 Describe and configure distance vector protocols.
- 42.0 Perform tasks related to protocol troubleshooting.
- 43.0 Examine and test networks.
- 44.0 Define, explain and describe access lists.
- 45.0 Solve problems using critical thinking skills, creativity and innovation.
- 46.0 Use information technology tools.
- 47.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
- 48.0 Describe the importance of professional ethics and legal responsibilities.
- 49.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 50.0 Participate in simulated work-based learning experiences.
- 51.0 Provide network support and assistance by troubleshooting and diagnosing through direct contact remote access.
- 52.0 Perform logical and physical network design activities.
- 53.0 Demonstrate proficiency in selecting appropriate various routing protocols and IP routing configuration for various network designs.
- 54.0 Demonstrate proficiency in using network traffic filtering to improve network performance and provide basic levels of security.
- 55.0 Perform network management activities related to documentation, security, performance, administration, troubleshooting and coping with environmental factors.
- 56.0 Identify and describe various wan functions, devices, and demonstrate understanding of the wan design process.
- 57.0 Describe the operation and implementation of virtual private networks.
- 58.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 59.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 60.0 Explain the importance of employability skill and entrepreneurship skills.
- 61.0 Demonstrate personal money-management concepts, procedures, and strategies.

- 62.0 Participate in simulated work-based learning experiences.
- 63.0 Compare and contrast hierarchical network design models and scalable internetworks.
- 64.0 Discuss advanced IP addressing management.
- 65.0 Demonstrate proficiency in basic router configuration.
- 66.0 Demonstrate proficiency in the use of OSPF.
- 67.0 Understand and discuss multi-area OSPF operation and configuration.
- 68.0 Demonstrate the use of stub and totally stubby areas.
- 69.0 Demonstrate proficiency in route optimization.
- 70.0 Demonstrate proficiency in the use of BGP.
- 71.0 Define and show proficiency in security.
- 72.0 Use lab equipment, demonstrate the setup, configuration, connectivity of routers to create a small WAN.
- 73.0 Configure and monitor DSL and DDR.
- 74.0 Demonstrate the use of scaling IP addresses with NAT.
- 75.0 Demonstrate proficiency using Authentication, Authorization & Accounting AAA to scale access control.
- 76.0 Understand and describe key characteristics of various switching technologies, LAN switching and the hierarchical model of network design, and the 3-tier model.
- 77.0 Understand and describe campus networks, design models, and switching technologies.
- 78.0 Show proficiency configuring a switch.
- 79.0 Demonstrate proficiency configuring VLANs.
- 80.0 Understand and explain spanning tree protocol (STP) and redundant links.
- 81.0 Demonstrate proficiency with multilayer switching.
- 82.0 Demonstrate the use of hot standby routing protocol (HSRP).
- 83.0 Understand and use IGMP and multicasting.
- 84.0 Demonstrate proficiency restricting network access.
- 85.0 Demonstrate proficiency using network troubleshooting tools and basic network management diagnostic tools.
- 86.0 List and define the commonly used protocols, routing techniques, and switching processes.
- 87.0 Demonstrate proficiency troubleshooting TCP/IP, LAN switch environment, VLANs, frame relay, and ISDN.
- 88.0 Participate in simulated work-based learning experiences.
- 89.0 Demonstrate proficiency in applying radio frequency (RF) technologies.
- 90.0 Develop an awareness of wireless LAN technologies.
- 91.0 Perform implementation and management activities.
- 92.0 Develop an awareness of wireless security systems.
- 93.0 Demonstrate knowledge of wireless industry standards.
- 94.0 Participate in simulated work-based learning experiences.
- 95.0 Demonstrate knowledge of general security concepts.
- 96.0 Develop an awareness of communication security concepts.
- 97.0 Develop an awareness of network infrastructure security.
- 98.0 Develop an awareness of cryptography and its relation to security.
- 99.0 Incorporate organizational and operational security in an appropriate and effective manner.

Florida Department of Education
Student Performance Standards

Program Title: Network Support Services
Career Certificate Program Number: B078000

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: EEV0504
Occupational Completion Point: B
Computer Support Assistant – 150 Hours – SOC Code 15-1151

15.0	Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. The student will be able to:
15.01	Develop strategies for resolving customer conflicts.
16.0	Identify, install, configure, and upgrade desktop and server computer modules and peripherals, following established basic procedures for system assembly and disassembly of field replaceable modules. The student will be able to:
16.01	Identify and describe the functions of main processing boards.
16.02	Identify and describe the functions of communication ports.
16.03	Identify and describe the functions of peripheral devices.
16.04	Identify and describe the components of portable systems.
16.05	Troubleshoot, install and upgrade computers and peripherals.
16.06	Perform system hardware setup.
16.07	Demonstrate an understanding of input/output devices.
16.08	Installation and configuration of applications software, hardware, and device drivers.
16.09	Demonstrate an understanding of the operation and purpose of hardware components.
16.10	Install operating system software.
16.11	Customize operating systems.
16.12	Install application software.
16.13	Perform storage formatting and preparation activities.
16.14	Identify data measurement.
16.15	Install and configure RAID.
16.16	Recognize and report on server room environmental issues.
17.0	Diagnose and troubleshoot common module problems and system malfunctions of computer software, hardware, peripherals, and other office equipment. The student will be able to:
17.01	Troubleshoot a personal computer system.

17.02	Identify configuration problems.
17.03	Identify software problems.
17.04	Identify hardware malfunctions.
17.05	Identify network malfunctions.
17.06	Resolve computer error messages.
17.07	Understand and troubleshoot memory and cache systems.
17.08	Verify that drives are the appropriate type.
17.09	Describe knowledge database search procedures used to identify possible solutions when troubleshooting software and hardware problems.
18.0	Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace. The student will be able to:
18.01	Apply basic rules for hardware safety.
18.02	Demonstrate proficiency in basic preventative hardware maintenance.
18.03	Special disposal procedures that comply with environmental guidelines for batteries, CRTs, toner kits/cartridges, chemical solvents and cans, and MSDS.
18.04	Apply ergonomic principles applicable to the configuration of computer workstations.
18.05	Describe ethical issues and problems associated with computers and information systems.
19.0	Identify specific terminology, facts, ways and means of dealing with classifications, categories and principles of motherboards, processors and memory in desktop and server computer systems. The student will be able to:
19.01	Identify Random Access Memory (RAM) types.
19.02	Identify I/O ports and devices.
20.0	Demonstrate knowledge of basic types of printers, basic concepts, printer components, how they work, how they print onto a page, paper path, care and service techniques, and common problems. The student will be able to:
20.01	Identify types of printers.
20.02	Identify care and service techniques and common problems with primary printer types.
20.03	Implement and manage printing on a network.
21.0	Identify and describe basic network concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring network interface cards, and knowledge of the ramifications of repairs when a computer is

	networked. The student will be able to:
21.01	Define networking and describe the purpose of a network.
21.02	Identify the purposes and interrelationships among the major components of networks.
21.03	Describe the various types of network topologies.
21.04	Identify and describe the purpose of standards, protocols, and the Open Systems Interconnection (OSI) reference model.
21.05	Configure network and verify network connectivity.
21.06	Discuss the responsibilities of the network.
21.07	Develop user logon procedures.
21.08	Utilize network management infrastructures to perform administrative tasks.
21.09	Identify common backup strategies and procedures.
21.10	Select and use appropriate electronic communications software and hardware for specific tasks.
21.11	Compare and contrast Internet software and protocols.
21.12	Diagnose and resolve electronic communications operational problems.
21.13	Design and implement directory tree structures.
21.14	Install services tools.
21.15	Perform and verify backups.
21.16	Identify bottlenecks.
21.17	Use the concepts of fault tolerance/fault recovery to create a disaster recovery plan.
21.18	Document and test disaster recovery plan regularly, and update as needed.
22.0	Perform end user support and assistance by troubleshooting and diagnosing through verbal or written communication. The student will be able to:
22.01	Apply call center vocabulary.
22.02	Listen and input information simultaneously.
22.03	Apply first response assistance for minor repair work.
23.0	Demonstrate proficiency using graphical user interface (GUI) operating systems. The student will be able to:

23.01	Identify parts of GUI windows.
23.02	Demonstrate proficiency in using menu systems.
23.03	Demonstrate proficiency in using pointing and selection devices.
23.04	Identify keyboard shortcuts and special function keys.
23.05	Demonstrate proficiency in manipulating windows.
23.06	Utilize help systems and hypertext links.
23.07	Create, organize, and maintain file system directories.
23.08	Organize desktop objects.
23.09	Run multiple applications.

Course Number: CTS0022
Occupational Completion Point: C
Network Support Help Desk Assistant – 150 Hours – SOC Code 15-1142

24.0	Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. The student will be able to:
24.01	Develop diplomatic methods to communicate with customers.
25.0	Perform end user support and assistance by troubleshooting and diagnosing through verbal or written communication. The student will be able to:
25.01	Apply first response assistance for minor repair work.
26.0	Understand, describe, and explain internet connections. The student will be able to:
26.01	Understand the physical connectivity necessary for a computer to connect to the Internet.
26.02	Recognize the primary components of a computer.
26.03	Install and troubleshoot network interface cards and/or modems.
26.04	Use basic testing procedures to test the Internet connection.
26.05	Demonstrate a basic understanding of the use of web browsers and plug-ins.
27.0	Define networking terminology. The student will be able to:
27.01	Explain the importance of bandwidth in networking.
27.02	Identify bps, kbps, Mbps, and Gbps as units of bandwidth.
27.03	Explain the difference between bandwidth and throughput.
27.04	Explain the development of the Open System Interconnection model (OSI).
27.05	List the advantages of a layered approach.
27.06	Identify each of the seven layers of the OSI model.
27.07	Identify the four layers of the TCP/IP model.
27.08	Describe the similarities and differences between the two models.
27.09	Briefly outline the history of networking.
27.10	Identify devices used in networking.

27.11	Understand the role of protocols in networking.
27.12	Define types of area networks.
27.13	Explain VPNs and their advantages.
27.14	Describe the differences between intranets and extranets.
28.0	Explain how to connect copper media, optical media, and wireless media. The student will be able to:
28.01	Discuss the electrical properties of matter.
28.02	Define voltage, resistance, impedance, current, and circuits.
28.03	Describe the specifications and performances of different types of cable.
28.04	Describe coaxial cable and its advantages and disadvantages over other types of cable.
28.05	Describe shielded twisted-pair (STP) cable and unshielded twisted-pair cable (UTP) and its uses.
28.06	Discuss the characteristics of straight-through, crossover, and rollover cables and where each is used.
28.07	Explain the basics of fiber-optic cable.
28.08	Describe how fibers can guide light for long distances.
28.09	Describe multimode and single-mode fiber.
28.10	Describe how fiber is installed.
28.11	Describe the type of connectors and equipment used with fiber-optic cable.
28.12	Explain how fiber is tested to ensure that it will function properly.
28.13	Discuss safety issues dealing with fiber-optics.
29.0	Perform tasks related to network cable testing and cable making. The student will be able to:
29.01	Differentiate between sine waves and square waves.
29.02	Define basic terminology related to time, frequency, and noise.
29.03	Differentiate between digital bandwidth and analog bandwidth.
29.04	Compare and contrast noise levels on various types of cabling.
29.05	Define and describe the effects of attenuation and impedance mismatch.

29.06	Define crosstalk, near-end crosstalk, far-end crosstalk, and power sum near-end crosstalk.
29.07	Describe how crosstalk and twisted pairs help reduce noise.
29.08	Describe the ten copper cable tests defined in TIA/EIA-568-A/B.
29.09	Describe the difference between Category 5 and Category 6 cable.
30.0	Define network topologies, devices and connections. The student will be able to:
30.01	Identify characteristics of Ethernet networks.
30.02	Identify straight-through, crossover, and rollover cable.
30.03	Describe various intermediary network devices.
30.04	Describe the function of peer-to-peer networks.
30.05	Describe the function, advantages, and disadvantages of client-server networks.
30.06	Describe and differentiate between serial, digital subscriber line (DSL), and cable modem WAN connections.
30.07	Identify router serial ports and their cable and connectors.
30.08	Identify and describe the placement of equipment used in various WAN configurations.
31.0	Define Ethernet fundamentals and operations. The student will be able to:
31.01	Describe the basics of Ethernet technology.
31.02	Explain naming rules of Ethernet technology.
31.03	Define how Ethernet and the OSI model interact.
31.04	Describe the Ethernet framing process and frame structure.
31.05	List Ethernet frame field names and purposes.
31.06	Identify the characteristics of CSMA/CD.
31.07	Describe the key aspects of Ethernet timing, interframe spacing and backoff time after a collision.
31.08	Define Ethernet errors and collisions.
31.09	Explain the concept of auto-negotiation in relation to speed and duplex.
32.0	Define and explain the functions of bridges and switches. The student will be able to:

32.01	Define bridging and switching.
32.02	Define and describe the content-addressable memory (CAM) table.
32.03	Define latency.
32.04	Describe store-and forward and cut-through switching modes.
32.05	Explain Spanning-Tree Protocol (STP).
32.06	Define collisions, broadcasts, collision domains, and broadcast domains.
32.07	Identify the Layer 1, 2, and 3 devices used to create collision domains and broadcast domains.
32.08	Discuss data flow and problems with broadcasts.
32.09	Explain network segmentation and list the devices used to create segments.
33.0	Explain the mathematical concepts and protocols behind the internet. The student will be able to:
33.01	Explain why the Internet was developed and how TCP/IP fits the design of the Internet.
33.02	List the four layers of the TCP/IP model.
33.03	Describe the functions of each layer of the TCP/IP model.
33.04	Compare the OSI model and the TCP/IP model.
33.05	Describe the function and structure of IP addresses.
33.06	Understand why subnetting is necessary.
33.07	Explain the difference between public and private addressing.
33.08	Understand the function of reserved IP addresses.
33.09	Explain the use of static and dynamic addressing for a device.
33.10	Use ARP to obtain the MAC address to send a packet to another device.
33.11	Understand the issues related to addressing between networks.
33.12	Demonstrate proficiency with IPv6.
34.0	Define and explain the difference between routed and routing protocols. The student will be able to:
34.01	Describe routed (routable) protocols.

34.02	List the steps of data encapsulation in an internetwork as data is routed to one or more Layer 3 devices.
34.03	Describe connectionless and connection-oriented delivery.
34.04	Name the IP packet fields.
34.05	Describe process of routing.
34.06	Compare and contrast different types of routing protocols.
34.07	List and describe several metrics used by routing protocols.
34.08	List several uses for subnetting.
34.09	Determine the prefix/subnet mask for a given situation.
34.10	Use a prefix/subnet mask to determine the subnet ID.
35.0	Recognize, define, and explain functions of the transport layer. The student will be able to:
35.01	Describe the functions of the TCP/IP transport layer.
35.02	Describe flow control.
35.03	Describe the processes of establishing a connection between peer systems.
35.04	Describe windowing.
35.05	Describe acknowledgment.
35.06	Identify and describe transport layer protocols.
35.07	Describe TCP and UDP header formats.
35.08	Describe TCP and UDP port numbers and ports used for services and clients.
35.09	List the major protocols of the TCP/IP application layer.
35.10	Provide a brief description of the features and operation of well-known TCP/IP applications.
35.11	Describe TCP and UDP with its function.
35.12	Describe TCP synchronization and flow control.
35.13	Describe multiple conversations between hosts.
35.14	Understand the differences and the relationship between MAC addresses, IP addresses, and port numbers.

36.0	Explain, define, and identify the components of a WAN and router. The student will be able to:
36.01	Explain the difference between a WAN and LAN and the type of addresses each uses.
36.02	Describe the role of a router in a WAN.
36.03	Identify internal components of the router and describe their functions.
36.04	Describe the physical characteristics of the router.
36.05	Identify common ports on a router.
36.06	Properly connect FastEthernet, serial WAN, and console ports.
37.0	Describe and identify an operating system for a router. The student will be able to:
37.01	Describe the purpose of the router operating system.
37.02	Describe the basic operation of the router operating system.
37.03	Identify various router operating system features.
37.04	Identify the methods to establish a CLI session with the router.
37.05	Establish a terminal emulation session on a router.
37.06	Log into a router.
37.07	Use the help feature in the command line interface.
37.08	Troubleshoot command errors.
37.09	Name a router.
37.10	Set passwords.
37.11	Explore router configuration commands.
37.12	Configure router interface.
37.13	Upgrade router operating system.
37.14	Configure an interface description.
37.15	Configure banner message.
37.16	Understand the importance of version control.

37.17	Save changes to a router.
38.0	Explain how to establish connections between neighboring routers. The student will be able to:
38.01	Enable and disable protocols.
38.02	Determine which neighboring devices are connected to which local interfaces.
38.03	Establish, Verify, Disconnect, Suspend a Telnet connection.
38.04	Perform alternative connectivity tests.
38.05	Troubleshoot remote terminal connections.
39.0	Identify and explain the router boot sequence and file system. The student will be able to:
39.01	Identify the stages of the router boot sequence.
39.02	Determine how a router locates and loads its operating system.
39.03	Use the boot system command.
39.04	Identify the configuration register values.
39.05	Briefly describe the files used by the router operating system and their functions.
39.06	List the locations on the router of the different file types.
39.07	Save and restore configuration files using TFTP and copy-and paste.
39.08	Load a router operating system image using TFTP.
39.09	Verify the file system.
40.0	Identify and explain static and dynamic routing protocols. The student will be able to:
40.01	Explain the significance of static routing.
40.02	Configure static and default routes.
40.03	Verify and troubleshoot static and default routes.
40.04	Identify routing protocols.
40.05	Identify distance vector routing protocols.
40.06	Identify link-state routing protocols.

40.07	Describe the basic characteristics of common routing protocols.
40.08	Identify interior gateway protocols.
40.09	Identify exterior gateway protocols BGP.
40.10	Enable Routing Information Protocol (RIP) on a router.
41.0	Describe and configure distance vector protocols. The student will be able to:
41.01	Describe how routing loops can occur in distance vector routing.
41.02	Describe several methods used by distance vector routing protocols to ensure that routing information is accurate.
41.03	Configure RIP.
42.0	Perform tasks related to protocol troubleshooting. The student will be able to:
42.01	Describe ICMP.
42.02	Describe the ICMP message format and error message types.
42.03	Identify potential causes of specific ICMP error messages.
42.04	Describe ICMP control messages.
42.05	Identify a variety of ICMP control messages used in networks today.
42.06	Determine the causes for ICMP control messages.
43.0	Examine and test networks. The student will be able to:
43.01	Use the commands to gather detailed information about the routes installed on the router.
43.02	Configure a default route or default network.
43.03	Understand how a router uses both Layer 2 and Layer addressing to move data through the network.
44.0	Define, explain and describe access lists. The student will be able to:
44.01	Describe the differences between standard and extended ACLs.
44.02	Explain the rules for placement of ACLs.
44.03	Create and apply named ACLs.
44.04	Describe the function of firewalls.

44.05	Use ACLs to restrict virtual terminal access.
45.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
45.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
45.02	Employ critical thinking and interpersonal skills to resolve conflicts.
45.03	Identify and document workplace performance goals and monitor progress toward those goals.
45.04	Conduct technical research to gather information necessary for decision-making.
46.0	Use information technology tools. The student will be able to:
46.01	Use personal information management (PIM) applications to increase workplace efficiency.
46.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
46.03	Employ computer operations applications to access, create, manage, integrate, and store information.
46.04	Employ collaborative/groupware applications to facilitate group work.
47.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. The student will be able to:
47.01	Describe the nature and types of business organizations.
47.02	Explain the effect of key organizational systems on performance and quality.
47.03	List and describe quality control systems and/or practices common to the workplace.
47.04	Explain the impact of the global economy on business organizations.
48.0	Describe the importance of professional ethics and legal responsibilities. The student will be able to:
48.01	Evaluate and justify decisions based on ethical reasoning.
48.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
48.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
48.04	Interpret and explain written organizational policies and procedures such as Sarbanes-Oxley, HIPPA, Gramm-Leach-Bliley.

Course Number: CTS0023

Occupational Completion Point: D

Network Support Administrator – 150 Hours – SOC Code 15-1142

49.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. The student will be able to:

49.01 Develop diplomatic methods to communicate with customers.

50.0 Participate in simulated work-based learning experiences. The student will be able to:

50.01 Participate in simulated work-based learning experiences in a network support services environment.

50.02 Discuss the use of technology in a network support services environment.

51.0 Provide network support and assistance by troubleshooting and diagnosing through direct contact remote access. The student will be able to:

51.01 Apply appropriate diagnostic techniques to solve network problems.

51.02 Perform local network support using various troubleshooting and diagnostic techniques.

51.03 Perform remote network support using various remote access methods.

52.0 Perform logical and physical network design activities. The student will be able to:

52.01 Describe the various LAN communication problems.

52.02 Describe the effects of LAN segmentation with bridges, routers, and switches.

52.03 Describe the operation, characteristics and benefits of VLANs.

52.04 Explain and identify LAN design goals, issues, and methodology.

52.05 Demonstrate the ability to analyze equipment necessary to meet specific design requirement.

52.06 Demonstrate the ability to create physical and logical network implementation documentation.

53.0 Demonstrate proficiency in selecting appropriate routing protocols and IP configuration for various network designs. The student will be able to:

53.01 Describe the two parts of network addressing, and then identify the parts in specific protocol address examples.

53.02 Demonstrate proficiency with IP addresses.

53.03 Configure IP addresses.

53.04 Verify IP addresses.

53.05	Identify the functions of the TCP/IP transport-layer protocols.
53.06	Identify the functions of the TCP/IP network-layer protocols.
53.07	Identify the functions performed by ICMP.
53.08	Explain the services of separate and integrated multi-protocol routing.
53.09	List problems that each routing type encounters when dealing with topology changes and describe techniques to reduce the number of these problems.
54.0	Demonstrate proficiency in using network traffic filtering to improve network performance and provide basic levels of security. The student will be able to:
54.01	Define and describe the purpose and operation of network traffic filtering.
54.02	Demonstrate proficiency in using configuration and interface commands to perform and monitor network traffic filtering.
55.0	Perform network management activities related to documentation, security, performance, administration, troubleshooting and coping with environmental factors. The student will be able to:
55.01	Perform documentation activities for networks, such as logs, journals, diagrams, labeling schemes, layouts, software listings, user policy, security policy.
55.02	Plan network security measures by establishing security policies and procedures, including user policies, authentication procedures, back-up and data recovery procedures, and redundancy techniques.
55.03	Demonstrate proficiency in using network monitoring software.
55.04	Explain the procedures necessary to monitor, create benchmarks, and plan for improvement of network performance.
55.05	Explain the administrative side of network management, including physical and logical boundaries, costs, error report documentation and the management of human resources.
56.0	Identify and describe various WAN functions, devices, and demonstrate understanding of the WAN design process. The student will be able to:
56.01	Describe the major features of WAN technology, including, devices, standards, encapsulation, link options, and packet and circuit switching.
56.02	Perform WAN design activities that require using the necessary steps in WAN design, the three-layered design model, and various other design models.
57.0	Describe the operation and implementation of virtual private networks. The student will be able to:
57.01	Describe the virtual private network operation.
57.02	Describe the virtual private network implementation.
57.03	Demonstrate an understanding of tunneling.
57.04	Describe secure VPN's.

58.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. The student will be able to:
58.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
58.02	Explain emergency procedures to follow in response to workplace accidents.
58.03	Create a disaster and/or emergency response plan.
59.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
59.01	Employ leadership skills to accomplish organizational goals and objectives.
59.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
59.03	Conduct and participate in meetings to accomplish work tasks.
59.04	Employ mentoring skills to inspire and teach others.
60.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:
60.01	Identify and demonstrate positive work behaviors needed to be employable.
60.02	Develop personal career plan that includes goals, objectives, and strategies.
60.03	Examine licensing, certification, and industry credentialing requirements.
60.04	Maintain a career portfolio to document knowledge, skills, and experience.
60.05	Evaluate and compare employment opportunities that match career goals.
60.06	Identify and exhibit traits for retaining employment.
60.07	Identify opportunities and research requirements for career advancement.
60.08	Research the benefits of ongoing professional development.
60.09	Examine and describe entrepreneurship opportunities as a career planning option.
61.0	Demonstrate personal money-management concepts, procedures, and strategies. – The student will be able to:
61.01	Identify and describe the services and legal responsibilities of financial institutions.
61.02	Describe the effect of money management on personal and career goals.
61.03	Develop a personal budget and financial goals.
61.04	Complete financial instruments for making deposits and withdrawals.

61.05 Maintain financial records.

61.06 Read and reconcile financial statements.

61.07 Research, compare and contrast investment opportunities.

Course Number: CTS0024
Occupational Completion Point: E
Senior Network Administrator – 150 Hours – SOC Code 15-1143

62.0 Participate in simulated work-based learning experiences. The student will be able to:

62.01 Participate in simulated work-based learning experiences in a network support services environment.

62.02 Discuss the use of technology in a network support services environment.

63.0 Compare and contrast hierarchical network design models and scalable internetworks. The student will be able to:

63.01 Show proficiency in the use of the three-layer hierarchical design model.

63.02 Describe router functions in the core layer, distribution layer, and access layer.

63.03 Describe key characteristics of making the network reliable, available, responsive, efficient, adaptable, accessible, scalable and secure.

64.0 Discuss advanced IP addressing management. The student will be able to:

64.01 Describe and explain IPv4 addressing, Internet's address architecture, classes of IP addresses, and perform subnet masking.

64.02 Understand and explain Classless Interdomain Routing (CIDR), route aggregation, supernetting and address allocation.

64.03 Discuss and explain Variable-Length Subnet Masks along with classless and classful routing protocols.

64.04 Compare and contrast route summarization and route flapping.

64.05 Describe and discuss Network Address Translation (NAT), private addressing with NAT, private IP addresses (RFC 1918) and discontiguous subnets.

64.06 Describe the functions of private addressing and be able to explain the major features of and configure NAT, PAT, and DHCP.

64.07 Configure IOS DHCP server, Easy IP and IP helper addresses.

64.08 Discuss IP addressing crisis and solutions with IPv6 address formats.

65.0 Demonstrate proficiency in basic router configuration. The student will be able to:

65.01 Configure VLSM using routing fundamentals.

65.02 Configure static routing and dynamic routing using distance-vector routing protocols, link-state routing protocols, and hybrid routing.

65.03 Configure static default routes and default routing with EIGRP using default route caveats and floating static routes.

65.04 Describe and explain convergence issues and route calculation fundamentals.

65.05	Start routing process using various configurations, initiate routing updates and routing metrics.
66.0	Demonstrate proficiency in the use of OSPF. The student will be able to:
66.01	Discuss issues addressed by the use OSPF, list and define OSPF terminology, list OSPF states and OSPF network types, describe OSPF Hello protocol and Steps of OSPF operation.
66.02	Establish router adjacencies, elect a DR and a BDR, and discover routes.
66.03	Select appropriate routes and maintain routing information, configuring OSPF on routers within a single area.
66.04	Use optional configuration commands and configure OSPF over NBMA in a lab setting.
66.05	Describe Full-Mesh Frame Relay, Partial-Mesh Frame Relay, Point-to-Multipoint OSPF.
67.0	Understand and discuss multi-area OSPF operation and configuration. The student will be able to:
67.01	Configure OSPF, examining the DR/BDR election process.
67.02	Configure Point-to-Multipoint OSPF over frame relay, create multiple OSPF areas, use OSPF router types, and incorporate OSPF LSA and area types.
67.03	Configuring OSPF operation across multiple areas and flooding LSUs to multiple areas, updating the routing table.
67.04	Configure Multi-area OSPF, using and configuring OSPF multi-area components, and configuring OSPF route summarization.
67.05	Verify OSPF operation, show commands, clear and debug commands.
68.0	Demonstrate the use of stub and totally stubby areas. The student will be able to:
68.01	Demonstrate understanding of stub and totally stubby areas.
68.02	Set up an OSPF stub area configuration example.
68.03	Monitor multi-area OSPF, verifying multi-area OSPF operation.
68.04	Create a multi-area OSPF.
69.0	Demonstrate proficiency in route optimization. The student will be able to:
69.01	Show how to control routing updates, policy routing, and route redistribution.
69.02	Create a route optimization configuration in lab setting.
70.0	Demonstrate proficiency in the use of BGP. The student will be able to:
70.01	Define and explain autonomous systems and basic BGP operations.
70.02	Configure and monitor BGP operations and routing process.

70.03	Define and explain BGP attributes and the BGP decision process.
70.04	Create BGP configuration in lab setting.
70.05	Develop a scaling BGP and route reflectors.
70.06	Set up BGP route filtering and policy routing.
70.07	Explain the community attribute and peer groups.
70.08	Explain redundancy, symmetry, and load balancing.
70.09	Define and explain BGP redistribution.
70.10	Perform scaling BGP lab exercises and configure BGP in a lab setting.
71.0	Define and show proficiency in security. The student will be able to:
71.01	Show proficiency in securing router access using access lists.
71.02	Show proficiency in using dynamic access lists.
71.03	Show proficiency in session filtering.
71.04	Define and explain context-based access control.
71.05	Use an alternative to access lists.
71.06	Configure router security in a lab setting.
72.0	Using lab equipment, demonstrate the setup, configuration, and the connectivity of routers to create a small WAN. The student will be able to:
72.01	Demonstrate the use of remote access.
72.02	Select appropriate WAN technologies for different scenarios.
72.03	Select remote access solutions for different technologies.
72.04	Assemble and cable WAN components.
73.0	Configure and monitor DSL and DDR. The student will be able to:
73.01	Explain and discuss DSL architecture and DSL protocol layers.
73.02	Configure DSL, static routing and default routing, and DSL PRI.
73.03	Create optional configurations.

73.04	Monitor the DSL interface.
73.05	Create DSL configurations.
74.0	Demonstrate the use of scaling IP addresses with NAT. The student will be able to:
74.01	Define and explain NAT concepts and terminology.
74.02	Demonstrate proficiency in configuring, creating and verifying NAT configurations in lab setting.
75.0	Demonstrate proficiency using Authentication, Authorization and Accounting (AAA) to scale access control. The student will be able to:
75.01	List and define AAA concepts and terminology.
75.02	Demonstrate proficiency configuring AAA.
75.03	Perform lab exercises using access control configurations.
76.0	Understand and describe key characteristics of various switching technologies, LAN switching and the hierarchical model of network design, and the 3-tier model. The student will be able to:
76.01	Discuss the requirements of the evolving campus structure and the issues with traditional network designs.
76.02	Describe the fundamental campus elements and contributing variables to campus networks.
76.03	Compare and contrast the traditional 80/20 rule of network traffic and the new 20/80 rule of network traffic.
76.04	Discuss switching and the OSI model, layer 2, 3, and 4 switching, and multilayer switching.
76.05	Discuss the core layer, the distribution layer, and the access layer in relation to switching.
76.06	List and describe the advantages and disadvantages of the building-block approach, scaling the switch block, building the core block and layer 2 and 3 backbone scaling.
77.0	Understand and describe campus networks, design models, and switching technologies. The student will be able to:
77.01	List and explain key characteristics of various switching technologies.
77.02	Discuss LAN switching and the hierarchical model of network design.
77.03	Show proficiency using the 3-tier model to networking.
78.0	Show proficiency configuring a switch. The student will be able to:
78.01	Demonstrate the process for initial connectivity to a switch.
78.02	Show proficiency creating the basic configuration of a switch.
78.03	List and explain important switch operating system features.

79.0	Demonstrate proficiency configuring VLANs. The student will be able to:
79.01	Understand and explain VLANs.
79.02	Discuss VLAN basics and VLAN types.
79.03	Configure a VLAN in a lab setting.
79.04	Show use of VLAN identification techniques and VLAN trunking protocol.
79.05	Create VTP configuration and use VTP pruning.
80.0	Understand and explain spanning tree protocol (STP) and redundant links. The student will be able to:
80.01	Discuss Basic STP Operations and STP Processes.
80.02	Compare and contrast VLANs and STP.
80.03	Show how STP is used in the Campus Network.
80.04	Demonstrate the resolution of Redundant Links.
81.0	Demonstrate proficiency with multilayer switching. The student will be able to:
81.01	Define and explain MLS Processes.
81.02	Create basic MLS configurations.
81.03	Show proficiency using flow masks.
82.0	Demonstrate the use of hot standby routing protocol (HSRP). The student will be able to:
82.01	Define and explain HSRP operations.
82.02	Create HSRP configurations in a lab setting.
83.0	Understand and use IGMP and multicasting. The student will be able to:
83.01	Define and explain multicasting.
83.02	Understand and discuss IGMP.
83.03	Show proficiency routing multicast traffic.
83.04	Demonstrate proficiency using multicast routing protocols.
83.05	Configure IP multicast routing in a lab setting.

83.06	List and describe optional IP multicast routing tasks.
84.0	Demonstrate proficiency restricting network access. The student will be able to:
84.01	Show proficiency creating networking policies.
84.02	Discuss and explain basic network security techniques.
84.03	Demonstrate execution of policy configurations on a set of routers.
85.0	Demonstrate proficiency using network troubleshooting tools and basic network management diagnostic tools. The student will be able to:
85.01	Explain and discuss troubleshooting methodologies and general problem-solving concepts.
85.02	List and define general considerations in troubleshooting.
85.03	Define and explain each component of the general problem-solving model.
85.04	Demonstrate proficiency using common management and diagnostic tools.
85.05	Show proficiency using network management software.
85.06	Demonstrate proficiency using router diagnostic commands.
85.07	Familiarize logging and error message formats.
85.08	Demonstrate proficiency interacting with technical support.
86.0	List and define the commonly used protocols, routing techniques, and switching processes. The student will be able to:
86.01	List and define network services, layer 2 LAN protocols, and layer 2 WAN protocols.
86.02	Trace packets through a router.
86.03	Define and explain packet switching paths.
86.04	Identify performance issues affecting packet switching.
86.05	Define and explain low-level troubleshooting.
87.0	Demonstrate proficiency troubleshooting TCP/IP, LAN switch environment, VLANs and frame relay. The student will be able to:
87.01	List, define, and explain theory, concepts, and terminology of TCP/IP, LAN switch environment, spanning tree, VLANs and frame relay.
87.02	List, define, and explain common problems with TCP/IP and LAN switching.
87.03	List, define, and explain common scenarios with VLANs and frame relay.

87.04	Troubleshoot TCP/IP in a Windows environment; use LAN switch troubleshooting tools, explain general VLAN troubleshooting issues; list and explain the steps in frame relay troubleshooting and DSL problem isolation.
87.05	Use show commands to verify LAN switch configuration settings.
87.06	Use show and debug commands for TCP/IP, router VLANs and frame relay.
87.07	Use TCP/IP diagnostic tools.

Course Number: CTS0029
Occupational Completion Point: F
Wireless Network Administrator– 150 Hours – SOC Code 15-1143

88.0 Participate in simulated work-based learning experiences. The student will be able to:

88.01 Participate in simulated work-based learning experiences in a network support services environment.

88.02 Discuss the use of technology in a network support services environment.

88.03 Discuss the management/supervisory skills needed in a network support service environment.

89.0 Demonstrate proficiency in applying radio frequency (RF) technologies. The student will be able to:

89.01 Define and apply the basic concepts of RF behavior.

89.02 Understand the applications of basic RF antenna concepts.

89.03 Understand and apply the basic components of RF.

89.04 Identify some of the different uses for spread spectrum technologies.

89.05 Comprehend the differences between, and apply the different types of spread spectrum technologies.

89.06 Identify and apply the concepts which make up the functionality of spread spectrum technology.

89.07 Identify the laws set forth by the FCC that govern spread spectrum technology, including power outputs, frequencies, bandwidths, hop times, and dwell times.

90.0 Develop an awareness of wireless LAN technologies. The student will be able to:

90.01 Identify and apply the processes involved in authentication and association.

90.02 Recognize the concepts associated with wireless LAN service sets.

90.03 Understand the implications of the following power management features of wireless LANs.

90.04 Specify the modes of operation involved in the movement of data traffic across wireless LANs.

91.0 Perform implementation and management activities. The student will be able to:

91.01 Identify the technology roles for which wireless LAN technology is an appropriate technology application.

91.02 Identify the purpose of infrastructure devices and explain how to install, configure, and manage them.

91.03 Identify the purpose of wireless LAN client devices and explain how to install, configure, and manage them.

91.04	Identify the purpose of wireless LAN gateway devices and explain how to install, configure, and manage them.
91.05	Identify the basic attributes, purpose, and function of types of antennas.
91.06	Describe the proper locations and methods for installing antennas.
91.07	Explain the concepts of polarization, gain, beamwidth, and free-space path loss as they apply to implementing solutions that require antennas.
91.08	Identify the use of wireless LAN accessories and explain how to install, configure, and manage them.
91.09	Identify, understand, correct or compensate for wireless LAN implementation challenges.
91.10	Explain how antenna diversity compensates for multipath.
91.11	Identify and understand the importance and process of conducting a thorough site survey.
91.12	Identify and understand the importance of the necessary tasks involved in preparing to do an RF site survey.
91.13	Identify the necessary equipment involved in performing a site survey.
91.14	Understand the necessary procedures involved in performing a site survey.
91.15	Identify and understand site survey reporting procedures.
92.0	Develop an awareness of wireless security systems. The student will be able to:
92.01	Identify the strengths, weaknesses and appropriate uses of wireless LAN security techniques including the use of WVLAN's.
92.02	Describe types of wireless LAN security attacks, and explain how to identify and prevent them.
92.03	Given a wireless LAN scenario, identify the appropriate security solution from the following available wireless LAN security solutions.
92.04	Explain the uses of corporate security policies and how they are used to secure a wireless LAN.
92.05	Identify how and security precautions are used to secure a wireless LAN.
93.0	Demonstrate knowledge of wireless industry standards. The student will be able to:
93.01	Identify, apply and comprehend the differences between wireless LAN standards.
93.02	Understand the roles of organizations in providing direction and accountability within the wireless LAN industry.
93.03	Identify the differences between the ISM and UNII bands.
93.04	Identify and understand the differences between the power output rules for point-to-point and point-to-multipoint links.

Course Number: EEV0317
Occupational Completion Point: G
Data Communications Analyst – 150 Hours – SOC Code 15-1143

94.0 Participate in simulated work-based learning experiences. The student will be able to:

94.01 Participate in simulated work-based learning experiences in a network support services environment.

94.02 Discuss the use of technology in a network support services environment.

94.03 Discuss the management/supervisors skills needed in a network support services environment.

95.0 Demonstrate a knowledge of general security concepts. The student will be able to:

95.01 Describe access control.

95.02 Describe network authentication.

95.03 Understand the various types of network attacks (backdoors, DOS, spoofing).

95.04 Identify and modify non-essential services and protocols.

95.05 Identify malicious code (virus, worm, Trojan).

95.06 Configure system auditing, logging, and scanning as it relates to security procedures.

96.0 Develop an awareness of communication security concepts. The student will be able to:

96.01 Describe remote access protocols (VPN, RADIUS, L2TP).

96.02 Identify E-mail security concerns (hoaxes, spam).

96.03 Identify web (HTML) security concepts and designs (HTTP/S, IM).

96.04 Demonstrate an awareness of file transfer security concerns.

96.05 Describe and identify wireless networking security concerns and vulnerabilities.

97.0 Develop an awareness of network infrastructure security. The student will be able to:

97.01 Install and configure network firewalls.

97.02 Identify security concerns with various wiring media (copper, fiber).

97.03 Identify security concerns associated with removable media and storage devices.

97.04 Demonstrate an awareness of security topologies (security zones, Intranets, NAT).

97.05	Configure and use intrusion detection software.
97.06	Establish security baselines (updates, patches, hot fixes, Access Control lists).
97.07	Demonstrate the ability to configure a Virtual Private Network (VPN).
97.08	Describe the function of Network Address Translation (NAT).
98.0	Develop an awareness of cryptography and its relation to security. The student will be able to:
98.01	Demonstrate an understanding of security algorithms and encryption.
98.02	Use and apply Public Key Certificates.
98.03	Demonstrate an understanding of standards and protocols in commerce.
99.0	Incorporate organizational and operational security in an appropriate and effective manner. The student will be able to:
99.01	Describe how to establish a network security policy.
99.02	Explain the importance of physical security to protect network resources.
99.03	Identify and use disaster recovery procedures.
99.04	Describe the importance of business continuity and its relationship to network and corporate security.
99.05	Describe security policies and procedures that would be used in a business environment.
99.06	Explain the importance of privilege management (access, password management, sign-on).
99.07	Describe the concept of forensics as it applies to network security (obtaining evidence of security breaches).
99.08	Explain the importance of educating users and supervisors in regard to network security.
99.09	Create documentation that describes standards and guidelines for a network security system.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Network Systems Administration
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	B079300
CIP Number	0511090105
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1142 – Network and Computer Systems Administrators 15-1143 – Computer Network Architects
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as a Computer Support Assistant, Network Support Technician, Systems Administrator, Systems Engineer, Wireless Network Administrator, and Data Communications Analyst in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to instruction in computer literacy; software application support; basic hardware configuration and troubleshooting; networking technologies, troubleshooting, security, and administration; and customer service and human relations skills.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of seven occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	EEV0504	Computer Support Assistant	BUS ED 1 @2 COMPU SCI 6 COMP SVC 7G CYBER TECH 7G INFO TECH 7G	150 hours	15-1151
C	CTS0026	Network Support Technician		150 hours	15-1142
D	CTS0027	Systems Administrator		150 hours	15-1142
E	CTS0028	Systems Engineer		150 hours	15-1143
F	CTS0029	Wireless Network Administrator		150 hours	15-1143
G	EEV0317	Data Communications Analyst		150 hours	15-1143

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 16.0 Identify, install, configure, and upgrade desktop and server computer modules and peripherals, following established basic procedures for system assembly and disassembly of field replaceable modules.
- 17.0 Diagnose and troubleshoot common module problems and system malfunctions of computer software, hardware, peripherals, and other office equipment.
- 18.0 Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace.
- 19.0 Identify specific terminology, facts, ways and means of dealing with classifications, categories and principles of motherboards, processors and memory in desktop and server computer systems.
- 20.0 Demonstrate knowledge of basic types of printers, basic concepts, printer components, how they work, how they print onto a page, paper path, care and service techniques, and common problems.
- 21.0 Identify and describe basic network concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring network interface cards, and knowledge of the ramifications of repairs when a computer is networked.
- 22.0 Perform end user support and assistance by troubleshooting and diagnosing through telephone, email, remote access, or direct contact.
- 23.0 Demonstrate proficiency using graphical user interface (GUI) operating systems.

- 24.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 25.0 Participate in work-based learning experiences.
- 26.0 Perform end user support and assistance by troubleshooting and diagnosing through telephone, email, remote access, or direct contact.
- 27.0 Perform installation and configuration activities.
- 28.0 Demonstrate proficiency using computer networks.
- 29.0 Demonstrate proficiency in configuring and troubleshooting hardware devices and drivers.
- 30.0 Demonstrate proficiency in managing, monitoring, and optimizing system performance, reliability and availability.
- 31.0 Demonstrate proficiency in managing, configuring and troubleshooting storage use.
- 32.0 Demonstrate proficiency in configuring and troubleshooting network connections.
- 33.0 Demonstrate proficiency in implementing, monitoring, and troubleshooting security.
- 34.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 35.0 Solve problems using critical thinking skills, creativity and innovation.
- 36.0 Use information technology tools.
- 37.0 Describe the roles within teams, work units, departments, organizations, interorganizational systems, and the larger environment.
- 38.0 Describe the importance of professional ethics and legal responsibilities.
- 39.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 40.0 Participate in work-based learning experiences.
- 41.0 Administer accounts and resources on computers running server operating system software in a networked environment.
- 42.0 Modify user and computer accounts on computers running a server operating system in a networked environment.
- 43.0 Perform various administrative functions using groups.
- 44.0 Enable resource access with permissions, manage access to files and folders using permissions, and manage permission inheritance.
- 45.0 Implement printing in a networked environment utilizing a particular server operating system.
- 46.0 Utilize available permissions for managing access to global directory objects, how to move objects between organizational units in the same domain, and how to delegate control of an organizational unit.
- 47.0 Use group policy to configure folder redirection, browser connectivity, and the desktop.
- 48.0 Manage computer security in a networking environment.
- 49.0 Administer servers remotely.
- 50.0 Monitor server performance by using performance tools, configure and manage performance logs, configure and manage alerts, and manage system monitor views.
- 51.0 Collect performance data by monitoring primary server subsystems and identify system bottlenecks by using the performance monitoring software.
- 52.0 Maintaining device drivers.
- 53.0 Use software tools to manage and set up disks.
- 54.0 Use file encryption for security of data.
- 55.0 Plan for a computer disaster and use the features of a server operating system to prevent a disaster or recover when one occurs.
- 56.0 Manage and distribute critical software updates that resolve known security vulnerabilities and other stability issues.
- 57.0 Construct and assign IP addresses and isolate addressing issues associated with the IP routing process.
- 58.0 Configure an internet protocol (IP) address for client computers.
- 59.0 Configure name resolution mechanisms for clients on a network and describe the name resolution process.
- 60.0 Isolate common connectivity issues and describe how to use utilities and tools as part of this process.

- 61.0 Configure a routing solution for a network environment.
- 62.0 Allocate IP addressing in a network environment.
- 63.0 Manage the DHCP service to reflect changing client IP addressing needs and monitor DHCP server performance.
- 64.0 Assign computer names to the IP addresses of the source and destination hosts, and then use the computer name to contact the hosts.
- 65.0 Resolve host names by using domain name system.
- 66.0 Manage and monitor DNS servers to ensure that they are functioning properly and to optimize network performance.
- 67.0 Configure a server with the routing and remote access service, create appropriate remote access connections on a network access server, and configure users' access rights.
- 68.0 Manage and monitor network access and the network access services.
- 69.0 Perform installation of a network client operating system.
- 70.0 Install and configure hardware devices.
- 71.0 Configure and manage file systems.
- 72.0 Troubleshoot the boot process and other system issues.
- 73.0 Configure the desktop.
- 74.0 Configure IP addresses and name resolution.
- 75.0 Configure the client to work in a network environment.
- 76.0 Support remote users.
- 77.0 Configure a client OS for mobile computing.
- 78.0 Monitor resources and performance.
- 79.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 80.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 81.0 Explain the importance of employability skill and entrepreneurship skills.
- 82.0 Apply communication skills (reading, writing, speaking, listening, and viewing) in a courteous, concise, and correct manner on personal and professional levels.
- 83.0 Participate in work-based learning experiences.
- 84.0 Plan a network infrastructure.
- 85.0 Plan and optimize a TCP/IP physical and logical network.
- 86.0 Plan and troubleshoot routing.
- 87.0 Plan a DHCP strategy.
- 88.0 Plan a DNS strategy.
- 89.0 Optimize and troubleshoot DNS.
- 90.0 Plan and troubleshoot IPSEC.
- 91.0 Plan a network access.
- 92.0 Troubleshoot network access.
- 93.0 Analyze global director infrastructure.
- 94.0 Implement a global directory structure and domain.
- 95.0 Implement an organizational unit structure.
- 96.0 Implement user, group, and computer accounts.
- 97.0 Implement group policy.
- 98.0 Deploy and manage software by using group policies.
- 99.0 Implement sites to manage global directory replication.

- 100.0 Implement placement of domain controllers.
- 101.0 Use a framework for designing security and create a security design team.
- 102.0 Recognize and predict common threats by using a threat model.
- 103.0 Apply a framework for planning risk management.
- 104.0 Design security for physical resources.
- 105.0 Design security for computers.
- 106.0 Design security for accounts.
- 107.0 Design security for authentication.
- 108.0 Design security for data.
- 109.0 Design security for data transmission.
- 110.0 Design security for network perimeter.
- 111.0 Design an audit policy and an incident response procedure.
- 112.0 Linux Foundation.
- 113.0 Linux Fundamentals.
- 114.0 Linux Installation.
- 115.0 Linux Operation.
- 116.0 Linux user Group and Permissions.
- 117.0 Linux Basic Security & System Monitoring.
- 118.0 Participate in work-based learning experiences.
- 119.0 Demonstrate proficiency in applying radio frequency (RF) technologies.
- 120.0 Develop an awareness of wireless LAN technologies.
- 121.0 Perform implementation and management activities.
- 122.0 Develop an awareness of wireless security systems.
- 123.0 Demonstrate knowledge of wireless industry standards.
- 124.0 Participate in work-based learning experiences.
- 125.0 Demonstrate knowledge of general security concepts.
- 126.0 Develop an awareness of communication security concepts.
- 127.0 Develop an awareness of network infrastructure security.
- 128.0 Develop an awareness of cryptography and its relation to security.
- 129.0 Incorporate organizational and operational security in an appropriate and effective manner.

Florida Department of Education
Student Performance Standards

Program Title: Network Systems Administration
Career Certificate Program Number: B079300

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: EEV0504
Occupational Completion Point: B
Computer Support Assistant – 150 Hours – SOC Code 15-1151

15.0	Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. The student will be able to:
15.01	Develop strategies for resolving customer conflicts.
16.0	Identify, install, configure, and upgrade desktop and server computer modules and peripherals, following established basic procedures for system assembly and disassembly of field replaceable modules. The student will be able to:
16.01	Identify and describe the functions of main processing boards.
16.02	Identify and describe the functions of communication ports.
16.03	Identify and describe the functions of peripheral devices.
16.04	Identify and describe the components of portable systems.
16.05	Troubleshoot, install and upgrade computers and peripherals.
16.06	Perform system hardware setup.
16.07	Demonstrate an understanding of input/output devices.
16.08	Installation and configuration of applications software, hardware, and device drivers.
16.09	Demonstrate an understanding of the operation and purpose of hardware components.
16.10	Install operating system software.
16.11	Customize operating systems.
16.12	Install application software.
16.13	Perform storage formatting and preparation activities.
16.14	Identify data measurement.
16.15	Install and configure RAID.
16.16	Recognize and report on server room environmental issues.
17.0	Diagnose and troubleshoot common module problems and system malfunctions of computer software, hardware, peripherals, and other office equipment. The student will be able to:
17.01	Troubleshoot a personal computer system.
17.02	Identify configuration problems.
17.03	Identify software problems.

17.04	Identify hardware malfunctions.
17.05	Identify network malfunctions.
17.06	Resolve computer error messages.
17.07	Understand and troubleshoot memory and cache systems.
17.08	Verify that drives are the appropriate type.
17.09	Describe knowledge database search procedures used to identify possible solutions when troubleshooting software and hardware problems.
18.0	Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace. The student will be able to:
18.01	Apply basic rules for hardware safety.
18.02	Demonstrate proficiency in basic preventative hardware maintenance.
18.03	Special disposal procedures that comply with environmental guidelines for batteries, CRTs, toner kits/cartridges, chemical solvents and cans, and MSDS.
18.04	Apply ergonomic principles applicable to the configuration of computer workstations.
18.05	Describe ethical issues and problems associated with computers and information systems.
19.0	Identify specific terminology, facts, ways and means of dealing with classifications, categories and principles of motherboards, processors and memory in desktop and server computer systems. The student will be able to:
19.01	Identify Random Access Memory (RAM) types.
19.02	Identify I/O ports and devices.
20.0	Demonstrate knowledge of basic types of printers, basic concepts, printer components, how they work, how they print onto a page, paper path, care and service techniques, and common problems. The student will be able to:
20.01	Identify types of printers.
20.02	Identify care and service techniques and common problems with primary printer types.
20.03	Implement and manage printing on a network.
21.0	Identify and describe basic network concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring network interface cards, and knowledge of the ramifications of repairs when a computer is networked. The student will be able to:
21.01	Define networking and describe the purpose of a network.
21.02	Identify the purposes and interrelationships among the major components of networks.
21.03	Describe the various types of network topologies.
21.04	Identify and describe the purpose of standards, protocols, and the Open Systems Interconnection (OSI) reference model.

21.05	Configure network and verify network connectivity.
21.06	Discuss the responsibilities of the network.
21.07	Develop user logon procedures.
21.08	Utilize network management infrastructures to perform administrative tasks.
21.09	Identify common backup strategies and procedures.
21.10	Select and use appropriate electronic communications software and hardware for specific tasks.
21.11	Compare and contrast Internet software and protocols.
21.12	Diagnose and resolve electronic communications operational problems.
21.13	Design and implement directory tree structures.
21.14	Install services tools.
21.15	Perform and verify backups.
21.16	Identify bottlenecks.
21.17	Use the concepts of fault tolerance/fault recovery to create a disaster recovery plan.
21.18	Document and test disaster recovery plan regularly, and update as needed.
22.0	Perform end user support and assistance by troubleshooting and diagnosing through verbal or written communication. The student will be able to:
22.01	Apply call center vocabulary.
22.02	Listen and input information simultaneously.
22.03	Apply first response assistance for minor repair work.
23.0	Demonstrate proficiency using graphical user interface (GUI) operating systems. The student will be able to:
23.01	Identify parts of GUI windows.
23.02	Demonstrate proficiency in using menu systems.
23.03	Demonstrate proficiency in using pointing and selection devices.
23.04	Identify keyboard shortcuts and special function keys.
23.05	Demonstrate proficiency in manipulating windows.
23.06	Utilize help systems and hypertext links.

23.07 Create, organize, and maintain file system directories.
23.08 Organize desktop objects.
23.09 Run multiple applications.

Course Number: CTS0026
Occupational Completion Point: C
Network Support Technician – 150 Hours – SOC Code 15-1142

24.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. The student will be able to:

24.01 Develop diplomatic methods to communicate with customers.

25.0 Participate in work-based learning experiences. The student will be able to:

25.01 Participate in work-based learning experiences in a network support services environment.

25.02 Discuss the use of technology in a network environment.

26.0 Perform end user support and assistance by troubleshooting and diagnosing through telephone, email, remote access, or direct contact. The student will be able to:

26.01 Apply first response assistance for minor repair work.

27.0 Perform installation and configuration activities. The student will be able to:

27.01 Configure the operating system environment.

27.02 Connect client workstation running similar operating system to the network.

27.03 Configure Internet access for a network.

27.04 Configure a web server.

27.05 Use remote server to deploy operating system.

27.06 Troubleshoot failed installations.

27.07 Install and configure network services for interoperability.

27.08 Monitor, configure troubleshoot and control access to printers.

27.09 Monitor, configure troubleshoot and control access to files, folders, and shared folders.

27.10 Monitor, configure troubleshoot and control access to websites.

28.0 Demonstrate proficiency using computer networks. The student will be able to:

28.01 Identify and describe the purpose of standards, protocols, and the Open Systems Interconnection (OSI) reference model.

29.0	Demonstrate proficiency in configuring and troubleshooting hardware devices and drivers. The student will be able to:
29.01	Configure hardware devices.
29.02	Configure driver signing options.
29.03	Update device drivers.
29.04	Troubleshoot problems with hardware.
30.0	Demonstrate proficiency in managing, monitoring, and optimizing system performance, reliability and availability. The student will be able to:
30.01	Monitor and optimize usage of system resources.
30.02	Manage processes.
30.03	Optimize disk performance.
30.04	Manage and optimize availability of system data and user data.
30.05	Recover systems and user data.
31.0	Demonstrate proficiency in managing, configuring and troubleshooting storage use. The student will be able to:
31.01	Configure and manage user profiles.
31.02	Monitor, configure and troubleshoot disks and volumes.
31.03	Configure data compression.
31.04	Monitor and configure disk quotas.
31.05	Recover from disk failures.
32.0	Demonstrate proficiency in configuring and troubleshooting network connections. The student will be able to:
32.01	Install, configure and troubleshoot shared access.
32.02	Install, configure and troubleshoot a virtual private network.
32.03	Install, configure and troubleshoot network protocols.
32.04	Install and configure network services.

32.05	Configure, monitor and troubleshoot remote access.
32.06	Install, configure, monitor, and troubleshoot Terminal Services.
32.07	Configure the properties of a connection.
32.08	Install, configure, and troubleshoot network adapters and drivers.
33.0	Demonstrate proficiency in implementing, monitoring, and troubleshooting security. The student will be able to:
33.01	Encrypt data on a hard disk by using Encrypting File System.
33.02	Implement, configure, manage and troubleshoot policies in an operating system environment.
33.03	Implement, configure, manage and troubleshoot auditing.
33.04	Implement, configure, manage and troubleshoot local accounts.
33.05	Implement, configure, manage and troubleshoot account policy.
33.06	Implement, configure, manage and troubleshoot security by using the Security Configuration Tool Set.
34.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
34.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
34.02	Locate, organize and reference written information from various sources.
34.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
34.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
34.05	Apply active listening skills to obtain and clarify information.
34.06	Develop and interpret tables and charts to support written and oral communications.
34.07	Exhibit public relations skills that aid in achieving customer satisfaction.
35.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
35.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
35.02	Employ critical thinking and interpersonal skills to resolve conflicts.

35.03	Identify and document workplace performance goals and monitor progress toward those goals.
35.04	Conduct technical research to gather information necessary for decision-making.
36.0	Use information technology tools. The student will be able to:
36.01	Use personal information management (PIM) applications to increase workplace efficiency.
36.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
36.03	Employ computer operations applications to access, create, manage, integrate, and store information.
36.04	Employ collaborative/groupware applications to facilitate group work.
37.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. The student will be able to:
37.01	Describe the nature and types of business organizations.
37.02	Explain the effect of key organizational systems on performance and quality.
37.03	List and describe quality control systems and/or practices common to the workplace.
37.04	Explain the impact of the global economy on business organizations.
38.0	Describe the importance of professional ethics and legal responsibilities. The student will be able to:
38.01	Evaluate and justify decisions based on ethical reasoning.
38.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
38.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
38.04	Interpret and explain written organizational policies and procedures.

Course Number: CTS0027
Occupational Completion Point: D
Systems Administrator – 150 Hours – SOC Code 15-1142

39.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. The student will be able to:

39.01 Develop diplomatic methods to communicate with customers, clients, and end-users of information technology services.

40.0 Participate in work-based learning experiences. The student will be able to:

40.01 Participate in work-based learning experiences in a network support services environment.

40.02 Discuss the use of technology in a network support services environment.

40.03 Discuss the management/supervisors skills needed in a network support services environment.

41.0 Administer accounts and resources on computers running server operating system software in a networked environment. The student will be able to:

41.01 Describe features of server operating system.

41.02 Log on to the server operating system.

41.03 Install and configure administrative tools.

41.04 Create user accounts.

41.05 Create computer accounts.

41.06 Create an organizational unit.

42.0 Modify user and computer accounts on computers running a server operating system in a networked environment. The student will be able to:

42.01 Modify user and computer account properties.

42.02 Enable and unlock user and computer accounts.

42.03 Create a user account template.

42.04 Locate user and computer accounts in a global directory structure.

42.05 Save queries.

42.06 Reset user and computer accounts.

42.07 Move domain objects.

43.0	Perform various administrative functions using groups. The student will be able to:
43.01	Create groups.
43.02	Manage group membership.
43.03	Apply strategies for using groups.
43.04	Modify groups.
43.05	Manage default groups.
44.0	Enable resource access with permissions, manage access to files and folders using permissions, and manage permission inheritance. The student will be able to:
44.01	Manage access to resources.
44.02	Manage access to shared folders.
44.03	Manage access to files and folders by using file system permissions.
44.04	Determine effective permissions.
44.05	Manage access to shared files by using offline caching.
45.0	Implement printing in a networked environment utilizing a particular server operating system. The student will be able to:
45.01	Install and share printers.
45.02	Manage access to printers by using shared printer permissions.
45.03	Manage printer drivers.
45.04	Implement printer locations.
45.05	Change the location of the print spooler.
45.06	Set printing priorities.
45.07	Schedule printer availability.
45.08	Configure a printing tool.
46.0	Utilize available permissions for managing access to global directory objects, how to move objects between organizational units in the same domain, and how to delegate control of an organizational unit. The student will be able to:
46.01	Identify the role of organizational units.
46.02	Modify permissions for global directory objects.

46.03	Delegate control of organizational units.
47.0	Use group policy to configure folder redirection, browser connectivity, and the desktop. The student will be able to:
47.01	Configure group policy settings.
47.02	Assign scripts with group policy.
47.03	Configure folder redirection.
48.0	Manage computer security in a security in a networking environment. The student will be able to:
48.01	Describe the security features a server operating system.
48.02	Use security templates to secure computers.
48.03	Test computer security policy.
48.04	Configure auditing.
48.05	Manage security logs.
49.0	Administer servers remotely. The student will be able to:
49.01	Explain the tasks, tools, and rights that are required to administer a server.
49.02	Configure remote access for administration and client preferences.
49.03	Manage remote desktop connections.
50.0	Monitor server performance by using performance tools, configure and manage performance logs, configure and manage alerts, and manage system monitor views. The student will be able to:
50.01	Establish a performance baseline.
50.02	Perform real-time and logged monitoring.
50.03	Configure and manage counter logs.
50.04	Configure alerts.
51.0	Collect performance data by monitoring primary server subsystems and identify system bottlenecks by using the performance monitoring software. The student will be able to:
51.01	Explain how the four primary server subsystems affect server performance.
51.02	Monitor server memory.
51.03	Monitor processor usage.

51.04	Monitor disks.
51.05	Monitor network usage.
51.06	Identify the guidelines for using counters and thresholds.
51.07	Describe the best practices for monitoring server performance.
52.0	Maintain device drivers. The student will be able to:
52.01	Configure device driver signing.
52.02	Restore the previous version of a device driver.
53.0	Use software tools to manage and set up disks. The student will be able to:
53.01	Initialize and partition a disk.
53.02	View and update disk properties.
53.03	Manage mounted drives.
53.04	Create volumes on a disk.
53.05	Convert a disk from basic to dynamic and from dynamic to basic.
53.06	Import disks.
54.0	Use file encryption for security of data. The student will be able to:
54.01	Manage disk based file compression.
54.02	Configure file encryption.
54.03	Implement disk quotas.
55.0	Plan for a computer disaster and use the features of a server operating system to prevent a disaster or recover when one occurs. The student will be able to:
55.01	Prepare for disaster recovery.
55.02	Back up data.
55.03	Schedule backup jobs.
55.04	Restore data.
55.05	Configure a shadow copy.

55.06	Recover from server failure.
55.07	Select a disaster recovery method.
56.0	Manage and distribute critical software updates that resolve known security vulnerabilities and other stability issues. The student will be able to:
56.01	Install and configure client computers to use receive software updates.
56.02	Install and configure servers to use perform software updates.
56.03	Manage the Software Update Services infrastructure.
57.0	Construct and assign IP addresses and isolate addressing issues associated with the IP routing process. The student will be able to:
57.01	Convert IP Addresses from decimal to binary.
57.02	Calculate a subnet mask.
57.03	Create subnets using VLSM and CIDR.
57.04	Isolate addressing issues associated with the IP routing process.
58.0	Configure an internet protocol (IP) address for client computers. The student will be able to:
58.01	Configure a client to use a static IP address.
58.02	Configure a client to obtain an IP address automatically by using DHCP.
58.03	Configure a client to obtain an IP address automatically by using Alternate Configuration.
59.0	Configure name resolution mechanisms for clients on a network and describe the name resolution process. The student will be able to:
59.01	Use ARP to identify client media access control (MAC) addresses.
59.02	Describe the function of Network Basic Input/Output System (NetBIOS).
59.03	Configure a client to use a static IP address.
59.04	Configure a client to use name resolution servers.
60.0	Isolate common connectivity issues and describe how to use utilities and tools as part of this process. The student will be able to:
60.01	Isolate common connectivity issues.
60.02	Use a flow chart to isolate a problem.
60.03	Use utilities and tools to isolate a problem.

61.0	Configure a routing solution for a network environment. The student will be able to:
61.01	Describe the role of routing in the network infrastructure.
61.02	Enable and configure the Routing and Remote Access service.
61.03	Configure packet filters.
62.0	Allocate IP addressing in a network environment. The student will be able to:
62.01	Describe the role of DHCP in the network infrastructure.
62.02	Add and authorize a DHCP Server service.
62.03	Configure a DHCP scope.
62.04	Configure DHCP options.
62.05	Configure a DHCP reservation.
62.06	Configure a DHCP relay agent.
63.0	Manage the DHCP service to reflect changing client IP addressing needs and monitor DHCP server performance. The student will be able to:
63.01	Manage a DHCP database.
63.02	Monitor DHCP.
63.03	Apply security guidelines for DHCP.
64.0	Assign computer names to the IP addresses of the source and destination hosts, and then use the computer name to contact the hosts. The student will be able to:
64.01	Describe the name resolution process.
64.02	View names on a client.
64.03	Configure host name resolution.
65.0	Resolve host names by using domain name system. The student will be able to:
65.01	Describe the role of DNS in the network infrastructure.
65.02	Install the DNS Server service.
65.03	Configure the properties for the DNS Server service.
65.04	Configure the DNS zones.

65.05	Configure DNS zone transfers.
65.06	Configure dynamic updates.
65.07	Configure a DNS client.
65.08	Delegate authority for zones.
66.0	Manage and monitor DNS servers to ensure that they are functioning properly and to optimize network performance. The student will be able to:
66.01	Configure the Time-to-Live (TTL) value.
66.02	Configure aging and scavenging.
66.03	Integrate DNS with WINS.
66.04	Test the DNS server configuration.
66.05	Monitor DNS server performance.
67.0	Configure a server with the routing and remote access service, create appropriate remote access connections on a network access server, and configure users' access rights. The student will be able to:
67.01	Describe a network access infrastructure.
67.02	Configure a virtual private network (VPN) connection.
67.03	Configure a dial-up connection.
67.04	Configure a wireless connection.
67.05	Control remote user access to a network.
67.06	Centralize authentication and policy management for network access by using Internet Authentication Service (IAS).
68.0	Manage and monitor network access and the network access services. The student will be able to:
68.01	Configure logging on the network access server.
68.02	Collect and monitor network access data.
69.0	Perform installation of a network client operating system. The student will be able to:
69.01	Plan a client operating system installation.
69.02	Install a client operating system.
69.03	Upgrade a client operating system from an earlier version.

69.04	Automate the installation process for a client operating system.
70.0	Install and configure hardware devices. The student will be able to:
70.01	Configure hardware devices and drivers on a computer running a client OS.
70.02	Add and remove devices by using built in utilities and wizards.
70.03	Restore device drivers.
71.0	Configure and manage file systems. The student will be able to:
71.01	Work with file systems.
71.02	Manage data compression.
71.03	Secure data by using EFS.
71.04	Configure disk compression.
71.05	Secure files by using EFS.
72.0	Troubleshoot the boot process and other system issues. The student will be able to:
72.01	Examine the boot process.
72.02	Control system settings during the boot process.
72.03	Change startup behavior.
72.04	Use advanced boot options to troubleshoot startup problems.
72.05	Restore a computer to a previous state.
72.06	Troubleshoot the boot process and other system issues.
73.0	Configure the desktop. The student will be able to:
73.01	Configure user desktop settings.
73.02	Customize the desktop environment.
73.03	Configure system settings.
73.04	Describe how user profiles and group policy affect desktop customization.
74.0	Configure IP addresses and name resolution. The student will be able to:

74.01	Configure IP addresses.
74.02	Troubleshoot IP addresses.
74.03	Determine TCP/IP name resolution methods.
74.04	Configure a DNS and WINS client.
74.05	Connect to a remote host.
74.06	Configure IP addresses.
74.07	Configure the DNS client.
75.0	Configure the client to work in a network environment. The student will be able to:
75.01	Examine workgroups and user accounts.
75.02	Create and authenticate local user accounts.
75.03	Configure local security.
75.04	Configure logon options.
75.05	Configure networking.
75.06	Join a domain.
75.07	Operate in a domain.
76.0	Support remote users. The student will be able to:
76.01	Establish remote access connections.
76.02	Connect to Virtual Private Networks.
76.03	Configure inbound connections.
76.04	Configure authentication protocols and encryption.
76.05	Using remote desktop.
76.06	Store user names and passwords to facilitate remote connections.
76.07	Configure a VPN connection.
76.08	Configure and using remote desktop.

76.09	Store user names and passwords.
77.0	Configure a client OS for mobile computing. The student will be able to:
77.01	Configure hardware for mobile computing.
77.02	Configure power management options for mobile computing.
77.03	Make files, folders, and webpages available for offline use.
78.0	Monitor resources and performance. The student will be able to:
78.01	Determine system information.
78.02	Use task manager to monitor system performance.
78.03	Use performance and maintenance tools to improve performance.
78.04	Monitor event logs.
78.05	Configure program compatibility.
79.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. The student will be able to:
79.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
79.02	Explain emergency procedures to follow in response to workplace accidents.
79.03	Create a disaster and/or emergency response plan.
80.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
80.01	Employ leadership skills to accomplish organizational goals and objectives.
80.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
80.03	Conduct and participate in meetings to accomplish work tasks.
80.04	Employ mentoring skills to inspire and teach others.
81.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:
81.01	Identify and demonstrate positive work behaviors needed to be employable.
81.02	Develop personal career plan that includes goals, objectives, and strategies.
81.03	Examine licensing, certification, and industry credentialing requirements.

81.04	Maintain a career portfolio to document knowledge, skills, and experience.
81.05	Evaluate and compare employment opportunities that match career goals.
81.06	Identify and exhibit traits for retaining employment.
81.07	Identify opportunities and research requirements for career advancement.
81.08	Research the benefits of ongoing professional development.
81.09	Examine and describe entrepreneurship opportunities as a career planning option.
81.10	Research, compare and contrast investment opportunities.

Course Number: CTS0028
Occupational Completion Point: E
Systems Engineer – 150 Hours – SOC Code 15-1143

82.0	Apply communication skills (reading, writing, speaking, listening, viewing) in a courteous, concise, and correct manner on personal and professional levels. The student will be able to:
82.01	Communicate technical information in a concise, understandable manner to a non-technical audience both verbally and in writing.
83.0	Participate in work-based learning experiences. The student will be able to:
83.01	Participate in work-based learning experiences in a network support services environment.
83.02	Discuss the use of technology in a network support services environment.
83.03	Compare and contrast the software applications used in a network support services environment.
84.0	Plan a network infrastructure. The student will be able to:
84.01	Explain how to plan a network.
84.02	Explain how to prepare development and test environments.
84.03	Explain the concepts of managing and maintaining a network environment by using specific tools.
84.04	Explain the technologies and services implemented in a network.
85.0	Plan and optimize a TCP/IP physical and logical network. The student will be able to:
85.01	Discuss TCP/IP.
85.02	Plan a TCP/IP addressing scheme.
85.03	Optimize network performance.
86.0	Plan and troubleshoot routing. The student will be able to:
86.01	Describe how routing works.
86.02	Create a secure routing plan.
86.03	Identify TCP/IP routing trouble shooting tools.
86.04	Troubleshoot TCP/IP routing.
87.0	Plan a DHCP strategy. The student will be able to:
87.01	Demonstrate how DHCP operates in an enterprise environment.

87.02	Plan a DHCP strategy.
87.03	Secure a DHCP strategy.
88.0	Plan a DNS strategy. The student will be able to:
88.01	Plan a namespace strategy.
88.02	Plan zones.
88.03	Plan zone replication.
88.04	Plan a DNS server implementation.
89.0	Optimize and troubleshoot DNS. The student will be able to:
89.01	Optimize a DNS server.
89.02	Optimize the DNS server-to-server communications.
89.03	Optimize DNS client support traffic.
89.04	Troubleshoot host name resolution.
90.0	Plan and troubleshoot IPSEC. The student will be able to:
90.01	Discuss IPsec.
90.02	Understand IPsec default policies, rules, and settings.
90.03	Plan IPsec deployment.
90.04	Troubleshoot IPsec.
91.0	Plan a network access. The student will be able to:
91.01	Select appropriate connection methods for a network access strategy.
91.02	Select a remote access policy strategy.
91.03	Select a network access authentication method.
91.04	Plan a network access strategy.
92.0	Troubleshoot network access. The student will be able to:
92.01	Identify network access troubleshooting resources.

92.02	Troubleshoot network authentication.
92.03	Troubleshoot LAN authentication.
92.04	Troubleshoot remote access.
93.0	Analyze global director infrastructure. The student will be able to:
93.01	Describe the architecture of global directory.
93.02	Describe the working of global directory.
93.03	Use administrative tools to examine the components of global directory.
93.04	Describe the global directory design, planning, and implementation processes.
94.0	Implement a global directory structure and domain structure. The student will be able to:
94.01	Create a forest and domain structure.
94.02	Configure DNS in a global directory environment.
94.03	Raise the functional level of a forest and a domain.
94.04	Create trust relationships between domains.
94.05	Secure trusts by using SID filtering.
95.0	Implement an organizational unit structure. The student will be able to:
95.01	Create an organizational unit.
95.02	Delegate control for an organizational unit.
95.03	Plan an organization unit strategy.
96.0	Implement user, group, and computer accounts. The student will be able to:
96.01	Describe the types of global directory accounts and groups.
96.02	Create multiple user and computer accounts.
96.03	Implement UPN suffixes.
96.04	Move objects within a domain and across domains in a global structure.
96.05	Plan a strategy for user computer and group accounts.

96.06	Plan a global directory audit strategy.
97.0	Implement group policy. The student will be able to:
97.01	Create and configure group policy objects.
97.02	Manage group policy objects.
97.03	Verify and troubleshoot group policies.
97.04	Delegate administrative control of group policies.
97.05	Plan a group policies strategy for the enterprise.
98.0	Deploy and manage software by using group policies. The student will be able to:
98.01	Explain the basic concepts of software deployment by using group policies.
98.02	Deploy software by using group policies.
98.03	Configure software deployment by using group policies.
98.04	Maintain deployed software by using group policies.
98.05	Troubleshoot some common problems with software deployment.
98.06	Plan a software deployment strategy.
99.0	Implement sites to manage global directory replication. The student will be able to:
99.01	Explain the components and the process of replication.
99.02	Create and configure sites.
99.03	Manage a global directory site topology.
99.04	Monitor and troubleshoot global directory replication failures.
99.05	Plan a site strategy.
100.0	Implement placement of domain controllers. The student will be able to:
100.01	Implement a global catalog in a global directory.
100.02	Determine the placement of domain controllers in a global directory.
100.03	Create a plan for placing domain controllers in a global directory.

101.0	Use a framework for designing security and create a security design team. The student will be able to:
101.01	Describe common elements of security policies and procedures.
101.02	Create a security design framework.
101.03	Create a security design team.
102.0	Recognize and predict common threats by using a threat model. The student will be able to:
102.01	Explain common network vulnerabilities and how attackers can exploit them.
102.02	Predict threats to security by using the STRIDE (Spoofing, Tampering, Repudiation, Information disclosure, Denial of service, Elevation of privilege) threat model.
103.0	Apply a framework for planning risk management. The student will be able to:
103.01	Explain the purpose and operation of risk management.
103.02	Draft the elements of a risk management plan.
104.0	Design security for physical resources. The student will be able to:
104.01	Determine threats and analyze risks to physical resources.
104.02	Design security for physical resources.
105.0	Design security for computers. The student will be able to:
105.01	Determine threats and analyze risks to computers.
105.02	Design security for computers.
106.0	Design security for accounts. The student will be able to:
106.01	Determine threats and analyze risks to accounts.
106.02	Design security for accounts.
107.0	Design security for authentication. The student will be able to:
107.01	Determine threats and analyze risks to authentication.
107.02	Design security for authentication.
108.0	Design security for data. The student will be able to:
108.01	Determine threats and analyze risks to data.

108.02 Design security for data.
109.0 Design security for data transmission. The student will be able to:
109.01 Determine threats and analyze risks to data transmission.
109.02 Design security for data transmission.
110.0 Design security for network perimeters. The student will be able to:
110.01 Determine threats and analyze risks to network perimeters.
110.02 Design security for network perimeters.
111.0 Design an audit policy and an incident response procedure. The student will be able to:
111.01 Explain the importance of auditing and incident response.
111.02 Design an auditing policy.
111.03 Design an incident response procedure.
112.0 Linux Foundation. The student will be able to:
112.01 Explain the creation history of Linux.
112.02 Explain Free and Open Source Software (FOSS).
112.03 Explain the concept of a GNU General Public License (GPL).
112.04 Explain the concept of a Linux distribution and name some well-known distributions.
112.05 Site common uses of Linux and it's roles in global networks.
113.0 Linux Fundamentals. The student will be able to:
113.01 Access and utilize the command line interface shell.
113.02 Explain the purpose of and demonstrate the use of the super user and super user do (sudo) command.
113.03 Know where to get help and how to use the manual (man) pages.
113.04 Use non-graphical text editors such as vi and nano.
113.05 Use and create command aliases.
113.06 Adjust environmental variables and shell configuration files.

113.07 Demonstrate redirection, piping, standard input, standard output, & standard error.
113.08 Work with Directories, links, and files.
113.09 Describe the most common Filesystem Hierarchy Standard (FHS).
113.10 Compress and decompress files using standard Linux utilities.
114.0 Linux Installation. The student will be able to:
114.01 Plan and perform a Linux installation including harddrive partitioning, Logical Volumes (LV), and basic Logical Volume Management (LVM) operation.
114.02 Install various distributions of Linux in server and client modes.
114.03 Explain the boot loader and describe the most common boot loader, GRUB2.
115.0 Linux System Operation. The student will be able to:
115.01 Start, display, and kill running processes.
115.02 Explain the purpose of the Process ID (PID).
115.03 Explain the relationship of parent, child, and zombie processes.
115.04 Explain the role of systemd.
115.05 Update and upgrade running Linux systems.
115.06 Describe the use of shared libraries.
115.07 Mount volumes.
116.0 Linux Users Groups and Permissions. The student will be able to:
116.01 Display existing groups and users.
116.02 Create users.
116.03 Explain the use of the shadow password file.
116.04 Create groups.
116.05 Assign users to groups.
116.06 Explain how Linux uses file and folder ownership and group permissions.
116.07 Change ownership and group ownership of files and folders.

116.08 Explain the attributes read, write, execute (rwx).
116.09 Demonstrate the ability to change attributes using the single, multiple, and binary methods.
116.10 Describe the use of special permissions.
117.0 Linux Basic Security & System Monitoring. The student will be able to:
117.01 Configure network interfaces for IPv4 and IPv6.
117.02 Display iptables and create a new firewall rule.
117.03 Demonstrate the ability to read and manipulate system & security log files using head, tail, cat, less, and more.
117.04 Demonstrate the ability to backup system & security logs.
117.05 Create basic scripts to automate tasks.
117.06 Block logins, disable, and re-enable accounts.
117.07 Remove un-needed services and disable unused ports.

Course Number: CTS0029
Occupational Completion Point: F
Wireless Network Administrator – 150 Hours – SOC Code 15-1143

118.0 Participate in simulated work-based learning experiences. The student will be able to:

118.01 Participate in simulated work-based learning experiences in a network support services environment.

118.02 Discuss the use of technology in a network support services environment.

118.03 Discuss the management/supervisory skills needed in a network support service environment.

119.0 Demonstrate proficiency in applying radio frequency (RF) technologies. The student will be able to:

119.01 Define and apply the basic concepts of RF behavior.

119.02 Understand the applications of basic RF antenna concepts.

119.03 Understand and apply the basic components of RF.

119.04 Identify some of the different uses for spread spectrum technologies.

119.05 Comprehend the differences between, and apply the different types of spread spectrum technologies.

119.06 Identify and apply the concepts which make up the functionality of spread spectrum technology.

119.07 Identify the laws set forth by the FCC that govern spread spectrum technology, including power outputs, frequencies, bandwidths, hop times, and dwell times.

120.0 Develop an awareness of wireless LAN technologies. The student will be able to:

120.01 Identify and apply the processes involved in authentication and association.

120.02 Recognize the concepts associated with wireless LAN service sets.

120.03 Understand the implications of the following power management features of wireless LANs.

120.04 Specify the modes of operation involved in the movement of data traffic across wireless LANs.

121.0 Perform implementation and management activities. The student will be able to:

121.01 Identify the technology roles for which wireless LAN technology is an appropriate technology application.

121.02 Identify the purpose of infrastructure devices and explain how to install, configure, and manage them.

121.03 Identify the purpose of wireless LAN client devices and explain how to install, configure, and manage them.

121.04 Identify the purpose of wireless LAN gateway devices and explain how to install, configure, and manage them.

121.05 Identify the basic attributes, purpose, and function of types of antennas.
121.06 Describe the proper locations and methods for installing antennas.
121.07 Explain the concepts of polarization, gain, beamwidth, and free-space path loss as they apply to implementing solutions that require antennas.
121.08 Identify the use of wireless LAN accessories and explain how to install, configure, and manage them.
121.09 Identify, understand, correct or compensate for wireless LAN implementation challenges.
121.10 Explain how antenna diversity compensates for multipath.
121.11 Identify and understand the importance and process of conducting a thorough site survey.
121.12 Identify and understand the importance of the necessary tasks involved in preparing to do an RF site survey.
121.13 Identify the necessary equipment involved in performing a site survey.
121.14 Understand the necessary procedures involved in performing a site survey.
121.15 Identify and understand site survey reporting procedures.
122.0 Develop an awareness of wireless security systems. The student will be able to:
122.01 Identify the strengths, weaknesses and appropriate uses of wireless LAN security techniques including the use of WVLAN's.
122.02 Describe types of wireless LAN security attacks, and explain how to identify and prevent them.
122.03 Given a wireless LAN scenario, identify the appropriate security solution from the following available wireless LAN security solutions.
122.04 Explain the uses of corporate security policies and how they are used to secure a wireless LAN.
122.05 Identify how and security precautions are used to secure a wireless LAN.
123.0 Demonstrate knowledge of wireless industry standards. The student will be able to:
123.01 Identify, apply and comprehend the differences between wireless LAN standards.
123.02 Understand the roles of organizations in providing direction and accountability within the wireless LAN industry.
123.03 Identify the differences between the ISM and UNII bands.
123.04 Identify and understand the differences between the power output rules for point-to-point and point-to-multipoint links.

Course Number: EEV0317
Occupational Completion Point: G
Data Communications Analyst – 150 Hours – SOC Code 15-1143

124.0 Participate in simulated work-based learning experiences. The student will be able to:

124.01 Participate in simulated work-based learning experiences in a network support services environment.

124.02 Discuss the use of technology in a network support services environment.

124.03 Discuss the management/supervisors skills needed in a network support services environment.

125.0 Demonstrate a knowledge of general security concepts. The student will be able to:

125.01 Describe access control.

125.02 Describe network authentication.

125.03 Understand the various types of network attacks (backdoors, DOS, spoofing).

125.04 Identify and modify non-essential services and protocols.

125.05 Identify malicious code (virus, worm, Trojan).

125.06 Configure system auditing, logging, and scanning as it relates to security procedures.

126.0 Develop an awareness of communication security concepts. The student will be able to:

126.01 Describe remote access protocols (VPN, RADIUS, L2TP).

126.02 Identify E-mail security concerns (hoaxes, spam).

126.03 Identify web (HTML) security concepts and designs (HTTP/S, IM).

126.04 Demonstrate an awareness of file transfer security concerns.

126.05 Describe and identify wireless networking security concerns and vulnerabilities.

127.0 Develop an awareness of network infrastructure security. The student will be able to:

127.01 Install and configure network firewalls.

127.02 Identify security concerns with various wiring media (copper, fiber).

127.03 Identify security concerns associated with removable media and storage devices.

127.04 Demonstrate an awareness of security topologies (security zones, Intranets, NAT).

127.05	Configure and use intrusion detection software.
127.06	Establish security baselines (updates, patches, hot fixes, Access Control lists).
127.07	Demonstrate the ability to configure a Virtual Private Network (VPN).
127.08	Describe the function of Network Address Translation (NAT).
128.0	Develop an awareness of cryptography and its relation to security. The student will be able to:
128.01	Demonstrate an understanding of security algorithms and encryption.
128.02	Use and apply Public Key Certificates.
128.03	Demonstrate an understanding of standards and protocols in commerce.
129.0	Incorporate organizational and operational security in an appropriate and effective manner. The student will be able to:
129.01	Describe how to establish a network security policy.
129.02	Explain the importance of physical security to protect network resources.
129.03	Identify and use disaster recovery procedures.
129.04	Describe the importance of business continuity and its relationship to network and corporate security.
129.05	Describe security policies and procedures that would be used in a business environment.
129.06	Explain the importance of privilege management (access, password management, sign-on).
129.07	Describe the concept of forensics as it applies to network security (obtaining evidence of security breaches).
129.08	Explain the importance of educating users and supervisors in regard to network security.
129.09	Create documentation that describes standards and guidelines for a network security system.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Game/Simulation/Animation Visual Design
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	B082100
CIP Number	0550041114
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other 27-1014 – Multimedia Artists and Animators
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

This program offers a sequence of project-based courses that provide coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster such as Game or Simulation Designer, Game or Simulation Graphic Artist, and Game or Simulation 3-D Animator; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to practical experiences in game/simulation conceptualization, design, storyboarding, development methodologies, 2D/3D animation design and production, and implementation issues. Specialized skills involving graphic animation software are used to produce a variety of two and three dimensional components.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of three occupational completion points

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	DIG0070	Game/Simulation Designer	BUS ED 1 @2 COMPU SCI 6 COMM ART @7 7G TV PRO TEC @7 7G DIGI MEDIA 7G COMP PROG 7G	300 hours	15-1199
B	DIG0071	Game/Simulation Graphic Artist		150 hours	27-1014
C	DIG0072	Game/Simulation 3D Animator		150 hours	27-1014

Note: OTA0040 is a highly recommended core.

Program Recommendations

The Game, Simulation and Animation Visual program emphasizes the development of technical abilities as well as ethical and societal awareness necessary to function in a highly technological society. The use of cooperative learning groups is recommended. By learning and practicing group process skills, students will be prepared to work "together" in real work situations. Program graduates will develop enhanced self-esteem as well as the problem solving and teamwork skills necessary to succeed in careers and postsecondary education.

The Game, Simulation & Animation Visual Design program places a strong emphasis on workplace learning. Job shadowing and mentoring experiences with game and simulation professionals along with on-site trips to local businesses connect classroom learning to the workplace. In-class guest speakers bring the real world into the classroom.

The Foundations and Design courses should be taken in sequence prior to the 2D Graphic Development and 3D Graphic Animation courses. The 2D Graphic Development and 3D Graphic Animation courses may be taken concurrently.

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Identify commonly used art and animation production tools in the game design industry.
- 02.0 Understand intellectual property rights, copyright laws and plagiarism as it applies to creative assets.
- 03.0 Explain the importance of employability skill and entrepreneurship skills as it relates to game/simulation development.
- 04.0 Identify tools and software commonly used in game development.
- 05.0 Investigate career opportunities in the game industry.
- 06.0 Demonstrate research and information fluency.
- 07.0 Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.
- 08.0 Explore the methods used to create and sustain player immersion.
- 09.0 Describe the game development life cycle.
- 10.0 Demonstrate the professional level of written and oral communication required in the game development industry.
- 11.0 Understand the core tasks and challenges that face a video game design team.
- 12.0 Demonstrate leadership and teamwork skills needed, as it relates to game/simulation development, to accomplish team goals and objectives.
- 13.0 Create a working game or simulation as part of a team.
- 14.0 Create a game design production plan that describes the game play, outcomes, controls, interface and artistic style of a video game.
- 15.0 Categorize the different gaming genres.
- 16.0 Identify popular games and identify commonality between them.
- 17.0 Understand the general procedure and requirements of game design.
- 18.0 Understand the general principles of storytelling for game design.
- 19.0 Understand character archetypes and character design.
- 20.0 Develop a game design document.
- 21.0 Understand the process of creating and designing player choice and other game designer strategy considerations.
- 22.0 Create and design the game flow as it relates to story and plot.
- 23.0 Assess common principles and procedures in game flow design.
- 24.0 Describe player challenge rule creation elements.
- 25.0 Understand the use of inventory systems in game design.
- 26.0 Understand the various job titles and responsibilities of a graphic artist as it relates to the game industry.
- 27.0 Develop the art direction for a game.
- 28.0 Determine and document the graphical needs of a game using design documents including art direction and reference materials.
- 29.0 Understand the fundamentals of drawing and painting techniques.
- 30.0 Demonstrate a working knowledge of vector and paint programs used to make graphics.
- 31.0 Demonstrate the effective use art input devices.
- 32.0 Demonstrate world building, making graphics and backgrounds for side scrolling, top down, and Isometric projection.
- 33.0 Understand the general concepts of environmental design.
- 34.0 Describe how environmental design is used in conjunction with game level design.
- 35.0 Demonstrate knowledge of basic lighting.
- 36.0 Demonstrate knowledge of basic materials and textures.

- 37.0 Demonstrate basic understanding of modeling principles.
- 38.0 Demonstrate knowledge of polygon modeling.
- 39.0 Demonstrate knowledge of non-uniform rational b-splines (NURBS) modeling.
- 40.0 Demonstrate advance texturing techniques.
- 41.0 Understand the various job titles and responsibilities of a 3D animator as it relates to the game industry.
- 42.0 Understand the principles of 2D and 3D animation as it relates to game graphics (walk, run, Jump, idle).
- 43.0 Demonstrate a working knowledge of modeling and paint programs used to make 3D graphics and animation.
- 44.0 Demonstrate knowledge of basic animation.
- 45.0 Demonstrate knowledge of rigging.
- 46.0 Understand the fundamentals of facial animation.
- 47.0 Create a user interface.
- 48.0 Individually design and create a playable game.
- 49.0 Create particle system effects.
- 50.0 Individually design and create a playable game.

Florida Department of Education
Student Performance Standards

Program Title: Game, Simulation, Animation Visual Design
Career Certificate Program Number: B082100

Course Number: DIG0070	
Occupational Completion Point: A	
Game/Simulation Designer – 300 Hours – SOC Code 15-1199	
01.0	Identify commonly used art and animation production tools in the game design industry. The student will be able to:
01.01	Identify, categorize and discuss art and animation tools commonly used in game design.
02.0	Understand intellectual property rights, copyright laws and plagiarism as it applies to creative assets. The student will be able to:
02.01	Understand the use of “Fair Use and Fair Dealing”.
02.02	Understand the transfer and licensing of creative works.
02.03	Understand the use of “exclusive rights” to intellectual creations.
02.04	Demonstrate the use of digital watermarking.
03.0	Explain the importance of employability skill and entrepreneurship skills as it relates to game/simulation development. The student will be able to:
03.01	Identify and demonstrate positive work behaviors needed to be employable.
03.02	Maintain a career portfolio to document knowledge, skills, and experience.
03.03	Evaluate and compare employment opportunities that match career goals.
03.04	Identify and exhibit traits for retaining employment.
04.0	Identify tools and software commonly used in game development. The student will be able to:
04.01	Identify and discuss the popular game development tools currently used in the industry.
04.02	Identify and discuss popular gaming engines.
04.03	Identify and discuss popular world building tools.
05.0	Investigate career opportunities in the game industry. The student will be able to:
05.01	Describe job requirements for a variety of occupations within the game development industry.
05.02	Identify current employment trends and career opportunities in the game industry.

06.0	Demonstrate research and information fluency. The student will be able to:
06.01	Play games to research and collect game play data.
06.02	Evaluate, analyze and document game styles and playability.
06.03	Determine the dramatic elements in games, including kinds of fun, player types and nonlinear storytelling.
07.0	Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design. The student will be able to:
07.01	Test and analyze games to determine the quality of rules, interfaces, navigation, performance, play, artistry and longevity in design and structure.
07.02	Research and evaluate the game analysis techniques used by the video game industry.
07.03	Identify the key elements in a game and make intelligent judgments about whether the game succeeded or failed in its objectives.
07.04	Evaluate professional reviews and write a critical analysis of a current video game.
08.0	Explore the methods used to create and sustain player immersion. The student will be able to:
08.01	Research and define the term “player immersion”.
08.02	Explore and explain the factors that create player immersion in a game.
08.03	Examine popular games and explain the methods each game uses to increase player immersion.
09.0	Describe the game development life cycle. The student will be able to:
09.01	Identify steps in the pre-production process including the proof of concept and market research.
09.02	Describe the iterative prototyping process – Alpha, Beta, RTM.
09.03	Determine platform, technology and scripting requirements.
09.04	Implement techniques of scenario development, levels, and missions.
09.05	Discuss game testing requirements and methods.
09.06	Identify and describe maintenance, upgrade and sequel issues.
10.0	Demonstrate the professional level of written and oral communication required in the game development industry. The student will be able to:
10.01	Use listening, speaking, telecommunication and nonverbal skills and strategies to communicate effectively with supervisors, co-workers, and customers.
10.02	Organize ideas and communicate oral and written messages appropriate for the game development industry environment.
11.0	Understand the core tasks and challenges that face a video game design team. The student will be able to:

11.01	Identify and define the roles and responsibilities of team members on a video game design team.
11.02	Explore and discuss methods of communications and scheduling for design teams.
12.0	Demonstrate leadership and teamwork skills needed, as it relates to game/simulation development, to accomplish team goals and objectives. The student will be able to:
12.01	Employ leadership skills to accomplish organizational goals and objectives.
12.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
12.03	Conduct and participate in meetings to accomplish work tasks.
12.04	Employ mentoring skills to inspire and teach others.
13.0	Create a working game or simulation as part of a team. The student will be able to:
13.01	Create a storyboard describing the essential elements, plot, flow, and functions of the game/simulation.
13.02	Create a design specification document to include interface and delivery choices, rules of play, navigation functionality, scoring, media choices, start and end of play, special features, and development team credits.
13.03	Using a simple game development tool, create a game or simulation.
13.04	Present the game or simulation.
14.0	Create a game design production plan that describes the game play, outcomes, controls, interface and artistic style of a video game. The student will be able to:
14.01	Use industry standard game design production documents to create a game design production plan.
15.0	Categorize the different gaming genres. The student will be able to:
15.01	Research, compare and categorize the different gaming genres.
15.02	Analyze examples of different gaming genres.
15.03	Define and use the necessary vocabulary related to gaming and the different genres.
16.0	Identify popular games and identify commonality between them. The student will be able to:
16.01	Analyze and deconstruct game environments and interactions.
16.02	Compare and contrast the top selling video games in terms of player interaction, plot complexity, and reward.
16.03	Categorize gameplay elements by player type (killer, talker, explorer and achiever).
17.0	Understand the general procedure and requirements of game design. The student will be able to:
17.01	Describe the design process from conception to production.

17.02	Explain the iterative nature of game design through the different stages of design iterations including pre-alpha, alpha, beta, release candidate, going gold and support.
17.03	Develop design plans, for example, character sketches, documentation and storyboards for proposed games.
18.0	Understand the general principles of storytelling for game design. The student will be able to:
18.01	Identify the essential elements of a story.
18.02	Describe how creative writing is used as a game design tool.
18.03	Compare and contrast methods of delivering a story in a game.
19.0	Understand character archetypes and character design. The student will be able to:
19.01	Research and identify common character archetypes used in computer games.
19.02	Design character prototypes to physically match archetype.
19.03	Create character backstory and profile.
20.0	Develop a game design document. The student will be able to:
20.01	Create a game strategy overview, character overview, and storyboard overview.
20.02	Define the rules of play and multi-player options.
20.03	Define strategic positioning of game immersion dynamics and psychological effect.
20.04	Describe how game layout charts are used in game design.
20.05	Understand the use of storyboards in the game design industry with regard to environmental illustrations, level designs, character designs, model sheets and GUI Designs.
21.0	Understand the process of creating and designing player choice and other game designer strategy considerations. The student will be able to:
21.01	Describe the use of artificial intelligence challenges in game design and the need for giving the player rest time between challenges.
21.02	Evaluate the impact of randomness in game design especially as it pertains to pattern recognition.
21.03	Identify techniques used in the industry to help the player to navigate.
21.04	Discuss the principles of player-centric design.
21.05	Examine and discuss design elements that encourage continuous active engagement both mental and physical.
21.06	Analyze design elements that maintain player interest and vary the degree of challenge.
21.07	Discuss the need for a balance of design elements for the purpose of rewarding and frustrating players.

22.0	Create and design the game flow as it relates to story and plot. The student will be able to:
22.01	Identify techniques of introducing the story plot and beginning play.
22.02	Describe story plot development techniques for the middle of play in game design.
22.03	Analyze and discuss planning techniques for climax and finale of games.
23.0	Assess common principles and procedures in game flow design. The student will be able to:
23.01	Assess missions and scenarios game flow techniques.
23.02	Describe common use of mission design and campaigns.
23.03	Evaluate usage of static versus dynamic campaigns.
24.0	Describe player challenge rule creation elements. The student will be able to:
24.01	Research common design methods for clearing obstacles or series of obstacles.
24.02	Describe common design elements introducing skill, luck and combinations including escalating challenges to games.
24.03	Identify common design elements used to vary weapons, characters and tools.
24.04	Discuss the incorporation of risk reward and adaptive challenges (AI).
25.0	Understand the use of inventory systems in game design. The student will be able to:
25.01	Discuss the various methods of describing items in player's inventory in contemporary game design.
25.02	Review and discuss industry methods of communicating how inventory items can have an effect on game play.

Course Number: DIG0071
Occupational Completion Point: B
Game/Simulation Graphic Artist – 150 Hours – SOC Code 27-1014

26.0	Understand the various job titles and responsibilities of a graphic artist as it relates to the game industry. The student will be able to:
26.01	Identify the job titles of graphic artist used in a game project.
26.02	Demonstrate the ability to work as part of an art team.
26.03	Perform one or more of the following roles for a game project: concept artist, art director, texture artist, environment artist.
27.0	Develop the art direction for a game. The student will be able to:
27.01	Develop a vision for visual elements of a game.
27.02	Create conceptual game art using various techniques, emphasizing space and form through range of value, placement, reflections, and shadows.
27.03	Create character sketches, architectural sketches and background sketches.
27.04	Understand the challenges of art direction as it relates to mobile devices.
28.0	Determine and document the graphical needs of a game using design documents including art direction and reference materials. The student will be able to:
28.01	Develop characters and game elements in respect to the art direction laid out in the design documents.
28.02	Determine the appropriate file format between vector based (resolution independent) vs. rasterized graphics (resolution dependent).
28.03	Understand the different aspects of quality and detail in relation to performance and size.
28.04	Understand the role of naming conventions as it applies to creative assets storage used in the work flow.
28.05	Demonstrate the effective use of alternative resolutions, scaling and file formats.
29.0	Understand the fundamentals of drawing and painting techniques. The student will be able to:
29.01	Demonstrate the use of different techniques, format, media or style.
29.02	Understand the use of primitives.
29.03	Demonstrate basic understanding of composition of a scene.
29.04	Understand the shape of the human form.
29.05	Know the value of lights and shadows.

30.0	Demonstrate a working knowledge of vector and paint programs used to make graphics. The student will be able to:
30.01	Know the difference between Vectors and Bitmaps.
30.02	Demonstrate understanding of various graphic art programs.
30.03	Utilize the programs tools and brushes.
30.04	Know the importance of Layers.
30.05	Identify file formats.
31.0	Demonstrate the effective use of art input devices. The student will be able to:
31.01	Demonstrate the use of a digital tablet within a paint software application.
31.02	Demonstrate the process of capturing textures using a digital camera.
31.03	Demonstrate the process of importing images from a digital camera into a photo editing software application.
32.0	Demonstrate world building, making graphics and backgrounds for side scrolling, top down, and Isometric projection. The student will be able to:
32.01	Know the importance of scale in relation to the player.
32.02	Understand level design to successfully lead the player.
32.03	Effectively use graphics to convey mood and story in the game world.
33.0	Understand the general concepts of environmental design. The student will be able to:
33.01	Survey and evaluate commonly used concept art.
33.02	Create a world sketch with particular attention to maintaining continuity of style.
33.03	Describe the emotional/psychological aspects of environmental design that signify mood, facade of freedom, and resource struggling.
34.0	Describe how environmental design is used in conjunction with game level design. The student will be able to:
34.01	Examine and evaluate examples of focus on a theme.
34.02	Describe methods of creating a purposeful architecture giving consideration to continuity and themes and taking advantage of revisiting.
34.03	Consider and discuss environmental design elements for multi-player or single player games.
34.04	Describe the history of creating shifts in game design environments and embracing novel ideas.
34.05	Identify and discuss environmental design pitfalls such as red herrings and cookie-cutter layouts.

35.0	Demonstrate knowledge of basic lighting. The student will be able to:
35.01	Demonstrate an understanding of 3 point lighting (key, fill, back).
35.02	Demonstrate an understanding of low-key and high-key lighting.
36.0	Demonstrate knowledge of basic materials and textures. The student will be able to:
36.01	Demonstrate an understanding of material and texture storage.
36.02	Apply textures to an object.
36.03	Demonstrate an understanding of procedural shaders.
36.04	Demonstrate an understanding of channels.
36.05	Adjust the transparency, luminance, and reflection of a material.
36.06	Demonstrate an understanding of displacement maps.
36.07	Demonstrate an understanding of bump maps.
36.08	Demonstrate an understanding of UV mapping.
36.09	Demonstrate an understanding of 3D painting.
37.0	Demonstrate basic understanding of modeling principles. The student will be able to:
37.01	Demonstrate an understanding of primitives and parametric modeling.
37.02	Demonstrate an understanding of non-uniform rational basis spline (NURBS), splines, and polygonal modeling.
37.03	Demonstrate the ability to use reference images and files while modeling.
38.0	Demonstrate knowledge of polygon modeling. The student will be able to:
38.01	Demonstrate an understanding of N-gons.
38.02	Demonstrate an understanding of subdivision.
38.03	Demonstrate basic polygon editing and manipulation.
38.04	Demonstrate an understanding of cutting/division tools.
38.05	Demonstrate an understanding of extrudes.
38.06	Demonstrate an understanding of symmetry.

38.07	Demonstrate an understanding of basic deformers (bend, twist, melt).
39.0	Demonstrate knowledge of non-uniform rational b-splines (NURBS) modeling. The student will be able to:
39.01	Demonstrate an understanding of points, vertices, edges, and polygons.
39.02	Demonstrate an understanding of poly-count.
39.03	Demonstrate an understanding of primitives.
39.04	Locate an object's properties, attributes, and coordinates.
39.05	Demonstrate understanding of Non uniform rational b-splines (NURBS).
39.06	Demonstrate understanding of splines and generators (extrude, lathe, sweep).
39.07	Understand the use of hierarchy.
39.08	Demonstrate an understanding of Boolean objects.
39.09	Demonstrate an understanding of Null objects.
40.0	Demonstrate advanced texturing techniques. The student will be able to:
40.01	Create texture maps for objects in games.
40.02	Develop 3D texture mapped objects.

Course Number: DIG0072
Occupational Completion Point: C
Game/Simulation 3D Animator – 150 Hours – SOC Code 27-1014

41.0	Understand the various job titles and responsibilities of a 3D animator as it relates to the game industry. The student will be able to:
41.01	Identify the job titles of a 3D animator used in a game project.
41.02	Demonstrate the ability to work as part of an animation team.
41.03	Perform one or more of the following roles for a game project: animator, rigger, vfx artist.
42.0	Understand the principles of 2D and 3D animation as it relates to game graphics (walk, run, Jump, idle). The student will be able to:
42.01	Demonstrate the ability to create character and object views from which to animate.
42.02	Break down animation into a series of pictures to import into a game engine.
42.03	Demonstrate an understanding of the value of timing to convey character motion.
42.04	Demonstrate the effective use of animation arcs for the articulation of body elements.
42.05	Demonstrate the use of principles of animation such as anticipation, squash, stretch, weight, exaggeration and overlapping & secondary motion.
42.06	Understand the use of motion capture techniques and acting principles.
43.0	Demonstrate a working knowledge of modeling and paint programs used to make 3D graphics and animation. The student will be able to:
43.01	Understand the limitation of bitmaps images.
43.02	Understand the use and application of bump map, normal and displacement images applied to a model.
43.03	Demonstrate understanding of various digital content creation tools.
43.04	Utilize the programs tools and brushes.
43.05	Know the importance of layers.
43.06	Identify file formats.
43.07	Create simple shapes and structures that can be exported to games or game editors.
44.0	Demonstrate knowledge of basic animation. The student will be able to:
44.01	Apply animation principles to object animation.
44.02	Demonstrate an understanding of animation timelines.

44.03	Demonstrate an understanding of key framing.
44.04	Demonstrate an understanding in the use of controllers.
45.0	Demonstrate knowledge of rigging. The student will be able to:
45.01	Define rigging as a process.
45.02	Compare and contrast rigging approaches and styles.
45.03	Demonstrate an understanding of the rig as it relates to the model.
45.04	Demonstrate an understanding of skeletal systems.
46.0	Understand the fundamentals of facial animation. The student will be able to:
46.01	Understand facial land marking.
46.02	Demonstrate the ability to show emotions thru the eyes.
46.03	Demonstrate the use of motion capture data as it applies to facial animation.
47.0	Create a user interface. The student will be able to:
47.01	Understand good menu flow of the user interface.
47.02	Design the ideal HUD (Heads Up Display).
48.0	Create visual effects. The student will be able to:
48.01	Understand particle design for fire and smoke.
48.02	Create water spray using 2D particles.
48.03	Know the anatomy of an explosion effect.
48.04	Create a 3D feel in a 2D world using light and shadows.
49.0	Create particle system effects. The student will be able to:
49.01	Understand particle design for fire and smoke.
49.02	Create water spray using 3D particles.
49.03	Know the aspects of an explosion effect.
50.0	Individually design and create a playable game. The student will be able to:

50.01 Use a number of computer tools to enhance and ease game programming and artistry.

50.02 Use a game engine to create a playable game.

50.03 Use animated objects.

50.04 Integrate sound and music to enhance the game experience.

50.05 Test and debug to game completion.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Game/Simulation/Animation Audio/Video Effects
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	B082200
CIP Number	0550041115
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other 27-1014 – Multimedia Artists and Animators
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as a Game/Simulation Designer, Digital Media Artist, and Digital Media Specialist in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to practical experiences in game/simulation conceptualization, design, storyboarding, development methodologies, audio/sound effects design and production, video/special effects design and production, and implementation issues. Specialized skills involving audio and video editing equipment and software are used to produce a variety of intrinsic and special audio/video effects.

This program is project-based and focuses on broad, transferable skills and stresses understanding and demonstration of the following rudiments of the game and simulation industry: production planning, elements of production design, storyboarding, elements of visual design, integration of digital audio and digital video into new game/simulation productions, and collaboration/teamwork.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of three occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	DIG0070	Game/Simulation Designer	BUS ED 1 @2	300 hours	15-1199
B	DIG0073	Digital Media Artist	COMPU SCI 6	150 hours	27-1014
C	DIG0074	Digital Media Specialist	COMM ART @7 7G TV PRO TEC @7 7G DIGI MEDIA 7G COMP PROG 7G	150 hours	27-1014

*Note: OTA0040 is a highly recommended core.

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Identify commonly used art and animation production tools in the game design industry.
- 02.0 Understand intellectual property rights, copyright laws and plagiarism as it applies to creative assets.
- 03.0 Explain the importance of employability skill and entrepreneurship skills as it relates to game/simulation development.
- 04.0 Identify tools and software commonly used in game development.
- 05.0 Investigate career opportunities in the game industry.
- 06.0 Demonstrate research and information fluency.
- 07.0 Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.
- 08.0 Explore the methods used to create and sustain player immersion.
- 09.0 Describe the game development life cycle.
- 10.0 Demonstrate the professional level of written and oral communication required in the game development industry.
- 11.0 Understand the core tasks and challenges that face a video game design team.
- 12.0 Demonstrate leadership and teamwork skills needed, as it relates to game/simulation development, to accomplish team goals and objectives.
- 13.0 Create a working game or simulation as part of a team.
- 14.0 Create a game design production plan that describes the game play, outcomes, controls, interface and artistic style of a video game.
- 15.0 Categorize the different gaming genres.
- 16.0 Identify popular games and identify commonality between them.
- 17.0 Understand the general procedure and requirements of game design.
- 18.0 Understand the general principles of storytelling for game design.
- 19.0 Understand character archetypes and character design.
- 20.0 Develop a game design document.
- 21.0 Understand the process of creating and designing player choice and other game designer strategy considerations.
- 22.0 Create and design the game flow as it relates to story and plot.
- 23.0 Assess common principles and procedures in game flow design.
- 24.0 Describe player challenge rule creation elements.
- 25.0 Understand the use of inventory systems in game design.
- 26.0 Understand the history of audio/sound effects in the entertainment industry.
- 27.0 Perform various job roles typical for an audio technician on a game/simulation project.
- 28.0 Understand intellectual property rights, copyright laws, and plagiarism as they apply to creative assets.
- 29.0 Demonstrate a knowledge of production writing as it relates to game and simulation design.
- 30.0 Demonstrate appropriate voice acting skills.
- 31.0 Demonstrate basic audio production.
- 32.0 Set-up and configure a computer for audio applications.
- 33.0 Operate an audio workstation.
- 34.0 Demonstrate application of MIDI in a game/simulation project.
- 35.0 Incorporate audio assets into game/simulation engine.

- 36.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 37.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 38.0 Explain the importance of employability skill and entrepreneurship skills.
- 39.0 Demonstrate personal money management concepts, procedures, and strategies.
- 40.0 Understand the history of video effects in the entertainment.
- 41.0 Understand the various job titles and responsibilities video technician as it relates to game and simulation design.
- 42.0 Understand intellectual property rights, copyright laws and plagiarism as it applies to creative assets.
- 43.0 Demonstrate a knowledge of production writing as it relates to game and simulation design.
- 44.0 Demonstrate appropriate acting skills.
- 45.0 Demonstrate basic video production.
- 46.0 Demonstrate set-up and configuration of a computer for video applications.
- 47.0 Demonstrate the basic operation of a video workstation.
- 48.0 Incorporate video assets into game/simulation engine.

Florida Department of Education
Student Performance Standards

Program Title: Game, Simulation & Animation Audio/Video Effects
Career Certificate Program Number: B082200

Game & Simulation Creation

Instruction relating to the standards in this section should be interspersed throughout the entire course with the other standards taught progressively in the context of game design and development.

Course Number: DIG0070	
Occupational Completion Point: A	
Game/Simulation Designer – 300 Hours – SOC Code 15-1199	
01.0	Identify commonly used art and animation production tools in the game design industry. The student will be able to:
01.01	Identify, categorize and discuss art and animation tools commonly used in game design.
02.0	Understand intellectual property rights, copyright laws and plagiarism as it applies to creative assets. The student will be able to:
02.01	Understand the use of “Fair Use and Fair Dealing”.
02.02	Understand the transfer and licensing of creative works.
02.03	Understand the use of “exclusive rights” to intellectual creations.
02.04	Demonstrate the use of digital watermarking.
03.0	Explain the importance of employability skill and entrepreneurship skills as it relates to game/simulation development. The student will be able to:
03.01	Identify and demonstrate positive work behaviors needed to be employable.
03.02	Maintain a career portfolio to document knowledge, skills, and experience.
03.03	Evaluate and compare employment opportunities that match career goals.
03.04	Identify and exhibit traits for retaining employment.
04.0	Identify tools and software commonly used in game development. The student will be able to:
04.01	Identify and discuss the popular game development tools currently used in the industry.
04.02	Identify and discuss popular gaming engines.
04.03	Identify and discuss popular world building tools.

05.0	Investigate career opportunities in the game industry. The student will be able to:
05.01	Describe job requirements for a variety of occupations within the game development industry.
05.02	Identify current employment trends and career opportunities in the game industry.
06.0	Demonstrate research and information fluency. The student will be able to:
06.01	Play games to research and collect game play data.
06.02	Evaluate, analyze and document game styles and playability.
06.03	Determine the dramatic elements in games, including kinds of fun, player types and nonlinear storytelling.
07.0	Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design. The student will be able to:
07.01	Test and analyze games to determine the quality of rules, interfaces, navigation, performance, play, artistry and longevity in design and structure.
07.02	Research and evaluate the game analysis techniques used by the video game industry.
07.03	Identify the key elements in a game and make intelligent judgments about whether the game succeeded or failed in its objectives.
07.04	Evaluate professional reviews and write a critical analysis of a current video game.
08.0	Explore the methods used to create and sustain player immersion. The student will be able to:
08.01	Research and define the term “player immersion”.
08.02	Explore and explain the factors that create player immersion in a game.
08.03	Examine popular games and explain the methods each game uses to increase player immersion.
09.0	Describe the game development life cycle. The student will be able to:
09.01	Identify steps in the pre-production process including the proof of concept and market research.
09.02	Describe the iterative prototyping process – Alpha, Beta, RTM.
09.03	Determine platform, technology and scripting requirements.
09.04	Implement techniques of scenario development, levels, and missions.
09.05	Discuss game testing requirements and methods.
09.06	Identify and describe maintenance, upgrade and sequel issues.
10.0	Demonstrate the professional level of written and oral communication required in the game development industry. The student will be able to:

10.01	Use listening, speaking, telecommunication and nonverbal skills and strategies to communicate effectively with supervisors, co-workers, and customers.
10.02	Organize ideas and communicate oral and written messages appropriate for the game development industry environment.
11.0	Understand the core tasks and challenges that face a video game design team. The student will be able to:
11.01	Identify and define the roles and responsibilities of team members on a video game design team.
11.02	Explore and discuss methods of communications and scheduling for design teams.
12.0	Demonstrate leadership and teamwork skills needed, as it relates to game/simulation development, to accomplish team goals and objectives. The student will be able to:
12.01	Employ leadership skills to accomplish organizational goals and objectives.
12.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
12.03	Conduct and participate in meetings to accomplish work tasks.
12.04	Employ mentoring skills to inspire and teach others.
13.0	Create a working game or simulation as part of a team. The student will be able to:
13.01	Create a storyboard describing the essential elements, plot, flow, and functions of the game/simulation.
13.02	Create a design specification document to include interface and delivery choices, rules of play, navigation functionality, scoring, media choices, start and end of play, special features, and development team credits.
13.03	Using a simple game development tool, create a game or simulation.
13.04	Present the game or simulation.
14.0	Create a game design production plan that describes the game play, outcomes, controls, interface and artistic style of a video game. The student will be able to:
14.01	Use industry standard game design production documents to create a game design production plan.
15.0	Categorize the different gaming genres. The student will be able to:
15.01	Research, compare and categorize the different gaming genres.
15.02	Analyze examples of different gaming genres.
15.03	Define and use the necessary vocabulary related to gaming and the different genres.
16.0	Identify popular games and identify commonality between them. The student will be able to:
16.01	Analyze and deconstruct game environments and interactions.
16.02	Compare and contrast the top selling video games in terms of player interaction, plot complexity, and reward.

16.03	Categorize gameplay elements by player type (killer, talker, explorer and achiever).
17.0	Understand the general procedure and requirements of game design. The student will be able to:
17.01	Describe the design process from conception to production.
17.02	Explain the iterative nature of game design through the different stages of design iterations including pre-alpha, alpha, beta, release candidate, going gold and support.
17.03	Develop design plans, for example, character sketches, documentation and storyboards for proposed games.
18.0	Understand the general principles of storytelling for game design. The student will be able to:
18.01	Identify the essential elements of a story.
18.02	Describe how creative writing is used as a game design tool.
18.03	Compare and contrast methods of delivering a story in a game.
19.0	Understand character archetypes and character design. The student will be able to:
19.01	Research and identify common character archetypes used in computer games.
19.02	Design character prototypes to physically match archetype.
19.03	Create character backstory and profile.
20.0	Develop a game design document. The student will be able to:
20.01	Create a game strategy overview, character overview, and storyboard overview.
20.02	Define the rules of play and multi-player options.
20.03	Define strategic positioning of game immersion dynamics and psychological effect.
20.04	Describe how game layout charts are used in game design.
20.05	Understand the use of storyboards in the game design industry with regard to environmental illustrations, level designs, character designs, model sheets and GUI Designs.
21.0	Understand the process of creating and designing player choice and other game designer strategy considerations. The student will be able to:
21.01	Describe the use of artificial intelligence challenges in game design and the need for giving the player rest time between challenges.
21.02	Evaluate the impact of randomness in game design especially as it pertains to pattern recognition.
21.03	Identify techniques used in the industry to help the player to navigate.
21.04	Discuss the principles of player-centric design.

21.05	Examine and discuss design elements that encourage continuous active engagement both mental and physical.
21.06	Analyze design elements that maintain player interest and vary the degree of challenge.
21.07	Discuss the need for a balance of design elements for the purpose of rewarding and frustrating players.
22.0	Create and design the game flow as it relates to story and plot. The student will be able to:
22.01	Identify techniques of introducing the story plot and beginning play.
22.02	Describe story plot development techniques for the middle of play in game design.
22.03	Analyze and discuss planning techniques for climax and finale of games.
23.0	Assess common principles and procedures in game flow design. The student will be able to:
23.01	Assess missions and scenarios game flow techniques.
23.02	Describe common use of mission design and campaigns.
23.03	Evaluate usage of static versus dynamic campaigns.
24.0	Describe player challenge rule creation elements. The student will be able to:
24.01	Research common design methods for clearing obstacles or series of obstacles.
24.02	Describe common design elements introducing skill, luck and combinations including escalating challenges to games.
24.03	Identify common design elements used to vary weapons, characters and tools.
24.04	Discuss the incorporation of risk reward and adaptive challenges (AI).
25.0	Understand the use of inventory systems in game design. The student will be able to:
25.01	Discuss the various methods of describing items in player's inventory in contemporary game design.
25.02	Review and discuss industry methods of communicating how inventory items can have an effect on game play.

Course Number: DIG0073
Occupational Completion Point: B
Digital Media Artist – 150 Hours – SOC Code 27-1014

26.0 Understand the history of audio/sound effects in the entertainment industry. The student will be able to:

26.01 Discuss the role of sound in a visual presentation.

26.02 Describe how audio/sound effects can establish or reinforce the mood.

26.03 Explain the importance of production value.

26.04 Describe the evolution of audio/sound effects production.

26.05 Identify the technology incorporated into the production of sound.

27.0 Perform various job roles typical for an audio technician on a game/ simulation project. The student will be able to:

27.01 Identify the job titles of audio technicians and artists typically involved in a game project.

27.02 Work as part of a sound design team.

27.03 Perform the role of the sound designer for a game/simulation project.

27.04 Perform the role of music supervisor for a game/simulation project.

27.05 Perform the role of Foley artist for a game/simulation project.

27.06 Perform the role of voice actor for a game/simulation project.

27.07 Perform the role of recording engineer for a game/simulation project.

27.08 Perform the role of sound editor for a game/simulation project.

27.09 Perform the role of composer/arranger for a game/simulation project.

28.0 Understand intellectual property rights, copyright laws, and plagiarism as they apply to creative assets. The student will be able to:

28.01 Compare and contrast the doctrines of fair use and fair dealing.

28.02 Describe the transfer and licensing of creative works.

28.03 Explain the use of “exclusive rights” to intellectual creations.

28.04 Use digital watermarking to embed copyright information in an audio file.

29.0	Demonstrate a knowledge of production writing as it relates to game and simulation design. The student will be able to:
29.01	Explain the job of a scriptwriter and outline the elements of a script.
29.02	Breakdown a script into audio production elements.
29.03	Write simple dialog.
29.04	Translate script elements into lyrics for a theme song.
29.05	Write narration or instructions for game/simulation.
30.0	Demonstrate appropriate voice acting skills. The student will be able to:
30.01	Read aloud in a professional manner.
30.02	Receive and properly act upon direction given by the producer/director.
30.03	Understand the concept of voice acting and playing a role while speaking.
30.04	Perform various voice acting assignments in a professional manner according to industry standards.
31.0	Demonstrate basic audio production. The student will be able to:
31.01	Describe digital audio storage concepts and digital storage media.
31.02	Operate digital recording decks and other digital storage devices.
31.03	Describe the function and operation of digital audio workstations.
31.04	Edit, cut, erase, and insert sound utilizing various digital production techniques.
31.05	Perform digital noise reduction and noise extraction via spectral display.
32.0	Set-up and configure a computer for audio applications. The student will be able to:
32.01	Install basic peripheral devices related to audio programs.
32.02	Install and configure software related to audio programs.
32.03	Demonstrate basic knowledge of computer system requirements.
32.04	Install plug-ins or additional audio source material such as beats and or samples.
32.05	Diagram the signal flow of a digital audio workstation.

33.0	Operate an audio workstation. The student will be able to:
33.01	Demonstrate knowledge of the digital audio workstation interface.
33.02	Create and arrange a multi-track project.
33.03	Create interest and effect using editing techniques.
33.04	Design and edit audio using a waveform editor.
33.05	Record audio directly to the digital audio workstation.
33.06	Mix audio.
33.07	Demonstrate skill in using audio effects and plug-ins.
33.08	Prepare an audio project for finishing and final mix down.
33.09	Transfer audio files between various audio software applications.
33.10	Demonstrate the understanding of audio file bit depth, bandwidth and dithering and be able to explain when and where these apply in various applications of digital audio production.
33.11	Export finished audio.
34.0	Demonstrate application of MIDI in a game/simulation project. The student will be able to:
34.01	Demonstrate an understanding of MIDI.
34.02	Discuss the advantage and use of MIDI in a game/simulation.
34.03	Discuss the limitations of MIDI.
34.04	Utilize a computer and multiple MIDI instruments.
34.05	Record a single sound track; add multiple sound tracks, and change MIDI voices using the software.
34.06	Export a MIDI soundtrack for use in a game/simulation.
34.07	Export a MIDI sound effect for use in a game/simulation.
34.08	Apply MIDI file to an object or game/simulation element.
35.0	Incorporate audio assets into game/simulation engine. The student will be able to:
35.01	Describe the audio effects workflow.
35.02	Explain audio codecs and formats used in game/simulation engines.
35.03	Import audio into the game/simulation engine.

35.04	Use appropriate naming conventions for audio assets.
35.05	Describe the use of 3D and surround sound.
35.06	Apply knowledge of distance/spatial effects including surround sound in a game/simulation.
35.07	Contrast the audio environment as it relates to the visual environment.
36.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. The student will be able to:
36.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
36.02	Explain emergency procedures to follow in response to workplace accidents.
36.03	Create a disaster and/or emergency response plan.
37.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
37.01	Employ leadership skills to accomplish organizational goals and objectives.
37.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
37.03	Conduct and participate in meetings to accomplish work tasks.
37.04	Employ mentoring skills to inspire and teach others.
38.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:
38.01	Identify and demonstrate positive work behaviors needed to be employable.
38.02	Develop personal career plan that includes goals, objectives, and strategies.
38.03	Examine licensing, certification, and industry credentialing requirements.
38.04	Maintain a career portfolio to document knowledge, skills, and experience.
38.05	Evaluate and compare employment opportunities that match career goals.
38.06	Identify and exhibit traits for retaining employment.
38.07	Identify opportunities and research requirements for career advancement.
38.08	Research the benefits of ongoing professional development.
38.09	Examine and describe entrepreneurship opportunities as a career planning option.
39.0	Demonstrate personal money-management concepts, procedures, and strategies. The student will be able to:

39.01	Identify and describe the services and legal responsibilities of financial institutions.
39.02	Describe the effect of money management on personal and career goals.
39.03	Develop a personal budget and financial goals.
39.04	Complete financial instruments for making deposits and withdrawals.
39.05	Maintain financial records.
39.06	Read and reconcile financial statements.
39.07	Research, compare and contrast investment opportunities.

Course Number: DIG0074
Occupational Completion Point: C
Digital Media Specialist – 150 Hours – SOC Code 27-1014

40.0	Understand the history of video effects in the entertainment.
41.0	The student will be able to:
41.01	Understand the role of video in a visual presentation.
41.02	Understand how video effects can establish or reinforce the mood.
41.03	Understand the importance of production value.
41.04	Understand the history of video effects production.
41.05	Understand the technology incorporated into the production video and video effects.
42.0	Understand the various job titles and responsibilities video technician as it relates to game and simulation design. The student will be able to:
42.01	Identify the job titles of video technicians and artist game project.
42.02	Demonstrate the ability to work as part of a video production team.
42.03	Perform the role of the video technical director for a game/simulation project.
42.04	Perform the role of video editor for a game/simulation project.
42.05	Perform the role of camera operator for a game/simulation project.
42.06	Perform the role of special effects coordinator for a game/simulation project.
42.07	Perform the role of video recording operator for a game/simulation project.
42.08	Perform the role of video effects artist for a game/simulation project.
42.09	Perform the role of compositor for a game/simulation project.
43.0	Understand intellectual property rights, copyright laws and plagiarism as it applies to creative assets. The student will be able to:
43.01	Understand the use of “Fair use and Fair Dealing”.
43.02	Understand the transfer and licensing of creative works.
43.03	Understand the use of “exclusive rights” to intellectual creations.
43.04	Demonstrate the use of digital watermarking.

44.0	Demonstrate a knowledge of production writing as it relates to game and simulation design. The student will be able to:
44.01	Explain the job of a scriptwriter and outline the elements of a script.
44.02	Demonstrate ability to breakdown a script into video production elements.
44.03	Demonstrate ability to write simple dialog.
44.04	Demonstrate ability to translate script elements into production schedule.
44.05	Demonstrate ability to write narration or instructions for game/simulation.
45.0	Demonstrate appropriate acting skills. The student will be able to:
45.01	Demonstrate the ability to read aloud in a professional manner.
45.02	Demonstrate the ability to receive and properly act upon direction given by the producer/director.
45.03	Understand the concept of acting and playing a role while speaking.
45.04	Perform the various assignments in a professional manner according to industry standards.
46.0	Demonstrate basic video production. The student will be able to:
46.01	Use current industry standard production video equipment.
46.02	Operate camera in studio and location (field) production environments.
46.03	Demonstrate understanding of digital video storage concepts and digital storage media.
46.04	Demonstrate knowledge of and the ability to operate digital recording decks, and other digital storage devices.
46.05	Identify and select microphones for production needs.
46.06	Determine appropriate lighting needs for production settings.
46.07	Identify location and studio lighting types, method of use and application.
47.0	Demonstrate set-up and configuration of a computer for video applications. The student will be able to:
47.01	Install basic peripheral devices related to video programs.
47.02	Install and configure software related to video programs.
47.03	Demonstrate basic knowledge of computer system requirements.
47.04	Demonstrate basic knowledge of installing plug-ins or additional audio source material such as beats and or samples.
47.05	Understand the signal flow of a digital video workstation.

48.0	Demonstrate the basic operation of a video workstation. The student will be able to:
48.01	Demonstrate knowledge of the digital video workstation interface.
48.02	Demonstrate a working familiarity and understanding of the function and operation of digital video workstations.
48.03	Demonstrate ability to edit, cut, erase, and insert video utilizing various digital production techniques.
48.04	Record video directly to the digital video workstation.
48.05	Demonstrate knowledge of editing video according to message.
48.06	Demonstrate skill in using video effects and plug-ins.
48.07	Prepare a video project for final compositing and export.
48.08	Transfer video files between various video software applications.
48.09	Export finished video.
49.0	Incorporate video assets into game/simulation engine. The student will be able to:
49.01	Demonstrate knowledge of the video effects workflow.
49.02	Demonstrate knowledge of video codecs and formats used in game/simulation engines.
49.03	Demonstrate knowledge and ability to import video into the game/simulation engine.
49.04	Use appropriate naming conventions for video assets.
49.05	Understand the use of placing video assets into a 3D environment.
49.06	Demonstrate knowledge of distance/spatial video effects in relation to sound effects in a game/simulation.
49.07	Understand the audio environment as it relates to the visual environment.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Game/Simulation/Animation Programming
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	B082300
CIP Number	0550041116
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as a Game/Simulation Designer, Game Programmer, and Game Software Developer in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to practical experiences in game/simulation conceptualization, design, storyboarding, development methodologies, essential programming techniques, and implementation issues. Specialized programming skills involving advanced mathematical calculations and physics are also integrated into the curriculum.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of three occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	DIG0070	Game/Simulation Designer	BUS ED 1 @2 COMPU SCI 6	300 hours	15-1199
B	DIG0075	Game/Simulation Programmer	COMM ART @7 7G TV PRO TEC @7 7G	150 hours	15-1131
C	DIG0076	Game/Simulation Software Developer	DIGI MEDIA 7G COMP PROG 7G	150 hours	15-1131

Note: OTA0040 is a highly recommended core.

Program Recommendations

This program is project-based and focuses on broad, transferable skills and stresses understanding and demonstration of the following rudiments of the game and simulation industry: production planning, elements of production design, storyboarding, elements of visual design, integration of digital audio and digital video into new game/simulation productions, programming for single and multi-user environments, delivery systems, and collaboration/teamwork.

The Foundations and Design courses should be taken in sequence prior to the Programming and Multi-User Programming courses. The Programming and Multi-User Programming courses may be taken concurrently. It is highly recommended that students complete a programming course prior to taking the last two courses of this program.

This program emphasizes the development of technical abilities as well as ethical and societal awareness necessary to function in a highly technological society. The use of cooperative learning groups is recommended. By learning and practicing group process skills, students will be prepared to work "together" in real work situations. Program graduates will develop enhanced self-esteem as well as the problem solving and teamwork skills necessary to succeed in careers.

The Game/Simulation/Animation Programming program places a strong emphasis on workplace learning. Job shadowing and mentoring experiences with game and simulation professionals along with on-site trips to local businesses connect classroom learning to the workplace. In-class guest speakers bring the real world into the classroom.

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Identify commonly used art and animation production tools in the game design industry.
- 02.0 Understand intellectual property rights, copyright laws and plagiarism as it applies to creative assets.
- 03.0 Explain the importance of employability skill and entrepreneurship skills as it relates to game/simulation development.
- 04.0 Identify tools and software commonly used in game development.
- 05.0 Investigate career opportunities in the game industry.
- 06.0 Demonstrate research and information fluency.
- 07.0 Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.
- 08.0 Explore the methods used to create and sustain player immersion.
- 09.0 Describe the game development life cycle.
- 10.0 Demonstrate the professional level of written and oral communication required in the game development industry.
- 11.0 Understand the core tasks and challenges that face a video game design team.
- 12.0 Demonstrate leadership and teamwork skills needed, as it relates to game/simulation development, to accomplish team goals and objectives.
- 13.0 Create a working game or simulation as part of a team.
- 14.0 Create a game design production plan that describes the game play, outcomes, controls, interface and artistic style of a video game.
- 15.0 Categorize the different gaming genres.
- 16.0 Identify popular games and identify commonality between them.
- 17.0 Understand the general procedure and requirements of game design.
- 18.0 Understand the general principles of storytelling for game design.
- 19.0 Understand character archetypes and character design.
- 20.0 Develop a game design document.
- 21.0 Understand the process of creating and designing player choice and other game designer strategy considerations.
- 22.0 Create and design the game flow as it relates to story and plot.
- 23.0 Assess common principles and procedures in game flow design.
- 24.0 Describe player challenge rule creation elements.
- 25.0 Understand the use of inventory systems in game design.
- 26.0 Identify functions of information processing.
- 27.0 Test programs.
- 28.0 Plan program design.
- 29.0 Code programs.
- 30.0 Perform program maintenance.
- 31.0 Create and maintain documentation.
- 32.0 Evaluate assigned game programming tasks.
- 33.0 Implement enhanced program structures.
- 34.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 35.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.

- 36.0 Explain the importance of employability skill and entrepreneurship skills.
- 37.0 Demonstrate personal money-management concepts, procedures, and strategies.
- 38.0 Identify and describe basic network terminology and network security.
- 39.0 Game configuration.
- 40.0 Test programs.
- 41.0 Plan program design.
- 42.0 Create and maintain documentation.
- 43.0 Code programs.
- 44.0 Demonstrate an understanding of operating systems, environments, and platforms.
- 45.0 Implement enhanced program structures.
- 46.0 Implement multimedia programming.
- 47.0 Develop an understanding of programming techniques and concepts.

Florida Department of Education
Student Performance Standards

Program Title: Game/Simulation/Animation Programming
Career Certificate Program Number: B082300

Course Number: DIG0070	
Occupational Completion Point: A	
Game/Simulation Designer – 300 Hours – SOC Code 15-1199	
01.0	Identify commonly used art and animation production tools in the game design industry. The student will be able to:
01.01	Identify, categorize and discuss art and animation tools commonly used in game design.
02.0	Understand intellectual property rights, copyright laws and plagiarism as it applies to creative assets. The student will be able to:
02.01	Understand the use of “Fair Use and Fair Dealing”.
02.02	Understand the transfer and licensing of creative works.
02.03	Understand the use of “exclusive rights” to intellectual creations.
02.04	Demonstrate the use of digital watermarking.
03.0	Explain the importance of employability skill and entrepreneurship skills as it relates to game/simulation development. The student will be able to:
03.01	Identify and demonstrate positive work behaviors needed to be employable.
03.02	Maintain a career portfolio to document knowledge, skills, and experience.
03.03	Evaluate and compare employment opportunities that match career goals.
03.04	Identify and exhibit traits for retaining employment.
04.0	Identify tools and software commonly used in game development. The student will be able to:
04.01	Identify and discuss the popular game development tools currently used in the industry.
04.02	Identify and discuss popular gaming engines.
04.03	Identify and discuss popular world building tools.
05.0	Investigate career opportunities in the game industry. The student will be able to:

05.01	Describe job requirements for a variety of occupations within the game development industry.
05.02	Identify current employment trends and career opportunities in the game industry.
06.0	Demonstrate research and information fluency. The student will be able to:
06.01	Play games to research and collect game play data.
06.02	Evaluate, analyze and document game styles and playability.
06.03	Determine the dramatic elements in games, including kinds of fun, player types and nonlinear storytelling.
07.0	Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design. The student will be able to:
07.01	Test and analyze games to determine the quality of rules, interfaces, navigation, performance, play, artistry and longevity in design and structure.
07.02	Research and evaluate the game analysis techniques used by the video game industry.
07.03	Identify the key elements in a game and make intelligent judgments about whether the game succeeded or failed in its objectives.
07.04	Evaluate professional reviews and write a critical analysis of a current video game.
08.0	Explore the methods used to create and sustain player immersion. The student will be able to:
08.01	Research and define the term “player immersion”.
08.02	Explore and explain the factors that create player immersion in a game.
08.03	Examine popular games and explain the methods each game uses to increase player immersion.
09.0	Describe the game development life cycle. The student will be able to:
09.01	Identify steps in the pre-production process including the proof of concept and market research.
09.02	Describe the iterative prototyping process – Alpha, Beta, RTM.
09.03	Determine platform, technology and scripting requirements.
09.04	Implement techniques of scenario development, levels, and missions.
09.05	Discuss game testing requirements and methods.
09.06	Identify and describe maintenance, upgrade and sequel issues.
10.0	Demonstrate the professional level of written and oral communication required in the game development industry. The student will be able to:

10.01	Use listening, speaking, telecommunication and nonverbal skills and strategies to communicate effectively with supervisors, co-workers, and customers.
10.02	Organize ideas and communicate oral and written messages appropriate for the game development industry environment.
11.0	Understand the core tasks and challenges that face a video game design team. The student will be able to:
11.01	Identify and define the roles and responsibilities of team members on a video game design team.
11.02	Explore and discuss methods of communications and scheduling for design teams.
12.0	Demonstrate leadership and teamwork skills needed, as it relates to game/simulation development, to accomplish team goals and objectives. The student will be able to:
12.01	Employ leadership skills to accomplish organizational goals and objectives.
12.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
12.03	Conduct and participate in meetings to accomplish work tasks.
12.04	Employ mentoring skills to inspire and teach others.
13.0	Create a working game or simulation as part of a team. The student will be able to:
13.01	Create a storyboard describing the essential elements, plot, flow, and functions of the game/simulation.
13.02	Create a design specification document to include interface and delivery choices, rules of play, navigation functionality, scoring, media choices, start and end of play, special features, and development team credits.
13.03	Using a simple game development tool, create a game or simulation.
13.04	Present the game or simulation.
14.0	Create a game design production plan that describes the game play, outcomes, controls, interface and artistic style of a video game. The student will be able to:
14.01	Use industry standard game design production documents to create a game design production plan.
15.0	Categorize the different gaming genres. The student will be able to:
15.01	Research, compare and categorize the different gaming genres.
15.02	Analyze examples of different gaming genres.
15.03	Define and use the necessary vocabulary related to gaming and the different genres.
16.0	Identify popular games and identify commonality between them. The student will be able to:
16.01	Analyze and deconstruct game environments and interactions.

16.02	Compare and contrast the top selling video games in terms of player interaction, plot complexity, and reward.
16.03	Categorize gameplay elements by player type (killer, talker, explorer and achiever).
17.0	Understand the general procedure and requirements of game design. The student will be able to:
17.01	Describe the design process from conception to production.
17.02	Explain the iterative nature of game design through the different stages of design iterations including pre-alpha, alpha, beta, release candidate, going gold and support.
17.03	Develop design plans, for example, character sketches, documentation and storyboards for proposed games.
18.0	Understand the general principles of storytelling for game design. The student will be able to:
18.01	Identify the essential elements of a story.
18.02	Describe how creative writing is used as a game design tool.
18.03	Compare and contrast methods of delivering a story in a game.
19.0	Understand character archetypes and character design. The student will be able to:
19.01	Research and identify common character archetypes used in computer games.
19.02	Design character prototypes to physically match archetype.
19.03	Create character backstory and profile.
20.0	Develop a game design document. The student will be able to:
20.01	Create a game strategy overview, character overview, and storyboard overview.
20.02	Define the rules of play and multi-player options.
20.03	Define strategic positioning of game immersion dynamics and psychological effect.
20.04	Describe how game layout charts are used in game design.
20.05	Understand the use of storyboards in the game design industry with regard to environmental illustrations, level designs, character designs, model sheets and GUI Designs.
21.0	Understand the process of creating and designing player choice and other game designer strategy considerations. The student will be able to:
21.01	Describe the use of artificial intelligence challenges in game design and the need for giving the player rest time between challenges.
21.02	Evaluate the impact of randomness in game design especially as it pertains to pattern recognition.
21.03	Identify techniques used in the industry to help the player to navigate.

21.04	Discuss the principles of player-centric design.
21.05	Examine and discuss design elements that encourage continuous active engagement both mental and physical.
21.06	Analyze design elements that maintain player interest and vary the degree of challenge.
21.07	Discuss the need for a balance of design elements for the purpose of rewarding and frustrating players.
22.0	Create and design the game flow as it relates to story and plot. The student will be able to:
22.01	Identify techniques of introducing the story plot and beginning play.
22.02	Describe story plot development techniques for the middle of play in game design.
22.03	Analyze and discuss planning techniques for climax and finale of games.
23.0	Assess common principles and procedures in game flow design. The student will be able to:
23.01	Assess missions and scenarios game flow techniques.
23.02	Describe common use of mission design and campaigns.
23.03	Evaluate usage of static versus dynamic campaigns.
24.0	Describe player challenge rule creation elements. The student will be able to:
24.01	Research common design methods for clearing obstacles or series of obstacles.
24.02	Describe common design elements introducing skill, luck and combinations including escalating challenges to games.
24.03	Identify common design elements used to vary weapons, characters and tools.
24.04	Discuss the incorporation of risk reward and adaptive challenges (AI).
25.0	Understand the use of inventory systems in game design. The student will be able to:
25.01	Discuss the various methods of describing items in player's inventory in contemporary game design.
25.02	Review and discuss industry methods of communicating how inventory items can have an effect on game play.

Course Number: DIG0075
Occupational Completion Point: B
Game/Simulation Programmer – 150 Hours – SOC Code 15-1131

26.0 Identify functions of information processing. The student will be able to:

26.01 Identify characteristics of high-level languages.

26.02 Identify characteristics of operating systems.

26.03 Identify characteristics of a network.

26.04 Identify needs for software development in the game/simulation industry.

26.05 Identify causes of software development problems in the game/simulation industry.

26.06 Identify most appropriate languages for solving game/simulation industry problems.

26.07 Manipulate data between numbering systems.

26.08 Identify how numeric and non-numeric data are represented in memory.

26.09 Distinguish among integer, fixed-point, and floating-point calculations.

27.0 Test programs. The student will be able to:

27.01 Develop a plan for testing programs.

27.02 Develop test harnesses for use in program testing.

27.03 Perform debugging activities.

27.04 Distinguish among the different types of program and design errors.

27.05 Evaluate program test results.

27.06 Execute programs and subroutines as they relate to the total application.

27.07 Use trace routines of compilers to assist in program debugging.

27.08 Compile and run programs.

27.09 Create a stable code base.

28.0 Plan program design. The student will be able to:

28.01	Formulate a plan to determine program specifications individually or in groups.
28.02	Use a graphical representation or pseudo code to represent the structure in a program or subroutine.
28.03	Design programs to solve problems using problem-solving strategies.
28.04	Prepare proper input/output layout specifications.
28.05	Examine existing utility programs and subroutines for use with other programs.
28.06	Manually trace the execution of programs and verify that programs follow the logic of their design as documented.
29.0	Code programs. The student will be able to:
29.01	Utilize reference manuals.
29.02	Write programs according to recognized programming standards.
29.03	Write internal documentation statements as needed in the program source code.
29.04	Code programs in high-level languages for game/simulation applications.
29.05	Write code that accesses sequential, random, and direct files.
29.06	Code programs using logical statements (e.g., If-Then-Else, Do...While).
29.07	Enter and modify source code using a program language editor.
29.08	Code routines within programs that validate input data.
29.09	Use the rounding function in calculations within programs.
29.10	Write programs as part of a development team.
29.11	Write event-driven programs.
29.12	Write programs using timed-event strategies and methodologies.
29.13	Write programs that include score keeping.
30.0	Perform program maintenance. The student will be able to:
30.01	Review requested modification of programs and establish a plan of action.
30.02	Design needed modifications in conformance with established standards.

30.03	Code, test, and debug modifications prior to updating production code.
30.04	Update production programs and documentation with changes.
30.05	Analyze output to identify and annotate errors or enhancements.
31.0	Create and maintain documentation. The student will be able to:
31.01	Write documentation to assist operators and end-users.
31.02	Follow established documentation standards.
31.03	Update existing documentation to reflect program changes.
32.0	Evaluate assigned game programming tasks. The student will be able to:
32.01	Estimate the time necessary to write a program.
33.0	Implement enhanced program structures. The student will be able to:
33.01	Write programs that include tables or arrays and routines for data entry and lookup.
33.02	Write programs to import/export data from external sources.
33.03	Write programs that use iteration.
33.04	Write routines that incorporate “help” text.
33.05	Write programs that read and write random files.
33.06	Write interactive programs.
33.07	Design screen layouts for use in interactive programs.
33.08	Write programs using object-oriented languages.
33.09	Write programs that include data structures (e.g., stacks, queues, trees, linked lists).
33.10	Write programs that are event-driven to support player goals and actions.
34.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. The student will be able to:
34.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
34.02	Explain emergency procedures to follow in response to workplace accidents.
34.03	Create a disaster and/or emergency response plan.

35.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
35.01	Employ leadership skills to accomplish organizational goals and objectives.
35.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
35.03	Conduct and participate in meetings to accomplish work tasks.
35.04	Employ mentoring skills to inspire and teach others.
36.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:
36.01	Identify and demonstrate positive work behaviors needed to be employable.
36.02	Develop personal career plan that includes goals, objectives, and strategies.
36.03	Examine licensing, certification, and industry credentialing requirements.
36.04	Maintain a career portfolio to document knowledge, skills, and experience.
36.05	Evaluate and compare employment opportunities that match career goals.
36.06	Identify and exhibit traits for retaining employment.
36.07	Identify opportunities and research requirements for career advancement.
36.08	Research the benefits of ongoing professional development.
36.09	Examine and describe entrepreneurship opportunities as a career planning option.
37.0	Demonstrate personal money-management concepts, procedures, and strategies. The student will be able to:
37.01	Identify and describe the services and legal responsibilities of financial institutions.
37.02	Describe the effect of money management on personal and career goals.
37.03	Develop a personal budget and financial goals.
37.04	Complete financial instruments for making deposits and withdrawals.
37.05	Maintain financial records.
37.06	Read and reconcile financial statements.
37.07	Research, compare and contrast investment opportunities.

Course Number: DIG0076
Occupational Completion Point: C
Game/Simulation Software Developer – 150 Hours – SOC Code 15-1131

38.0 Identify and describe basic network terminology and network security. The student will be able to:

38.01 Define networking and describe the purpose of a network.

38.02 Identify the purposes and interrelationships among the major components of networks (e.g., servers, clients, transmission media, network operating system, network boards).

38.03 Describe the various types of network topologies.

38.04 Describe the various types of game protocols.

38.05 Demonstrate knowledge of general security concepts.

38.06 Develop an awareness of communication security concepts.

38.07 Develop an awareness of network infrastructure security.

38.08 Describe the various types of multiplayer game architectures.

38.09 Identify networking and server design requirements for multi-player games.

38.10 List and describe performance metrics for networked games.

39.0 Game configuration. The student will be able to:

39.01 Create a window to run a game.

39.02 Describe and use appropriate game libraries to run a windowed game.

39.03 Use reference materials such as on-line help, vendor bulletin boards, tutorials, and manuals available.

39.04 Troubleshoot problems with computer hardware based on different graphic modes of the game.

39.05 Describe ethical issues and problems associated with computer games.

39.06 Read and comprehend technical and non-technical reading assignments related to course content including trade journals, books, magazines and electronic sources.

39.07 Respond to and utilize information derived from multiple sources (e.g., written documents, instructions, e-mail, voice mail) to solve business problems and complete business tasks.

39.08 Explore, design, implement, and evaluate organizational structures and cultures for managing project teams.

39.09 Identify characteristics of operating systems and graphics pipeline.

39.10	Distinguish among integer and floating-point bounding box collision calculations.
39.11	Illustrate various configurations of software libraries.
40.0	Test programs. The student will be able to:
40.01	Develop data for use in program testing.
40.02	Perform debugging activities.
40.03	Distinguish among the different types of program and design errors.
40.04	Evaluate program test results.
40.05	Execute programs and subroutines as they relate to the total application.
40.06	Use trace routines of compilers to assist in program debugging.
40.07	Compile and run programs.
41.0	Plan program design. The student will be able to:
41.01	Formulate a plan to determine program specifications individually or in groups.
41.02	Use a graphical representation or pseudo code to represent the structure in a program or subroutine.
41.03	Design programs to solve problems using problem-solving strategies.
41.04	Prepare proper input/output layout specifications.
41.05	Examine existing utility programs and subroutines for use with other programs.
41.06	Manually trace the execution of programs and verify that programs follow the logic of their design as documented.
42.0	Create and maintain documentation. The student will be able to:
42.01	Write documentation to assist operators and end-users.
42.02	Follow established documentation standards.
42.03	Update existing documentation to reflect program changes.
43.0	Code programs. The student will be able to:
43.01	Utilize reference manuals.
43.02	Write programs according to recognized programming standards.
43.03	Write internal documentation statements as needed in the program source code.

43.04	Code programs in high-level languages for gaming and simulation applications.
43.05	Write code that accesses sequential, indexed sequential, random, and direct files.
43.06	Code programs using logical statements (e.g., if-then-else, do...while).
43.07	Enter and modify source code using a program language editor.
43.08	Code routines within programs that validate input data.
43.09	Use the rounding function in calculations within programs.
43.10	Write programs that display text.
43.11	Demonstrate proficiency in drawing lines using graphic primitive functions.
43.12	Demonstrate proficiency in drawing rectangles using graphic primitive functions.
43.13	Demonstrate proficiency in drawing circles using graphic primitive functions.
43.14	Demonstrate proficiency in drawing ellipses using graphic primitive functions.
43.15	Demonstrate proficiency in drawing polygons using graphic primitive functions.
43.16	Write programs that use composite graphic objects.
43.17	Write programs that load a bitmap for background.
43.18	Write programs that use a sprite handler.
43.19	Write programs that use animation.
43.20	Write programs that use scrolling.
43.21	Write programs that use transparency.
44.0	Demonstrate an understanding of operating systems, environments, and platforms. The student will be able to:
44.01	Identify various types of operating systems/environments for different computer hardware platforms.
44.02	Assess and analyze the functions of different operating systems.
44.03	Distinguish between different types of computer hardware platforms.
45.0	Implement enhanced program structures. The student will be able to:

45.01	Write programs that include tables or arrays and routines for data entry and lookup.
45.02	Write routines to sort arrays.
45.03	Write programs that sort records in files.
45.04	Write programs to process transactions.
45.05	Write programs that use iteration.
45.06	Write programs that read and write sequential files.
45.07	Write programs that read and write random files.
46.0	Implement multimedia programming. The student will be able to:
46.01	Demonstrate proficiency in creating multiple composite objects.
46.02	Demonstrate proficiency in moving composite graphics objects.
46.03	Demonstrate proficiency in rotating composite graphics objects by hand.
46.04	Distinguish between flock and flee artificial intelligence algorithms.
46.05	Write programs that use blitting.
46.06	Simulate circular game board.
46.07	Demonstrate proficiency in creating a firing simulation.
46.08	Identify the basic constructs used in bounding box collision algorithm.
46.09	Identify the basic constructs used in truer bounding box collision.
46.10	Demonstrate proficiency in creating a creating a bouncing simulation.
46.11	Simulate pattern based movement.
46.12	Simulate multiple sprites movement.
46.13	Identify the basic constructs used in keyboard input.
46.14	Identify the basic constructs used in mouse input.
46.15	Identify the basic constructs used in double buffering.
47.0	Develop an understanding of programming techniques and concepts. The student will be able to:
47.01	Identify the basic constructs used in structured programming.

47.02 Distinguish between top-down and bottom-up design.

47.03 Distinguish between iteration and recursion.

47.04 Evaluate Boolean expressions.

47.05 Distinguish between interpreters and compilers.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Game/Simulation/Animation Advanced Applications
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	B082400
CIP Number	0550041117
Grade Level	30, 31
Standard Length	150 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other
Basic Skills Level	N/A

Purpose

This program is designed to prepare students for employment as a Game/Simulation Project Manager.

The content includes but is not limited to a capstone opportunity for students to learn and apply principles of project management, team-building, scheduling, coordination and budgeting to create a complete game or simulation product.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of a single capstone course with one occupational completion point. A student who completes the applicable competencies may exit as an occupational completer.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	DIG0077	Game, Simulation, & Animation Advanced Applications	BUS ED 1 @2 COMPU SCI 6 COMM ART @7 7G TV PRO TEC @ 7 7G	150 hours	15-1199

The Game, Simulation, & Animation Advanced Applications program **must** include the following components:

Pre-Project Planning Conference: The teacher and all team members must participate in a pre-project planning conference, which is essential to designing advanced learning experiences that are appropriate for each individual's learning needs and career interests. It is critical that all parties involved understand and agree on time schedules, expectations, advanced learning applications and evaluation criteria.

Project Criteria: The following criteria shall be met when choosing the Game, Simulation, & Animation Advanced Applications project:

The project must allow experiences that utilize both skills and knowledge directly related to the student's career interests and the Game, Simulation, & Animation Education program in which the student is enrolled or has completed.

The project must provide opportunities for members to experience a high level of interactivity related to the challenges of learning and applying advanced skills.

The project must provide a safe and ethically sound environment with up-to-date facilities and equipment.

Each student must maintain a journal with daily entries describing:

- (a) Time spent on the project (log in and log out)
- (b) Description of the activity for the period(s)
- (c) Materials/equipment/fixtures used
- (d) Problems identified
- (e) Possible solutions to problems identified

- (f) Work accomplished
- (g) Solutions attempted
- (h) Solutions that failed
- (i) Which led to a new problem statement
- (j) Video or Still Images of the project as it progresses.
- (k) Plans, sketches, drawings, patterns, fixtures or other documentation of components designed or created

Each student will be expected to maintain a portfolio of the project according to the standards contained in this curriculum framework.

A progress report at mid-term will be given by each student to include a written research paper, that describes the area of investigation and an oral presentation to the remainder of the class and instructor or supervising faculty team, on the progress of the project, and all work accomplished. The progress report will be the basis for the mid-term evaluation grade.

A final oral progress report presentation at the end of the course will be given by each student or team that includes:

- (a) a review of the portfolio and the journal,
- (b) a demonstration of the project's final product
- (c) results
- (d) problems identified and solutions that worked or did not work, and
- (e) a conclusion.

The final progress report will be the basis for the final exam evaluation grade.

When offered for multiple credits, the student should have varied learning experiences in order to provide maximum education exposure.

The course may be supervised by a faculty team consisting of the members of the faculty who will be granting the multiple credit(s) if that is the case.

Project Experience: This component shall provide a match between the student's career interests and a project based situation that will provide exposure to the broad aspects of the selected industry. The assigned tasks should allow a progression and rotation through experiences requiring a variety of knowledge, skills and abilities at increasingly higher levels related to the student's studies and career interests.

Supervision: Teacher-coordinators of the Game, Simulation, & Animation Advanced Applications project must monitor and support learning. Students must also be evaluated a minimum of once per grading period by the teacher-coordinator. The evaluation should assess how well the student is progressing toward goals established by the teacher-coordinator. Portfolio assessment, orchestrated by the teacher-coordinator, is a recommended method of student assessment.

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Complete a skills inventory.
- 02.0 Demonstrate acceptable work values.
- 03.0 Demonstrate the ability to identify and solve problems.
- 04.0 Successfully work as a member of a team.
- 05.0 Manage time according to a plan.
- 06.0 Keep acceptable records of progress, problems and solutions.
- 07.0 Plan, organize and carry out a project plan.
- 08.0 Manage resources.
- 09.0 Use tools, materials, and processes in an appropriate and safe manner.
- 10.0 Demonstrate an understanding of the game and simulation development process.
- 11.0 Demonstrate appropriate scientific content related to the project.
- 12.0 Demonstrate appropriate mathematics content related to the project.
- 13.0 Research content related to the project and document the results.
- 14.0 Use presentation skills, and appropriate media to describe the progress, results and outcome of the experience.
- 15.0 Demonstrate competency in the area of expertise related to the Game, Simulation & Animation education program previously completed, that this project is based upon.

Florida Department of Education
Student Performance Standards

Program Title: Game/Simulation/Animation Advanced Applications
Career Certificate Program Number: B082400

Course Number: DIG0077	
Occupational Completion Point: A	
Game, Simulation, & Animation Advanced Applications – 150 Hours – SOC Code 15-1199	
01.0	Complete a safety skills inventory. The student will be able to:
01.01	Practice safety procedures while enrolled in this course.
01.02	Demonstrate an understanding of safety and general policies and procedures.
02.0	Demonstrate acceptable project values. The student will be able to:
02.01	Maintain a positive relationship with peers.
02.02	Demonstrate adaptive self-management skills.
02.03	Rotate through a wide variety of increasingly responsible experiences.
02.04	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities.
03.0	Demonstrate the ability to identify and solve problems. The student will be able to:
03.01	Prepare a design brief for each step in the project plan to identify constraints or design boundaries.
03.02	Identify possible solutions for each design brief.
03.03	Complete research and development activities associated with each design brief.
03.04	Document problems as they arise.
03.05	Prepare a problem statement for any activity that is not successful.
03.06	Identify possible solutions for the new problem statement.
03.07	Continue the R & D process until workable solutions are found to each problem stated.
04.0	Successfully work as a member of a team. The student will be able to:

04.01	Accept responsibility for specific tasks in a given situation.
04.02	Document progress, and provide feedback on work accomplished in a timely manner.
04.03	Complete assigned tasks in a timely and professional manner.
04.04	Reassign responsibilities when the need arises.
04.05	Complete daily tasks as assigned on one's own initiative.
05.0	Manage time according to a plan. The student will be able to:
05.01	Set realistic time frames and schedules.
05.02	Keep a written time sheet of work accomplished on a daily basis.
05.03	Meet goals and objectives set by the team.
05.04	Identify individual priorities.
05.05	Complete a weekly evaluation of accomplishments, and reevaluate goals, objectives and priorities as needed.
06.0	Keep acceptable records of progress problems and solutions. The student will be able to:
06.01	Develop a record keeping system in the form of a log book to record daily progress.
06.02	Use a project journal to identify problem statement.
06.03	Develop a portfolio of work accomplished to include design drawings, research, drawings and plans, storyboards, models, mock-ups and prototypes.
07.0	Plan, organize, and carry out a project plan. The student will be able to:
07.01	Determine the scope of a project.
07.02	Organize the team according to individual strengths.
07.03	Assign specific tasks within a team.
07.04	Determine project priorities.
07.05	Identify required resources.
07.06	Plan research, design, development, and evaluation activities as required.
07.07	Carry out the project plan to successful completion.
08.0	Manage resources. The student will be able to:
08.01	Identify required resources for each stage of the project plan.

08.02	Determine the methods needed to acquire needed resources.
08.03	Demonstrate good judgment in the use of resources.
08.04	Recycle and reuse resources where appropriate.
08.05	Demonstrate an understanding of proper legal and ethical treatment of copyrighted material.
09.0	Use tools, materials, and processes in an appropriate and safe manner. The student will be able to:
09.01	Identify the proper tool for a given job.
09.02	Use tools and machines in a safe manner.
09.03	Adhere to laboratory or job site safety rules and procedures.
09.04	Identify the application of processes appropriate to the task at hand.
09.05	Identify materials appropriate to their application.
10.0	Demonstrate an understanding of the game and simulation development process. The student will be able to:
10.01	State the goals of the game or simulation clearly.
10.02	Identify and write a plan to achieve each goal.
10.03	Develop a list of materials and content required for each goal.
10.04	Develop a step by step procedure for developing the game or simulation.
10.05	Follow a written procedure.
10.06	Record data from evaluation activities.
10.07	Document conclusions and solutions based on evaluation results, observations and data.
10.08	Document progress using a project log.
10.09	Write an abstract describing the project plan.
11.0	Demonstrate appropriate scientific content related to the project. The student will be able to:
11.01	Document how types of motion may be described, measured, and predicted.
11.02	Demonstrate how types of force that act on an object and the effect of that force can be described, measured, and predicted.
11.03	Document how the principles of Human Computer Interface (HCI) are incorporated into the project design.
11.04	Demonstrate how science, technology, and society are interwoven and interdependent.

12.0	Demonstrate appropriate mathematics content related to the project. The student will be able to:
12.01	Identify different ways numbers are represented and used.
12.02	Demonstrate proper use of the number systems.
12.03	Develop effective operations on numbers and the relationships among these operations.
12.04	Use estimation in problem solving and computation.
12.05	Apply theories used in the solution to numbers.
12.06	Use quantities in the real world and uses the measures to solve problems.
12.07	Compare data within systems of measurement (both standard/nonstandard and metric/customary).
12.08	Solve mathematical problems using length, time, weight/mass, temperature, money, perimeter, area, and volume, and estimate the effects of measurement errors on calculations.
12.09	Apply appropriate units and instruments for measurement to achieve the degree of precision and accuracy required in real-world situations.
12.10	Describe, draw, Identify, and analyzes two-and three-dimensional shapes.
12.11	Visualize and illustrate ways in which shapes can be combined, subdivided, and changed.
12.12	Coordinate geometry to locate objects in both two and three dimensions and to describe objects algebraically.
12.13	Describe, analyze, and generalize a wide variety of patterns, relations, and functions.
12.14	Uses expressions, equations, inequalities, graphs, and formulas to represent and interpret situations.
12.15	Uses the tools of data analysis for managing information.
12.16	Identify patterns and makes predictions from an orderly display of data using concepts of probability and statistics.
12.17	Uses statistical methods to make inferences and valid arguments about real-world situations.
13.0	Research content related to the project and document the results. The student will be able to:
13.01	Identify the basic research needed to develop the project plan.
13.02	Identify available resources for completing background research required in the project plan.
13.03	Demonstrate the ability to locate resource materials in a library, data base, internet and other research resources.
13.04	Demonstrate the ability to organize information retrieval.
13.05	Demonstrate the ability to prepare a topic outline.

13.06	Write a draft of the research report.
13.07	Edit and proof the research report. Use proper form for a bibliography, footnotes, quotations, and references.
13.08	Prepare an electronically composed research paper in proper form.
13.09	Conduct an alpha and beta evaluation of the project's product.
13.10	Write a report on the evaluations, documenting results, data, observations, and design changes based on the results.
14.0	Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience. The student will be able to:
14.01	Prepare a multi-media presentation on the completed project.
14.02	Make an oral presentation, using multi-media materials.
14.03	Review the presentation, and make changes in the delivery method(s) to improve presentation skills.
15.0	Demonstrate competency in the area of expertise related to the Game, Simulation & Animation education program previously completed that this project is based upon. The student will be able to:
15.01	Demonstrate a mastery of the content of the selected subject area.
15.02	Demonstrate the ability to use related technological tools, materials and processes related to the specific program area.
15.03	Demonstrate the ability to apply the knowledge, experience and skill developed in the previous program completion to the successful completion of this demonstration.
15.04	Demonstrate the acquisition of additional knowledge, skill and experience in one area of the selected field of study beyond the performance standards of the initial program standards.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Geospatial/Geographic Information Systems (GIS) Technology
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	T860020
CIP Number	0545070214
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	FL-TSA, SkillsUSA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic benchmarks and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

This program is designed to prepare students for employment as a GIS Technology Assistant or a GIS Technician. Students are introduced to the concepts of Geospatial/Geographic Information System (GIS)— an organized collection of computer hardware, specialized software, and geographic data designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced (spatial) information. Students will research and learn detailed information about global and local matters related to political, environmental, commercial, and other areas, through the use of specialized geospatial tools and products.

This program offers a broad foundation of core knowledge, transferable skills, and applications to prepare students for future careers as skilled GIS professionals. As GIS is a rapidly developing field, GIS professionals are in high demand and this program will prepare students for entry into the field. The content of this program includes the development of the following computer skills and concepts: computer application skills (e.g., word processing, spreadsheet, presentation, and desktop publishing), Internet browser applications, computer programming, advanced web tools, and basic concepts of relational databases and the tools to use them. Additionally, this program stresses understanding and demonstration of GIS

concepts, project management strategies, applications of geographic data elements and remotely sensed data, visualizations of spatial data, data inventory management, demographic and economic data analysis, data collection methods and techniques, and extensive exploration of GIS careers and job opportunities.

Additional Information relevant to this Career and Technical Education (CTE) program at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	GIS0090	GIS Technician Assistant	BUS ED @2	300 hours	15-1199
B	GIS0091	GIS Technician	COMPU SCI 6 ENG&TEC ED1@2 TEC ED @2 TEC EN AID @7 G <i>Any Vocational Coverage suitable for Secondary or CAREER CERTIFICATE PROGRAM implementation accompanied by industry-recognized GIS Technician certification in accordance with FS 1012.39</i>	300 hours	15-1199

Program Implementation

This program emphasizes the development of abilities and/or awareness necessary to function in a highly technological society. The use of cooperative learning groups is recommended. By learning and practicing group process skills, students will be prepared to work "together" in real work situations. Program graduates will develop enhanced self-esteem as well as the problem-solving and teamwork skills necessary to succeed in careers and postsecondary education. Students will gain knowledge about career paths, have access to business role models, and have choices they would not otherwise have.

The Geospatial/Geographic Information Systems (GIS) Technology program places a strong emphasis on workplace learning. Shadowing and mentoring experiences with GIS professionals along with on-site trips to local businesses connect classroom learning to the workplace. In-class guest speakers bring the real world into the classroom.

Although a variety of GIS software applications and utilities are available in industry, the standards specified in this program focus on the underlying functions and associated competencies in alignment with the STARS program.

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this course the student will be able to perform the following:

- 01.0 Perform general computer application activities.
- 02.0 Design and prepare multi-view drawings.
- 03.0 Understand the history, societal implications, underlying theories, and industry applications of GIS technology.
- 04.0 Understand map types, purposes, and information they depict.
- 05.0 Demonstrate an understanding of coordinate systems, projections, scale, orthorectified imagery, earth geometry and geodesy and other concepts integral to geographic information systems.
- 06.0 Create, change, validate and manipulate data used to create a map.
- 07.0 Demonstrate language arts knowledge and skills.
- 08.0 Demonstrate mathematics knowledge and skills.
- 09.0 Demonstrate science knowledge and skills.
- 10.0 Explain the importance of employability skill and entrepreneurship skills.
- 11.0 Demonstrate personal money-management concepts, procedures, and strategies.
- 12.0 Customize the display of geospatial data.
- 13.0 Manage, query, and symbolize geospatial data.
- 14.0 Create a geospatial model.
- 15.0 Introduction to data collection and uses.
- 16.0 Layout and print maps.
- 17.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 18.0 Solve problems using critical thinking skills, creativity and innovation.
- 19.0 Use information technology tools.
- 20.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
- 21.0 Describe the importance of professional ethics and legal responsibilities.
- 22.0 Create surface models of spatial data to map distance.
- 23.0 Demonstrate density models of spatial data.
- 24.0 Demonstrate different surface interpolation methods.
- 25.0 Demonstrate different surface analysis methods.
- 26.0 Use different statistical methods in raster analysis.
- 27.0 Interpret different types of spatial data used in 3D visualization and analysis.
- 28.0 Create network datasets using existing shapefiles and geodatabases.
- 29.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 30.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 31.0 Explain the importance of employability skill and entrepreneurship skills.
- 32.0 Create a 3D map using a GPS unit for use in a class wide project.
- 33.0 Create an extensive campus-based geospatial project.
- 34.0 Design an individual career plan that reflects the transition from school to work, lifelong learning, and personal and professional goals.

Florida Department of Education
 Student Performance Standards

Program Title: Geospatial/Geographic Information Systems (GIS) Technology
 Career Certificate Program Number: T860020

Course Number: GIS0090
Occupational Completion Point: A
GIS Technician Assistant – 300 Hours – SOC Code 15-1199

01.0	Perform general computer application activities. The student will be able to:
01.01	Develop keyboarding skills to enter and manipulate text and data.
01.02	Demonstrate basic computer file management skills.
01.03	Use reference materials such as on-line help, vendor bulletin boards, tutorials, and manuals available for application software.
01.04	Use spreadsheet, presentation software, and integrated software packages to enhance communication.
01.05	Use computer networks (e.g., Internet, on-line databases) to facilitate collaborative or individual learning and communication.
01.06	Use computers to access, retrieve, organize, process, maintain, interpret, and evaluate data and information.
01.07	Prepare presentation graphics.
01.08	Apply geometric construction techniques.
02.0	Design and prepare multi-view drawings. The student will be able to:
02.01	Analyze challenges and identify solutions for design problems.
02.02	Investigate the use of space, scale and environmental features to create three-dimensional form, or the illusion of depth and form.
02.03	Prepare multi-view scaled drawings or maps.
02.04	Select proper drawing scale, views and layout.
02.05	Prepare drawings containing horizontal and vertical surfaces.
02.06	Prepare drawings containing circles and/or arcs.
02.07	Prepare detail drawings.
02.08	Draw a site plan.

03.0	Understand the history, societal implications, underlying theories, and industry applications of GIS technology. The student will be able to:
03.01	Discuss the history and societal implications of mapping and GIS.
03.02	Describe the underlying theories of GIS.
03.03	Identify industry applications for GIS technology.
04.0	Understand map types, purposes, and information they depict. The student will be able to:
04.01	Compare and contrast various forms of maps in terms of purpose, information, and application.
04.02	Convert latitude and longitude information between DMS and DD forms.
04.03	Demonstrate how to read a topographical map.
04.04	Identify different types of maps.
04.05	List the major elements of maps.
04.06	Calculate straight line distances on the earth from latitudes and longitudes.
05.0	Demonstrate an understanding of coordinate systems, projections, scale, orthorectified imagery, earth geometry and geodesy and other concepts integral to geographic information systems. The student will be able to:
05.01	Identify terminology associated with map coordinate systems and location, map scale, map projections, and orienteering.
05.02	Discuss the roles of several geometric approximations of the earth's shape, such as geoids, ellipsoids, and spheres.
05.03	Describe characteristics of appropriate uses of common geospatial coordinate systems, such as geographic (latitude and longitude), UTM and State Plane coordinates.
05.04	Interpret location using the Geographic Coordinate System to identify absolute location.
05.05	Explain, interpret and describe the characteristics and uses of common map datum and projections.
05.06	Explain the Universal Transverse Mercator (UTM) coordinate system.
05.07	Interpret locations using the UTM coordinate system.
05.08	Demonstrate an understanding of how maps are created using aerial photography.
05.09	Explain the State Plane Coordinate System (SPC).
05.10	Interpret locations using the SPC system.
05.11	Convert data between different datums and projections.

05.12	Explain the difference between aerial and orthorectified images.
06.0	Create, change, validate and manipulate data used to create a map. The student will be able to:
06.01	Identify sources of GIS information and their applicability to GIS projects.
06.02	Identify the primary components of the GIS Project Management Model.
06.03	Discuss the elements of geospatial data quality including geometric accuracy thematic accuracy, resolution, precision and fitness for use.
06.04	Create and customize a localized satellite map scenario using an appropriate GIS software application.
06.05	Demonstrate the use of zooming, identifying, bookmarks, selecting, and panning tools.
06.06	Utilize a GPS unit to collect waypoints, measure distance, and calculate area.
06.07	Explain the components of the map display and the tools in the tool bars of common mapping software.
06.08	Explain the need for and uses of metadata.
06.09	Demonstrate geocoding addresses, editing symbols, clipping data layers, and creating buffers.
06.10	Demonstrate various styles of displaying symbols of data, sorting querying, and selection techniques.
06.11	Demonstrate editing feature data.
06.12	Demonstrate how to georeference an Image Data Layer and add Control Points.
07.0	Demonstrate language arts knowledge and skills. The student will be able to:
07.01	Locate, comprehend and evaluate key elements of oral and written information.
07.02	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
07.03	Present information formally and informally for specific purposes and audiences.
07.04	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
07.05	Present information formally and informally for specific purposes and audiences.
08.0	Demonstrate mathematics knowledge and skills. The student will be able to:
08.01	Demonstrate knowledge of arithmetic operations.
08.02	Analyze and apply data and measurements to solve problems and interpret documents.

08.03	Construct charts/tables/graphs using functions and data.
09.0	Demonstrate science knowledge and skills. The student will be able to:
09.01	Discuss the role of creativity in constructing scientific questions, methods and explanations.
09.02	Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.
09.03	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
09.04	Present information formally and informally for specific purposes and audiences.
10.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:
10.01	Identify and demonstrate positive work behaviors needed to be employable.
10.02	Develop personal career plan that includes goals, objectives, and strategies.
10.03	Examine licensing, certification, and industry credentialing requirements.
10.04	Maintain a career portfolio to document knowledge, skills, and experience.
10.05	Evaluate and compare employment opportunities that match career goals.
10.06	Identify and exhibit traits for retaining employment.
10.07	Identify opportunities and research requirements for career advancement.
10.08	Research the benefits of ongoing professional development.
10.09	Examine and describe entrepreneurship opportunities as a career planning option.
11.0	Demonstrate personal money-management concepts, procedures, and strategies. The student will be able to:
11.01	Identify and describe the services and legal responsibilities of financial institutions.
11.02	Describe the effect of money management on personal and career goals.
11.03	Develop a personal budget and financial goals.
11.04	Complete financial instruments for making deposits and withdrawals.
11.05	Maintain financial records.
11.06	Read and reconcile financial statements.

11.07	Research, compare and contrast investment opportunities.
12.0	Customize the display of geospatial data. The student will be able to:
12.01	Edit Layer Properties.
12.02	Create Layer Files.
12.03	Edit an attribute table by adding a new field with calculating values.
12.04	Perform relates and joins with data tables.
13.0	Manage, query, and symbolize geospatial data. The student will be able to:
13.01	Label features.
13.02	Insert, copy, and paste data into new data frames.
13.03	Create graphs and reports from data.
13.04	Demonstrate how to analyze land use, population, and flood zone data.
13.05	Create geospatial data.
13.06	Symbolize a raster layer.
13.07	Geocode addresses and resolve unmatched addresses.
13.08	Use dissolve features, hyperlink, spatially join data, and create buffer functions.
13.09	Demonstrate understanding of the conceptual foundations of which geographic information systems (GIS) are based, including the problem of representing change over time and the imprecision and uncertainty that characterizes all geographic information.
13.10	Compare advantages and disadvantages of standard spatial data models, including the nature of vector, raster, and object-oriented models, in the context of spatial data used in the workplace.
14.0	Create a geospatial model. The student will be able to:
14.01	Create a geodatabase, import existing feature classes into a geodatabase, and import multiple feature classes to a geodatabase.
14.02	Plan and build a local data inventory.
14.03	Acquire and integrate a variety of field data, image data, vector data, and attribute data to create, update and maintain GIS databases.
15.0	Introduction to data collection and uses. The student will be able to:
15.01	Explain spatial reference.

15.02	Demonstrate how to georeference an Image Data Layer and add Control Points.
15.03	Use geospatial software tools to perform basic GIS hardware and software capabilities, including real-time GPS/GIS mapping systems.
15.04	Manipulate digital elevation models (DEM's) to create slope, aspect, view shed and hill shade layers.
15.05	Register aerial photographs or satellite images to a specific geographical coordinate system.
16.0	Layout and print maps. The student will be able to:
16.01	Demonstrate the ability to define page margins and parameters for printing a specific size.
16.02	Demonstrate effective use of map elements that must be included in a map including title, author, data, legend, scale bar, north arrow.
16.03	Demonstrate effective use of page space through map scale and frame size.
17.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
17.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
17.02	Locate, organize and reference written information from various sources.
17.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
17.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
17.05	Apply active listening skills to obtain and clarify information.
17.06	Develop and interpret tables and charts to support written and oral communications.
17.07	Exhibit public relations skills that aid in achieving customer satisfaction.
18.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
18.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
18.02	Employ critical thinking and interpersonal skills to resolve conflicts.
18.03	Identify and document workplace performance goals and monitor progress toward those goals.
18.04	Conduct technical research to gather information necessary for decision-making.
19.0	Use information technology tools. The student will be able to:
19.01	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.

19.02	Employ computer operations applications to access, create, manage, integrate, and store information.
19.03	Employ collaborative/groupware applications to facilitate group work.
20.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. The student will be able to:
20.01	Describe the nature and types of business organizations.
20.02	Explain the effect of key organizational systems on performance and quality.
20.03	List and describe quality control systems and/or practices common to the workplace.
21.0	Describe the importance of professional ethics and legal responsibilities. The student will be able to:
21.01	Evaluate and justify decisions based on ethical reasoning.
21.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
21.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
21.04	Interpret and explain written organizational policies and procedures.
21.05	Compare benefits and shortcomings of desktop, server, enterprise, and hosted (cloud) software applications.
21.06	Discuss trends in geospatial technology and applications.

Course Number: GIS0091
Occupational Completion Point: B
GIS Technician – 300 Hours – SOC Code 15-1199

22.0 Create surface models of spatial data to map distance. The student will be able to:

22.01 Create a straight line distance calculation.

22.02 Create a cost weighted distance calculation based on multiple inputs (costs).

22.03 Analyze an allocation grid created from a distance analysis calculation.

23.0 Demonstrate density models of spatial data. The student will be able to:

23.01 Identify different distance density calculation techniques.

23.02 Calculate density using both the kernel and simple calculation methods.

24.0 Demonstrate different surface interpolation methods. The student will be able to:

24.01 Create a surface from a set of features using the Inverse Distance Weighted interpolation method.

24.02 Create a surface from a set of features using the Spline interpolation method.

25.0 Demonstrate different surface analysis methods. The student will be able to:

25.01 Create elevation contour data from an elevation raster.

25.02 Calculate and display slope derived from an elevation raster.

25.03 Determine and display aspect from an elevation raster.

25.04 Create a hillshade surface from an elevation raster.

25.05 Calculate the viewshed of a surface to determine visible objects.

25.06 Calculate the cut/fill of a surface to estimate volume changes.

26.0 Use different statistical methods in raster analysis. The student will be able to:

26.01 Calculate cell statistics using temporal raster grid data.

26.02 Calculate neighborhood statistics and zonal statistics using raster grid data.

27.0 Interpret different types of spatial data used in 3D visualization and analysis. The student will be able to:

27.01	Navigate various types of surfaces.
27.02	Explore methods of obtaining, downloading, and extracting free data using the Internet.
27.03	Build 3D datasets.
27.04	Display 2D features onto a 3D surface.
27.05	Create shapefiles to view in a 3D environment.
27.06	Construct a 3D model of an urban environment.
27.07	Display georeferenced data measurements in 3D.
27.08	Apply Interpolation methods.
27.09	Utilize georeferenced 2D data in a 3D environment to provide valuable information.
27.10	Create contour lines in a 3D environment.
27.11	Search, select, and download public domain data and imagery from the Nation Elevation Dataset (NED).
28.0	Create network datasets using existing shapefiles and geodatabases. The student will be able to:
28.01	Find the most efficient routes for multiple stops on a complex street network.
28.02	Generate directions from one location to another using a street network.
28.03	Find the closest facility from a location on a complex street network.
28.04	Define service areas using a street network based on travel time.
28.05	Create an Origin-Destination Cost Matrix to communicate costs associated with travel from facilities to destinations in a geospatial network.
28.06	Demonstrate modeling of real world traffic flow.
29.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. The student will be able to:
29.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
29.02	Explain emergency procedures to follow in response to workplace accidents.
29.03	Create a disaster and/or emergency response plan.
30.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives – The student will be able to:

30.01	Employ leadership skills to accomplish organizational goals and objectives.
30.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
30.03	Conduct and participate in meetings to accomplish work tasks.
30.04	Employ mentoring skills to inspire and teach others.
31.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:
31.01	Identify and demonstrate positive work behaviors needed to be employable.
31.02	Develop personal career plan that includes goals, objectives, and strategies.
31.03	Examine licensing, certification, and industry credentialing requirements.
31.04	Maintain a career portfolio to document knowledge, skills, and experience.
31.05	Evaluate and compare employment opportunities that match career goals.
31.06	Identify and exhibit traits for retaining employment.
31.07	Identify opportunities and research requirements for career advancement.
31.08	Research the benefits of ongoing professional development.
31.09	Examine and describe entrepreneurship opportunities as a career planning option.
32.0	Create a 3D map using a GPS unit for use in a class wide project. The student will be able to:
32.01	Demonstrate implementation of surface analysis, three dimension and networked data.
33.0	Create an extensive campus-based geospatial project. The student will be able to:
33.01	Create a campus inventory.
33.02	Plan a complete geospatial project.
33.03	Implement a campus-based geospatial project.
33.04	Organize project into an effective report including map layouts.
33.05	Present project using a written and/or oral report.
34.0	Design an individual career plan that reflects the transition from school to work, lifelong learning, and personal and professional goals. The student will be able to:

34.01	Research, compare, and contrast GIS technology careers (e.g., characteristics needed, skills required, education required, industry certifications, advantages and disadvantages of GIS technology careers, the need for GIS technology workers).
34.02	Describe the variety of occupations and professions within the world of GIS technology including those where information technology is either in a primary focus or in a supportive role.
34.03	Describe job requirements for the variety of occupations and professions within the global world of GIS technology.
34.04	Analyze personal skills and aptitudes in comparison with GIS technology career opportunities.
34.05	Refine and implement a plan to facilitate personal growth and skill development related to GIS technology career opportunities.
34.06	Develop and maintain an electronic career portfolio, to include, but not limited to the Resume and Letter of Application.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

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Cooperative Training – OJT

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Basic Skills (if applicable)

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Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed online.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Technology Support Services
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y100100
CIP Number	0515120200
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in computer technology support positions in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills.

The content includes but is not limited to practical experiences in the implementation, management, and maintenance of advanced technology user environments.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of one occupational completion point in the program.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0059	Technology Support Specialist	BUS ED 1 @2 COMPU SCI 6 INFO TECH 7G	600 hours	15-1151

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of computer systems.
- 02.0 Demonstrate knowledge of different operating systems.
- 03.0 Develop a familiarity with the information technology industry.
- 04.0 Develop an awareness of microprocessors and digital computers.
- 05.0 Develop an awareness of the different types of printers.
- 06.0 Develop an awareness of emerging technologies.
- 07.0 Demonstrate an understanding of the Open Systems Interface (OSI) model.
- 08.0 Identify computer components and their functions.
- 09.0 Demonstrate proficiency using the Internet to locate information.
- 10.0 Demonstrate proficiency using Hypertext Markup Language (HTML).
- 11.0 Demonstrate proficiency in webpage design.
- 12.0 Demonstrate proficiency using common software applications.
- 13.0 Perform email activities.
- 14.0 Demonstrate proficiency in using presentation software and equipment.
- 15.0 Perform decision-making activities in a multimedia environment.
- 16.0 Demonstrate proficiency with personal computer hardware.
- 17.0 Troubleshoot printers.
- 18.0 Demonstrate proficiency with installing and configuring client system hardware.
- 19.0 Demonstrate proficiency in troubleshooting, repair and maintenance of client systems.
- 20.0 Demonstrate proficiency with client operating systems and software.
- 21.0 Configure and perform system backup and recovery of a client system.
- 22.0 Configure a Virtual Hard Disk (VHD) on a client system.
- 23.0 Demonstrate proficiency with networking.
- 24.0 Demonstrate an understanding of fundamental computer security.
- 25.0 Demonstrate proficiency with installing, configuring, and upgrading common client software applications or suites.
- 26.0 Solve software installation escalations.
- 27.0 Solve software failure escalations.
- 28.0 Demonstrate proficiency with technical support operational procedures.
- 29.0 Describe the operation of data networks.
- 30.0 Differentiate between various network media and topologies.
- 31.0 Install and configure basic network devices.
- 32.0 Demonstrate proficiency using basic network tools.
- 33.0 Demonstrate an understanding of network IP addressing and associated issues.
- 34.0 Demonstrate an understanding of network management tasks and methodologies.
- 35.0 Implement a Wireless Local Area Network (WLAN).
- 36.0 Demonstrate an understanding of network security threats and mitigation techniques.
- 37.0 Demonstrate proficiency with troubleshooting network operating systems.
- 38.0 Configure Full Disk Encryption (FDE) software.

- 39.0 Identify basic cloud concepts.
- 40.0 Configure intranet tunneling software.
- 41.0 Demonstrate proficiency with cloud based technologies.
- 42.0 Demonstrate proficiency in configuring and maintaining remote connections.
- 43.0 Perform installation, configuration, and management operations for both client and server disks.
- 44.0 Monitor system performance.
- 45.0 Optimize system performance.
- 46.0 Demonstrate proficiency with troubleshooting specialized network and communications devices.
- 47.0 Configure and maintain network-based technologies associated with providing web services.

Florida Department of Education
Student Performance Standards

Program Title: Technology Support Services
Career Certificate Program Number: Y100100

Course Number: CTS0059	
Occupational Completion Point: A	
Technology Support Specialist – 600 Hours – SOC Code 15-1151	
01.0	Demonstrate knowledge, skill, and application of computer systems. The student will be able to:
01.01	Describe and use current and emerging computer technology and software to perform personal and business related tasks.
01.02	Describe the types of communications and networking systems used in workplace environments.
01.03	Locate and use software application reference materials such as on-line help, vendor bulletin boards, tutorials, and manuals.
01.04	Troubleshoot problems with computer hardware peripherals.
01.05	Describe ethical, privacy, and security issues and problems associated with computers and information systems.
01.06	Demonstrate proficiency in using the basic features of GUI browsers.
02.0	Demonstrate knowledge of different operating systems. The student will be able to:
02.01	Identify the most common computer operating systems.
02.02	Describe and use industry accepted file naming conventions, particularly in NTFS and FAT file systems.
02.03	Demonstrate proficiency with file management tasks.
02.04	Demonstrate a working knowledge of standard file formats.
02.05	Compare and contrast various operating systems.
02.06	Differentiate between different operating systems and applications.
02.07	Compare and contrast open source and proprietary software.
02.08	Explain how system utilities are used to maintain computer performance.
03.0	Develop a familiarity with the information technology industry. The student will be able to:

03.01	Explain how information technology impacts the operation and management of business and society.
03.02	Identify and describe the various ways of segmenting the IT industry (e.g., hardware vs. software, server vs. client, business vs. entertainment, stable vs. mobile).
03.03	Describe how digital technologies (social media) are changing both work and personal lifestyles.
04.0	Develop an awareness of microprocessors and digital computers. The student will be able to:
04.01	Describe the evolution of the digital computer.
04.02	Explain the general architecture of a microcomputer system.
04.03	Explain the evolution of microprocessors.
04.04	Explain software hierarchy and its impact on microprocessors.
04.05	Explain the need for and use of peripherals.
04.06	Demonstrate proficiency installing and using plug-and-play peripherals.
04.07	Identify the basic concepts of computer maintenance and upgrades.
05.0	Develop an awareness of the different types of printers. The student will be able to:
05.01	Describe the different types.
05.02	Explain how drivers work with printers.
05.03	Demonstrate troubleshooting techniques to repair printers.
06.0	Develop an awareness of emerging technologies. The student will be able to:
06.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
06.02	Describe social media as an emerging technology.
06.03	Adhere to published best practices for protecting personal identifiable information when using the Internet.
06.04	Identify trends related to the use of information technology in people's personal and professional lives.
06.05	Characterize how the rapid pace of change in information technology impacts our society.
07.0	Demonstrate an understanding of the Open Systems Interface (OSI) model. The student will be able to:
07.01	Describe the evolution of OSI from its inception to the present and into the future.
07.02	Explain the interrelations of the seven layers of the Open Systems Interface (OSI) as it relates to hardware and software.

07.03	Describe the purpose of the OSI model and each of its layers.
07.04	Explain specific functions belonging to each OSI model layer.
07.05	Understand how two network nodes communicate through the OSI model.
07.06	Discuss the structure and purpose of data packets and frames.
07.07	Describe the two types of addressing covered by the OSI model.
08.0	Identify computer components and their functions. The student will be able to:
08.01	Identify the internal components of a computer.
08.02	Use common computer and DOS commands terminology.
09.0	Demonstrate proficiency using the Internet to locate information. The student will be able to:
09.01	Identify and describe web terminology.
09.02	Define Universal Resource Locators (URLs) and associated protocols.
09.03	Compare and contrast the types of Internet domains.
09.04	Describe and observe Internet/Intranet ethics and copyright laws and regulatory control.
09.05	Trace the evolution of the Internet from its inception to the present and into the future.
09.06	Demonstrate proficiency using search engines, including Boolean search strategies.
09.07	Demonstrate proficiency using various web tools.
09.08	Compare and contrast the roles of web servers and web browsers.
10.0	Demonstrate proficiency using Hypertext Markup Language (HTML). The student will be able to:
10.01	Categorize websites according to their purpose.
10.02	Describe the types of documents that might be used in a web environment.
10.03	Identify elements of a webpage.
10.04	Define basic HTML terminology.
10.05	Critique the aesthetic and functional operation of sample websites.

10.06	Create storyboards depicting a multi-page website.
10.07	Design, edit, and test HTML documents for accuracy and validity.
10.08	Create and modify webpages using a Graphical User Interface (GUI) editor.
10.09	Enhance webpages through the addition of images and graphics including animation.
10.10	Analyze webpage source code developed by others.
10.11	Create webpages using basic HTML tags.
11.0	Demonstrate proficiency in webpage design. The student will be able to:
11.01	Develop an awareness of acceptable webpage design, including index pages in relation to the rest of the website.
11.02	Describe and apply color theory as it applies to webpage design.
11.03	Access and digitize graphics through various resources.
11.04	Use image design software to create and edit images.
11.05	Demonstrate proficiency in publishing to the Internet.
11.06	Explain the need for web-based applications.
12.0	Demonstrate proficiency using common software applications. The student will be able to:
12.01	Compare and contrast the appropriate use of various software applications.
12.02	Demonstrate proficiency in the use of various software applications.
13.0	Perform email activities. The student will be able to:
13.01	Describe email capabilities and functions.
13.02	Identify components of an email message.
13.03	Identify the components of an email address.
13.04	Identify when to use different email options.
13.05	Attach a file to an email message.
13.06	Forward an email message.
13.07	Use an address book.

13.08	Create a private email group.
13.09	Reply to an email message.
13.10	Use the Internet to perform email activities.
13.11	Identify the appropriate use of email and demonstrate related email etiquette.
13.12	Identify when to include information from an original email message in a response.
13.13	Identify common problems associated with widespread use of email.
14.0	Demonstrate proficiency in using presentation software and equipment. The student will be able to:
14.01	Produce a presentation that includes music, animation, and digital photography and present it using a projection system.
14.02	Using presentation software, create a multimedia presentation that incorporates shot and edited video, animation, music, narration and adheres to good design principles, use of transitions, and effective message conveyance.
14.03	Demonstrate knowledge of the roles and responsibilities of a multimedia production team.
14.04	Collaborate with team members to plan, edit, evaluate, and present a multimedia presentation where individuals on the team function in specific production roles.
14.05	Create a self-running presentation with synchronized audio, convert presentation slides into streaming ASF files for use on the web.
15.0	Perform decision-making activities in a multimedia environment. The student will be able to:
15.01	Determine work priorities, the audience, project budgets, project specifications, and the production schedule.
15.02	Evaluate and select appropriate software packages and multimedia tools to complete assigned tasks.
15.03	Present and defend design projects.
15.04	Evaluate criteria for selecting an operating system.
16.0	Demonstrate proficiency with personal computer hardware. The student will be able to:
16.01	Categorize storage devices and backup media.
16.02	Explain motherboard components, types and features.
16.03	Classify power supplies types and characteristics.
16.04	Explain the purpose and characteristics of CPUs and their features.
16.05	Explain cooling methods and devices.
16.06	Compare and contrast memory types, characteristics and their purpose.
16.07	Distinguish between the different display devices and their characteristics.

16.08	Summarize the function and types of adapter cards.
17.0	Troubleshoot printers. The student will be able to:
17.01	Demonstrate proficiency with device drivers.
17.02	Troubleshoot common hardware errors.
18.0	Demonstrate proficiency with installing and configuring client system hardware. The student will be able to:
18.01	Install, configure and optimize personal computer components.
18.02	Install, configure, and optimize laptop components.
18.03	Install, configure, and optimize client system peripherals.
18.04	Demonstrate proficiency using the following tools:
18.04.1	Multimeter.
18.04.2	Power supply tester.
18.04.3	Cable testers.
18.04.4	Loop back plugs.
18.04.5	Anti-static pad and wrist strap.
18.04.6	Extension magnet.
19.0	Demonstrate proficiency in troubleshooting, repairing and maintaining of client systems. The student will be able to:
19.01	Explain the troubleshooting theory.
19.02	Explain and interpret common hardware and operating system symptoms and their causes.
19.03	Determine the troubleshooting methods and tools for printers.
19.04	Explain and interpret common mobile device issues and determine the appropriate basic troubleshooting method.
19.05	Integrate common preventative maintenance techniques.
19.06	Analyze system/application logs and other system resources to identify and/or resolve performance issues related to display, disk space, and virtual memory.
19.07	Use appropriate client system tools and utilities to diagnose and resolve hardware failure issues, including hard drive sectors, memory, cabling, and BIOS.
20.0	Demonstrate proficiency with client operating systems and software. The student will be able to:

20.01	Compare and contrast the different client operating systems and their features.
20.02	Explain the process and steps to install and configure a client operating system.
20.03	Explain the basics of boot sequences, methods and startup utilities.
20.04	Perform a clean installation of an operating system.
20.05	Perform a version upgrade to an existing operating system, maintaining user profiles, preferences, and historical information.
21.0	Configure and perform a system backup and recovery of a client system. The student will be able to:
21.01	Compare and contrast system backup and system imaging.
21.02	Create a system image file or backup file as appropriate.
21.03	Create system restore points.
21.04	Configure system images and backup files for automatic update.
21.05	Recover a system using either a system image file or backup file.
22.0	Configure a Virtual Hard Disk (VHD) on a client system. The student will be able to:
22.01	Create, deploy, boot, mount, and update a VHD.
22.02	Perform offline updates.
22.03	Perform offline servicing.
23.0	Demonstrate proficiency with networking. The student will be able to:
23.01	Summarize the basics of networking fundamentals, including technologies, devices and protocols.
23.02	Categorize network cables by function, speed, and connectors.
23.03	Compare and contrast the different network types.
23.04	Validate client configuration for network connectivity.
23.05	Install and configure connectivity for a small local area network using either IPv4 or IPv6.
23.06	Set up user accounts for a small local area network.
23.07	Configure file and folder access using NTFS permissions and sharing.
24.0	Demonstrate an understanding of fundamental computer security. The student will be able to:
24.01	Explain basic security concepts and technologies, including firewalls, encryption technologies, and authentication.

24.02	Describe the following security and authentication features and technologies:
24.02.1	Advantages and disadvantages of specific wireless security types; keys; SSID; MAC filters.
24.02.2	Malicious software protection.
24.02.3	BIOS Security.
24.02.4	Password complexity.
24.02.5	Locking workstation.
24.02.6	Biometrics and physical authentication.
24.03	Discuss the basics of data sensitivity and security, including compliance, classifications, and social engineering.
24.04	Install, configure, and launch antivirus software, isolating or removing viruses and malware as needed.
24.05	Configure a local security policy and associated authentication and authorization rules.
25.0	Demonstrate proficiency with installing, configuring, and upgrading common client software applications or suites. The student will be able to:
25.01	Validate software licensing compliance and system compatibility.
25.02	Perform initial installation of a common software application.
25.03	Perform an upgrade of a common software application.
25.04	Set default Internet browser.
25.05	Install software and/or browser add-ins.
26.0	Solve software installation escalations. The student will be able to:
26.01	Verify installation permissions.
26.02	Validate local administrator requirement.
26.03	Determine licensing restrictions.
26.04	Validate digital signing.
27.0	Solve software failure escalations. The student will be able to:
27.01	Check the appropriate OS troubleshooting utilities.
27.02	Check whether the application runs in Safe mode.

27.03	Isolate the problem and repair the installation.
27.04	Check recently added programs.
27.05	Restore or reimage the system.
28.0	Demonstrate proficiency with technical support operational procedures. The student will be able to:
28.01	Adhere to safety and environmental procedures related to ESD, SMI, RFI, electrical safety, cabling, and physical/environmental.
28.02	Describe the characteristics desired in establishing and maintaining good customer relations.
28.03	Demonstrate appropriate communication skills and professionalism in customer interactions.
28.04	Apply call center vocabulary.
29.0	Describe the operation of data networks. The student will be able to:
29.01	Explain the function of common networking protocols.
29.02	Identify commonly used TCP and UDP default ports.
29.03	Identify IP address formats.
29.04	Identify the proper use of IP addressing technologies and addressing schemes.
29.05	Identify common IPv4 and IPv6 routing protocols.
29.06	Explain the purpose and properties of routing.
29.07	Compare the characteristics of wireless communication standards.
29.08	Interpret network diagrams.
30.0	Differentiate between various network media and topologies. The student will be able to:
30.01	Categorize standard cable types and their properties.
30.02	Identify common connector types.
30.03	Identify common physical network topologies.
30.04	Differentiate and implement appropriate wiring standards.
30.05	Select the appropriate media, cables, ports, and connectors to connect network devices.
30.06	Categorize WAN technology types and properties.

30.07	Categorize LAN technology types and properties.
30.08	Explain common logical network topologies and their characteristics.
30.09	Install components of wiring distribution.
31.0	Install and configure basic network devices. The student will be able to:
31.01	Install, configure and differentiate between common network devices.
31.02	Identify the functions of specialized network devices.
31.03	Explain the advanced features of a switch.
31.04	Implement a small switched network, including remote access management.
31.05	Verify network status and operation using basic utilities (e.g., ping, traceroute, telnet, SSH, arp, ipconfig).
31.06	Implement a basic wireless network.
32.0	Demonstrate proficiency using basic network tools. The student will be able to:
32.01	Select the appropriate command line interface tool and interpret the output to verify functionality.
32.02	Explain the purpose of network scanners.
32.03	Utilize the appropriate hardware tools.
33.0	Demonstrate an understanding of network IP addressing and associated issues. The student will be able to:
33.01	Assign and verify valid IP addresses in a LAN environment.
33.02	Describe Network Address Translation (NAT) and its role in network communication.
33.03	Distinguish between public and private IP addresses.
33.04	Explain the operation of DHCP and DNS services and their impact on network client systems.
33.05	Detect and correct IP addressing issues.
34.0	Demonstrate an understanding of network management tasks and methodologies. The student will be able to:
34.01	Explain the function of each layer of the OSI model.
34.02	Identify types of configuration management documentation.
34.03	Evaluate the network based on configuration management documentation.

34.04	Explain network segmentation and traffic management concepts.
34.05	Conduct network monitoring to identify performance and connectivity issues.
34.06	Explain different methods and rationales for network performance optimization.
34.07	Configure updates to a network operating system to include manual, automatic, and rollback aspects.
34.08	Implement network troubleshooting methodologies.
34.09	Troubleshoot common connectivity issues and select an appropriate solution.
35.0	Implement a Wireless Local Area Network (WLAN). The student will be able to:
35.01	Describe the standards associated with wireless media.
35.02	Identify and describe the purpose of the components of a small WLAN.
35.03	Configure a small WLAN such that devices connect to the correct access point.
35.04	Describe the security features and capabilities of WI-FI Protected Access (WPA).
35.05	Describe common issues with implementing a WLAN and methods for addressing these issues.
36.0	Demonstrate an understanding of network security threats and mitigation techniques. The student will be able to:
36.01	Explain the function of hardware and software security devices.
36.02	Explain common features of a firewall.
36.03	Explain the methods of network access security.
36.04	Explain methods of user authentication.
36.05	Explain issues that affect device security.
36.06	Implement password and physical security in a small routed network.
36.07	Identify common security threats and mitigation techniques.
37.0	Demonstrate proficiency with troubleshooting server based operating systems. The student will be able to:
37.01	Select the appropriate commands and options to troubleshoot and resolve problems.

37.02	Select and use system utilities/tools appropriate to a problem and evaluate the results.
37.03	Evaluate and resolve common issues.
38.0	Configure Full Disk Encryption (FDE) software (e.g., BitLocker, BitLocker To Go). The student will be able to:
38.01	Describe disk encryption and its role and benefits in computer system security.
38.02	Compare and contrast disk encryption with file system encryption.
38.03	Configure system policies to accommodate full disk encryption.
38.04	Explain the role of the Trusted Platform Module (TPM) relative to computer system identification and security.
38.05	Manage TPM startup keys.
38.06	Configure startup key storage.
38.07	Describe a Data Recovery Agent (DRA) and its role in system security.
38.08	Configure a DRA on a client and network server.
38.09	Perform data and system recovery operations.
39.0	Identify basic cloud concepts. The student will be able to:
39.01	Understand the distinction between SaaS, IaaS and PaaS.
39.02	Distinguish between cloud deployment models.
39.03	Understand cloud computing characteristics.
40.0	Configure intranet tunneling software. The student will be able to:
40.01	Describe Internet Protocol Security (IPSec) and its role in secure tunnel connectivity.
40.02	Compare and contrast the characteristics and operation of an infrastructure tunnel and an intranet tunnel.
40.03	Configure endpoints required for an intranet tunnel connection.
40.04	Configure system and user authentication for an intranet tunnel connection.
40.05	Define the requirements for establishing a network infrastructure tunnel.

40.06	Resolve tunnel connectivity issues.
41.0	Demonstrate proficiency with cloud based technologies. The student will be able to:
41.01	Describe cloud based technologies and their unique challenges.
41.02	Map network drives.
41.03	Configure offline file policies for synchronized access to network shared files.
41.04	Describe transparent caching and explain its role in optimizing network performance, particularly mobile networks.
41.05	Describe Power over Ethernet (PoE) and its role in creating a power management schema.
42.0	Demonstrate proficiency in configuring and maintaining remote connections. The student will be able to:
42.01	Establish a Virtual Private Network (VPN) connection with authentication.
42.02	Enabling a VPN reconnect to accommodate mobile remote users.
42.03	Perform a Strength, Weakness, Opportunity, and Threat (SWOT) analysis of a local area network configured for remote access connectivity.
42.04	Describe Network Access Protection (NAP) and its role in ensuring health and compliance of connected devices.
42.05	Compare and contrast the use of quarantine and captive portals to accomplish remediation of connected devices.
42.06	Configure NAP for wireless remote connections.
42.07	Configure dial-up connections.
42.08	Enable and configure remote desktop in both client and server environments.
43.0	Perform installation, configuration, and management operations for both client and server disks. The student will be able to:
43.01	Install, initialize, and partition a hard drive.
43.02	Describe file system fragmentation and its impact on system performance.
43.03	Perform a file system defragmentation.
43.04	Describe Redundant Array of Independent Disks (RAID) configuration.
43.05	Configure removable device policies.

44.0	Monitor system performance. The student will be able to:
44.01	Configuring event logging.
44.02	Filtering event logs.
44.03	Event subscriptions.
44.04	Data collector sets.
44.05	Generating a system diagnostics report.
45.0	Optimize system performance. The student will be able to:
45.01	Update device drivers.
45.02	Configure a Network Interface Card (NIC) for full duplex operation.
45.03	Create a power plan (scheme) for optimum power/energy efficiency.
45.04	Configure performance settings under Advanced System Properties.
45.05	Configure desktop settings and user profiles.
45.06	Configure services and programs to resolve performance issues.
45.07	Resolve mobile computing performance issues.
46.0	Demonstrate proficiency with troubleshooting specialized network and communications devices. The student will be able to:
46.01	Select the appropriate commands and options to troubleshoot and resolve problems with network devices.
46.02	Select and use system utilities/tools appropriate to a problem and evaluate the results.
46.03	Evaluate and resolve common issues related to network connectivity, security, and performance of connected devices.
47.0	Configure and maintain network-based technologies associated with providing web services. The student will be able to:
47.01	Configure and maintain a web server, to include setting up authentication, security certificates, and permissions for Active Server Page operation.
47.02	Connect to a File Transfer Protocol (FTP) server, to include setting up access and permissions.
47.03	Connect to mail transfer protocol server.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Computer Systems & Information Technology (CSIT)
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y100200
CIP Number	0511090107
Grade Level	30, 31
Standard Length	900 hours
Teacher Certification	Refer to the Program Structure section.
CTSO	Phi Beta Lambda BPA SkillsUSA
SOC Codes (all applicable)	15-1152 – Computer Network Support Specialists 15-1142 – Network and Computer Systems Administrators 15-1122 – Information Security Analysts
Basic Skills Level	Mathematics: 10 Language: 9 Reading: 9

Purpose

The purpose of this program is to prepare students for employment or advanced training in a variety of occupations in the information technology industry.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the information technology industry; technical and product skills, underlying principles of technology, planning, management, finance, labor issues, community issues and health, safety, and environmental issues.

The content includes but is not limited to communication, leadership skills, human relations and employability skills; and safe, efficient work practices.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points. When the recommended sequence is followed, the structure is intended to prepare students to complete the CompTIA A+, Network+, and Security+ industry certifications. Sufficient coverage of advanced networking concepts and competencies may also lead to Cisco's CCENT and CCNA industry certifications. A student who completes the applicable competencies at any occupational completion point may either continue with the training or become an occupational completer.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0082	Computer Systems Technician	BUS ED 1 @2 COMPU SCI 6 COMP SVC 7G INFO TECH 7 G CYBER TECH 7 G ELECTRONIC @7 7 G	300 hours	15-1152
B	CTS0083	Computer Network Technician		150 hours	15-1142
C	CTS0084	Computer Networking Specialist		150 hours	15-1142
D	CTS0069	Computer Security Technician		300 hours	15-1122

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate proficiency with personal computer hardware.
- 02.0 Apply troubleshooting, repairing and maintenance techniques.
- 03.0 Understand operating systems and software.
- 04.0 Identify and construct a basic network.
- 05.0 Analyze and react to various security threats and vulnerabilities.
- 06.0 Explain the basic physical security elements of a network.
- 07.0 Demonstrate proficiency with operational procedure.
- 08.0 Demonstrate language arts knowledge and skills.
- 09.0 Demonstrate mathematics knowledge and skills.
- 10.0 Demonstrate proficiency with installing, configuring, and troubleshooting personal computer hardware.
- 11.0 Apply techniques to various operating systems.
- 12.0 Build, secure and troubleshoot medium to large.
- 13.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 14.0 Solve problems using critical thinking skills, creating and innovation.
- 15.0 Use information technology tools.
- 16.0 Describe the roles within teams, work units, departments, organizations, interorganizational systems, and the larger environment.
- 17.0 Describe the importance of professional ethics and legal responsibilities.
- 18.0 Describe the operation of data networks.
- 19.0 Verify connectivity between two end devices.
- 20.0 Configure a Layer 3 switch.
- 21.0 Program a router with basic configurations
- 22.0 Explain how IPv6 address assignments are implemented in a business network.
- 23.0 Explain how data is moved across the network, from opening an application, to receiving data.
- 24.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 25.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 26.0 Explain the importance of employability skill and entrepreneurship skills.
- 27.0 Describe a switched network a small-to-medium-sized business.
- 28.0 Describe a routing environment.
- 29.0 Explore the concept of switches and security.
- 30.0 Configure and troubleshoot a Layer 3 environment.
- 31.0 Configure, troubleshoot and implement ACLs.
- 32.0 Demonstrate knowledge of how network services and protocols interact to provide network communication in order to securely implement and use common protocols.
- 33.0 Demonstrate an understanding of cybersecurity concepts and research.
- 34.0 Recognize attacks and apply appropriate solutions.
- 35.0 Recognize and be able to differentiate and explain the following access control models.
- 36.0 Comprehend and develop an understanding of protocol security and associated risks.

- 37.0 Recognize and understand remote access technologies.
- 38.0 Identify and administer security fixes as defined by the appropriate OSI layers.
- 39.0 Recognize and understand the administration of the following directory security concepts.
- 40.0 Identify-wireless technologies, concepts and vulnerabilities.
- 41.0 Apply advanced principles of security techniques.
- 42.0 Define concepts of Key Management and Certificate Lifecycles.
- 43.0 Understand the application of the following concepts of physical security.
- 44.0 Understand security concerns for types of network topologies and media.
- 45.0 Implement the process of network system hardening within a computer network.
- 46.0 Describe the security implications of the following topics of disaster recovery options.
- 47.0 Demonstrate proficiency in applying the concepts and uses of the following types of policies and procedures.
- 48.0 Understand different types of privilege management.
- 49.0 Understand the concepts of cybersecurity guidelines.
- 50.0 Understand training of end users, executives and human resources in security vulnerabilities.

Florida Department of Education
Student Performance Standards

Program Title: Computer Systems & Information Technology
Career Certificate Program Number: Y100200

Course Number: CTS0082	
Occupational Completion Point: A	
Computer Systems Technician – 300 Hours – SOC Code 15-1152	
01.0	Demonstrate proficiency with personal computer hardware. The student will be able to:
01.01	Categorize storage devices and backup media.
01.02	Explain motherboard components, types and features.
01.03	Classify power supplies types and characteristics.
01.04	Explain the purpose and characteristics of CPUs and their features.
01.05	Explain cooling methods and devices.
01.06	Compare and contrast memory types, characteristics and their purpose.
01.07	Distinguish between the different display devices and their characteristics.
01.08	Install and configure peripherals and input devices.
01.09	Summarize the function and types of adapter cards.
01.10	Install, configure and optimize laptop components and features.
01.11	Install and configure printers.
01.12	Explain advantages of using PCIe adapter cards.
01.13	Configure tablets and mobile phones.
01.14	Configure network printers using a static IP address.
02.0	Apply troubleshooting, repairing and maintenance techniques. The student will be able to:
02.01	Explain the troubleshooting theory.
02.02	Explain and interpret common hardware and operating system symptoms and their causes.

02.03	Explain and interpret common operating system symptoms and their causes.
02.04	Determine the troubleshooting methods and tools for printers.
02.05	Explain and interpret common laptop issues and determine the appropriate basic troubleshooting method.
02.06	Integrate common preventative maintenance techniques.
02.07	Explain and interpret common software symptoms and their causes.
03.0	Understand operating systems and software. The student will be able to:
03.01	Compare and contrast the different Windows Operating Systems from Windows 7 up and their features.
03.02	Explain the difference in features of the various Windows versions from Windows 7 through Windows 10.
03.03	Explain the process and steps to install and configure the Windows OS.
03.04	Explain the basics of boot sequences, methods and startup utilities, including msconfig.
04.0	Identify and construct a basic network. The student will be able to:
04.01	Summarize the basics of networking fundamentals, including technologies and devices.
04.02	Summarize the basics of networking fundamentals, including technologies and protocols.
04.03	Categorize network cables and connectors and their implementations.
04.04	Compare and contrast the different network types include SOHO networks.
05.0	Analyze and react to various security threats and vulnerabilities. The student will be able to:
05.01	Explain the basic principles of security concepts and technologies (physical, software, social engineering).
05.02	Explain and define security features.
06.0	Explain the basic physical security elements of a network. The student will be able to:
06.01	Explain the basic software security elements of a network, including firewalls, IDS and IPS.
06.02	Explain how the human element plays a major role in network security, including social engineering.
07.0	Demonstrate proficiency with operational procedure. The student will be able to:
07.01	Outline the purpose of appropriate safety and environmental procedures and given a scenario apply them.
07.02	Given a problem, demonstrate communication and technical skills to escalate the problem for a solution.
07.03	Explain chain of custody for various scenarios.

08.0	Demonstrate language arts knowledge and skills. The student will be able to:
08.01	Locate, comprehend and evaluate key elements of oral and written information.
08.02	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
08.03	Present information formally and informally for specific purposes and audiences.
09.0	Demonstrate mathematics knowledge and skills. The student will be able to:
09.01	Demonstrate knowledge of arithmetic operations.
09.02	Analyze and apply data and measurements to solve problems and interpret documents.
09.03	Construct charts/tables/graphs using functions and data.
10.0	Demonstrate proficiency with installing, configuring, and troubleshooting personal computer hardware. The student will be able to:
10.01	Install, configure and maintain personal computer components.
10.02	Detect problems, troubleshoot and repair/replace personal computer components.
10.03	Install, configure, detect problems, troubleshoot and repair/replace laptop components.
10.04	Explain and demonstrate the use of computer tools.
11.0	Apply techniques to various operating systems. The student will be able to:
11.01	Select the appropriate commands and options to troubleshoot and resolve problems.
11.02	Differentiate between Operating System file structures.
11.03	Given a scenario, select and use system utilities/tools and evaluate the results.
11.04	Evaluate and resolve common issues.
12.0	Build, secure and troubleshoot medium to large. The student will be able to:
12.01	Troubleshoot client-side connectivity issues using appropriate tools.
12.02	Install and configure a small office home office (SOHO) network.
12.03	Given a scenario, prevent, troubleshoot and remove viruses and malware.
12.04	Implement security and troubleshoot common issues.
13.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
13.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the

	workplace.
13.02	Locate, organize and reference written information from various sources.
13.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
13.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
13.05	Apply active listening skills to obtain and clarify information.
13.06	Develop and interpret tables and charts to support written and oral communications.
13.07	Exhibit public relations skills that aid in achieving customer satisfaction.
14.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
14.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
14.02	Employ critical thinking and interpersonal skills to resolve conflicts.
14.03	Identify and document workplace performance goals and monitor progress toward those goals.
14.04	Conduct technical research to gather information necessary for decision-making.
15.0	Use information technology tools. The student will be able to:
15.01	Use personal information management (PIM) applications to increase workplace efficiency.
15.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
15.03	Employ computer operations applications to access, create, manage, integrate, and store information.
15.04	Employ collaborative/groupware applications to facilitate group work.
16.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. The student will be able to:
16.01	Describe the nature and types of business organizations.
16.02	Explain the effect of key organizational systems on performance and quality.
16.03	List and describe quality control systems and/or practices common to the workplace.
16.04	Explain the impact of the global economy on business organizations.
17.0	Describe the importance of professional ethics and legal responsibilities. The student will be able to:
17.01	Evaluate and justify decisions based on ethical reasoning.

17.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
17.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
17.04	Interpret and explain written organizational policies and procedures.
17.05	Explain various types of software licensing.

Course Number: CTS0083
Occupational Completion Point: B
Computer Network Technician – 150 Hours – SOC Code 15-1142

18.0 Describe the operation of data networks. The student will be able to:

18.01 Explain how multiple networks are used in everyday life.

18.02 Explain the topologies and devices used in a small-to-medium-sized business network.

18.03 Explain the basic characteristics of a network that supports communication in a small-to-medium-sized business.

18.04 Explain trends in networking that will affect the use of networks in small-to-medium-sized businesses.

18.05 Explain the purpose of the IOS.

18.06 Explain how to access and navigate the IOS to configure network devices.

18.07 Describe the command structure of the IOS software.

18.08 Configure hostnames on an IOS device using the CLI.

18.09 Use IOS commands to limit access to device configurations.

18.10 Use IOS commands to save the running configuration.

18.11 Explain how devices communicate across network media.

18.12 Configure a host device with an IP address.

19.0 Verify connectivity between two end devices. The student will be able to:

19.01 Explain how rules are used to facilitate communication.

19.02 Explain the role of protocols and standards organizations in facilitating interoperability in network communications.

19.03 Explain how devices on a LAN access resources in a small to medium-sized business network.

19.04 Identify device connectivity options.

19.05 Describe the purpose and functions of the physical layer in the network.

19.06 Describe basic principles of the physical layer standards.

19.07 Identify the basic characteristics of network cables and connector types.

19.08 Build and terminate UTP cable used in Ethernet networks.

19.09	Describe, build and terminate fiber-optic cabling and its main advantages over other media.
19.10	Describe wireless media.
19.11	Select the appropriate media for a given requirement and connect devices.
19.12	Describe the operation of the Ethernet sub layers.
19.13	Identify the major fields of the Ethernet frame.
19.14	Describe the purpose and characteristics of the Ethernet MAC address.
19.15	Describe the purpose of ARP.
19.16	Explain how ARP requests impact network and host performance.
19.17	Explain basic switching concepts.
19.18	Compare fixed configuration and modular switches.
20.0	Configure a Layer 3 switch. The student will be able to:
20.01	Explain how network layer protocols and services support communications across data networks.
20.02	Explain how routers enable end-to-end connectivity in a small to medium-sized business network.
20.03	Determine the appropriate device to route traffic in a small to medium-sized business network.
21.0	Program a router with basic configurations. The student will be able to:
21.01	Describe the purpose of the transport layer in managing the transportation of data in end-to-end communication.
21.02	Describe characteristics of the TCP and UDP protocols, including port numbers and their uses.
21.03	Explain how TCP session establishment and termination processes facilitate reliable communication.
21.04	Explain how TCP protocol data units are transmitted and acknowledged to guarantee delivery.
21.05	Explain the UDP client processes to establish communication with a server.
21.06	Determine whether high-reliability TCP transmissions, or non-guaranteed UDP transmissions, are best suited for common applications.
21.07	Describe the structure of an IPv4 address.
21.08	Describe the purpose of the subnet mask.
21.09	Compare the characteristics and uses of the unicast, broadcast, and multicast IPv4 addresses.

21.10	Compare the use of public address space and private address space.
21.11	Explain the need for IPv6 addressing.
21.12	Describe the representation of an IPv6 address.
21.13	Describe types of IPv6 network addresses.
21.14	Configure global unicast addresses.
21.15	Describe multicast addresses.
21.16	Describe the role of ICMP in an IP network. (Include IPv4 and IPv6).
21.17	Use ping and trace route utilities to test network connectivity.
21.18	Explain why routing is necessary for hosts on different networks to communicate.
21.19	Describe IP as a communication protocol used to identify a single device on a network.
21.20	Given a network and a subnet mask, calculate the number of host addresses available.
21.21	Calculate the necessary subnet mask in order to accommodate the requirements of a network.
21.22	Describe the benefits of variable length subnet masking (VLSM).
22.0	Explain how IPv6 address assignments are implemented in a business network. The student will be able to:
22.01	Explain how the functions of the application layer, session layer, and presentation layer work together to provide network services to end user applications.
22.02	Describe how common application layer protocols interact with end user applications.
22.03	Describe, at a high level, common application layer protocols that provide Internet services to end-users, including WWW services and email.
22.04	Describe application layer protocols that provide IP addressing services.
22.05	Describe the features and operation of well-known application layer protocols that allow for file sharing services.
23.0	Explain how data is moved across the network, from opening an application, to receiving data. The student will be able to:
23.01	Identify the devices and protocols used in a small network.
23.02	Explain how a small network serves as the basis of larger networks.
23.03	Describe the need for basic security measures on network devices.
23.04	Identify security vulnerabilities and general mitigation techniques.

23.05	Configure network devices with device hardening features to mitigate security threats.
23.06	Use the output of ping and trace commands to establish relative network performance.
24.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. The student will be able to:
24.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
24.02	Explain emergency procedures to follow in response to workplace accidents.
24.03	Create a disaster and/or emergency response plan.
25.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
25.01	Employ leadership skills to accomplish organizational goals and objectives.
25.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
25.03	Conduct and participate in meetings to accomplish work tasks.
25.04	Employ mentoring skills to inspire and teach others.
26.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:
26.01	Identify and demonstrate positive work behaviors needed to be employable.
26.02	Develop personal career plan that includes goals, objectives, and strategies.
26.03	Examine licensing, certification, and industry credentialing requirements.
26.04	Maintain a career portfolio to document knowledge, skills, and experience.
26.05	Evaluate and compare employment opportunities that match career goals.
26.06	Identify and exhibit traits for retaining employment.
26.07	Identify opportunities and research requirements for career advancement.
26.08	Research the benefits of ongoing professional development.
26.09	Examine and describe entrepreneurship opportunities as a career planning option.

Course Number: CTS0084
Occupational Completion Point: C
Computer Networking Specialist – 150 Hours – SOC Code 15-1142

27.0 Describe a switched network a small-to-medium-sized business. The student will be able to:

27.01 Describe convergence of data, voice, and video in the context of switched networks.

27.02 Setup and configure a switched environment.

27.03 Troubleshoot and diagnose a switched environment.

28.0 Describe a routing environment. The student will be able to:

28.01 Configure a router to route between multiple directly connected networks.

28.02 Describe the primary functions and features of a router.

28.03 Explain how routers use information in data packets to make forwarding decisions in a small-to medium-sized business network.

28.04 Describe configure and troubleshoot VLAN routing environment.

29.0 Explore the concept of switches and security. The student will be able to:

29.01 Explain the advantages and disadvantages of static routing.

29.02 Configure switch ports and security.

29.03 Describe security best practices in a switch environment.

29.04 Explain, configure and troubleshoot VLAN in a switch network.

30.0 Configure and troubleshoot a Layer 3 environment. The student will be able to:

30.01 Explain the advantages and disadvantages of Layer 3 ~~of static~~ routing.

30.02 Define, compare and configure the different categories of routing protocols

31.0 Configure, troubleshoot and implement ACLs. The student will be able to:

31.01 Explain, configure and modify ACL's

31.02 Apply ACLs to filter traffic.

32.0 Demonstrate knowledge of how network services and protocols interact to provide network communication in order to securely implement and use common protocols. The student will be able to:

32.01 Describe and configure protocols (i.e., SMTP, TCP-IP, MAC, DNS, FTP and DHCP).

32.02 Identify commonly used default network ports.

32.03 Troubleshoot configure protocols within a switched network.

Course Number: CTS0069
Occupational Completion Point: D
Computer Security Technician – 300 Hours – SOC Code 15-1122

33.0	Demonstrate an understanding of cybersecurity concepts and research. The student will be able to:
33.01	Describe the history of cybersecurity, including the evolution of a hacker culture.
33.02	Discuss the trends and national initiatives related to cybersecurity.
33.03	Distinguish between information assurance and cybersecurity.
33.04	Describe the concepts of confidentiality as it relates to user and data impact.
33.05	Explain authentication and the concept of non-repudiation.
34.0	Recognize attacks and apply appropriate solutions. The student will be able to:
34.01	Recognize and define network susceptibilities and attacks. (i.e., DOS/DDOS (Denial of Service/Distributed Denial of Service)).
34.02	Recognize and define Password Guessing (e.g., Brute Force, Dictionary).
34.03	Recognize and define Software Exploitation.
34.04	Define email vulnerabilities apply appropriate security measures.
35.0	Recognize and be able to differentiate and explain the following access control models. The student will be able to:
35.01	Recognize and define MAC (Mandatory Access Control).
35.02	Recognize and define DAC (Discretionary Access Control).
35.03	Recognize and define RBAC (Role Based Access Control).
36.0	Comprehend and develop an understanding of protocol security and associated risks. The student will be able to:
36.01	Identify non-essential services and protocols running on hosts and network devices and know what actions to take to reduce the risks of those services and protocols.
36.02	Understand the concept of and know how reduce the risks of social engineering.
36.03	Understand the concept and significance of auditing, logging and system scanning.
36.04	Identify and be able to differentiate different cryptographic standards and protocols.
37.0	Recognize and understand remote access technologies. The student will be able to:
37.01	Recognize and define 802.1x.

37.02	Recognize and define RADIUS (Remote Authentication Dial-In User Service).
37.03	Recognize and define TACACS (Terminal Access Controller Access Control System) and TACTCs+.
37.04	Recognize and define L2TP/PPTP (Layer Two Tunneling Protocol/Point to Point Tunneling Protocol).
37.05	Recognize and define SSH (Secure Shell).
37.06	Recognize and define IPSEC (Internet Protocol Security).
38.0	Identify and administer security fixes as defined by the appropriate OSI layers. The student will be able to:
38.01	Recognize and define SSL/TLS (Secure Sockets Layer/Transport Layer Security).
38.02	Recognize and define LDAP (Lightweight Directory Access Protocol).
39.0	Recognize and understand the administration of the following directory security concepts. The student will be able to:
39.01	Identify the different types of application layer protocol (POP3, SMTP, DNS and FTP).
39.02	Recognize and define File Sharing.
39.03	Recognize and define Vulnerabilities (i.e., packet sniffing, naming conventions).
40.0	Identify-wireless technologies, concepts and vulnerabilities. The student will be able to:
40.01	Recognize and define WTLS (Wireless Transport Layer Security).
40.02	Differentiate Wi-Fi threats.
40.03	Apply encryption protocols for wireless networks.
41.0	Apply advanced principles of security techniques. The student will be able to:
41.01	Compare and contrast Host and Network Based security techniques.
41.02	Be able to identify and explain cryptographic algorithms
41.03	Understand how cryptography and digital signatures address the following security concepts.
41.04	Identify authentication tools (e.g. PKI Public Key Infrastructure, Certificates, Renocation and Trust Models).
42.0	Define concepts of Key Management and Certificate Lifecycles. The student will be able to:
42.01	Identify various security CA requirements.
42.02	Understand Hardware versus software key storage, Private key storage, Escrow, Expiration, Revocation, Renewal, Destruction, Key Usage, Multiple Key Pairs.

42.03	Create key management and procedures.
43.0	Understand the application of the following concepts of physical security. The student will be able to:
43.01	Define Access Control (e.g., physical barriers, biometrics).
43.02	Define Social Engineering.
43.03	Defines issues related to Environment (e.g., wireless cells, location, shielding, fire suppression).
44.0	Understand security concerns for types of network topologies and media. The student will be able to:
44.01	Recognize, define, and configure network hardware, appliances and handheld devices.
44.02	Define, and configure Network Monitoring/Diagnostics tools.
44.03	Understand the security concerns for the following types of media.
45.0	Implement the process of network system hardening within a computer network. The student will be able to:
45.01	Install and configure Updates (Firmware & Software).
45.02	Install and configure Operating System and ACL's.
45.03	Enable and Disable Services and Protocols.
45.04	Setup and configure a server hardening within a computer network.
46.0	Describe the security implications of the following topics of disaster recovery options and utilities. The student will be able to:
46.01	Define and use Backups Secure Recovery, Recovery Plan and Alternative sites. (On-site versus off-site storage).
46.02	Recognize and define Backup Utilities and High Availability/Fault Tolerance.
47.0	Demonstrate proficiency in applying the concepts and uses of the following types of policies and procedures. The student will be able to:
47.01	Demonstrate proficiency and understanding of Security Policy Acceptable Use, Privacy, Separation of Duties, Need to Know, Password Management and SLA's.
47.02	Demonstrate proficiency and understanding of Disposal/Destruction.
47.03	Demonstrate proficiency and understanding of HR policies related to passwords, privileges, and Code of Ethics in hiring and termination situations.
47.04	Demonstrate proficiency and understanding of Incident Response Policy.
48.0	Understand different types of privilege management. The student will be able to:
48.01	Identify User/Group/Role Management and Single Sign-on.

48.02	Define Centralized vs. Decentralized.
48.03	Understand the importance of Auditing (Privilege, Usage, Escalation).
48.04	Define MAC/DAC/RBAC (Mandatory Access Control/Discretionary Access Control/Role Based Access Control).
49.0	Understand the concepts of cybersecurity guidelines. The student will be able to:
49.01	Demonstrate an understanding of the concepts of forensics guidelines.
49.02	Explain Systems Architecture and documentation.
49.03	Explain Change Logs and Inventories.
49.04	Explain Classification/Notification, Schema, Retention/Storage, and Destruction.
49.05	Understand and be able to explain the following concepts of risk identification.
49.06	Explain Asset Identification and Risk Assessment.
49.07	Define threat identification and vulnerabilities.
50.0	Understand training of end users, executives and human resources in security vulnerabilities. The student will be able to:
50.01	Identify effective training strategies and education resources.
50.02	Create appropriate methods of security Information awareness strategies.
50.03	Understand importance of On-line Resources.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Applied Cybersecurity
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y100300
CIP Number	0511100302
Grade Level	30, 31
Standard Length	750 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1122 – Information Security Analysts
Basic Skills Level	Mathematics: 10 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and cybersecurity-related careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of cybersecurity.

The content includes but is not limited to foundational knowledge and skills in computer and network security, security vulnerabilities, attack mechanisms and techniques, intrusion detection and prevention, cryptographic systems, system hardening, risk identification, incidence response, penetration testing, key management, access control, and recovery. Specialized courses focus on database security, planning and analysis, software, and web security.

Additional Information relevant to this Career and Technology (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points (OCPs). To complete this program, students must complete OCP A plus one of the subsequent courses in OCP B.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0018	Cybersecurity Associate		600 hours	15-1122
B	CTS0019	Information Security Manager OR	BUS ED 1 @2	150 hours	15-1122
	CTS0021	Data Security Specialist OR	COMPU SCI 6	150 hours	15-1122
	CTS0060	Software Security Specialist OR	CYBER TECH 7G	150 hours	15-1122
	CTS0085	Web Security Specialist OR	INFO TECH 7G	150 hours	15-1122
	CTS0089	Information Security Administrator		150 hours	15-1122

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of computer systems.
- 02.0 Demonstrate knowledge of different operating systems.
- 03.0 Develop a familiarity with the information technology industry.
- 04.0 Develop an awareness of microprocessors and digital computers.
- 05.0 Develop an awareness of programming languages.
- 06.0 Develop an awareness of emerging technologies.
- 07.0 Demonstrate an understanding of the Open Systems Interface (OSI) model.
- 08.0 Identify computer components and their functions.
- 09.0 Demonstrate proficiency using the Internet to locate information.
- 10.0 Demonstrate an understanding of Internet safety and ethics.
- 11.0 Demonstrate proficiency using common software applications.
- 12.0 Perform email activities.
- 13.0 Demonstrate proficiency in using presentation software and equipment.
- 14.0 Perform decision-making activities in a multimedia environment.
- 17.0 Demonstrate an understanding of cybersecurity, including its origins, trends, culture, and legal implications.
- 18.0 Describe the national agencies and supporting initiatives involved in cybersecurity.
- 19.0 Discuss the underlying concepts of terms used in cybersecurity.
- 20.0 Demonstrate an understanding of basic computer components, their functions, and their operation.
- 21.0 Demonstrate knowledge of different operating systems.
- 22.0 Demonstrate an understanding of the Open Systems Interface (OSI) model.
- 23.0 Describe the services and protocols that operate in the application, transport, network, and link layers of the OSI Model.
- 24.0 Demonstrate proficiency using computer networks.
- 25.0 Demonstrate an understanding of basic security concepts.
- 26.0 Demonstrate an understanding of legal and ethical issues in cybersecurity.
- 27.0 Demonstrate an understanding of virtualization technology.
- 28.0 Recognize and understand the administration of the following types of remote access technologies.
- 29.0 Understand the application of the following concepts of physical security.
- 30.0 Understand security concerns and concepts of the following types of devices.
- 31.0 Recognize and be able to differentiate and explain the following access control models.
- 32.0 Understand the security concerns for the following types of media.
- 33.0 Explain the following security topologies as they relate to cybersecurity.
- 34.0 Demonstrate an understanding of the technical underpinnings of cybersecurity and its taxonomy, terminology, and challenges.
- 35.0 Demonstrate an understanding of common information and computer system security vulnerabilities.
- 36.0 Demonstrate an understanding of common cyber attack mechanisms, their consequences, and motivation for their use.
- 37.0 Be able to identify and explain the following different kinds of cryptographic algorithms.
- 38.0 Demonstrate an understanding of the following kinds of steganographic techniques and their use in cybersecurity.
- 39.0 Understand how cryptography and digital signatures address the following security concepts.
- 40.0 Understand and be able to explain the following concepts of PKI (Public Key Infrastructure).

- 41.0 Demonstrate an understanding of certificates and their role in cybersecurity.
- 42.0 Demonstrate an understanding of intrusion, the types of intruders, their techniques, and their motivation.
- 43.0 Demonstrate an understanding of Intrusion Detection Systems (IDS).
- 44.0 Describe host-based IDS, its capabilities, and its approaches to detection (i.e., anomaly, signature).
- 45.0 Describe network-based IDS, its capabilities, and its approaches to detection (i.e., anomaly, signature).
- 46.0 Demonstrate an understanding of IDS applications.
- 47.0 Demonstrate an understanding of port scanning and network traffic monitoring employed as intrusion detection techniques.
- 48.0 Demonstrate an understanding of firewalls and other means of intrusion prevention.
- 49.0 Demonstrate an understanding of vulnerabilities unique to virtual computing environments.
- 50.0 Demonstrate an understanding of social engineering and its implications to cybersecurity.
- 51.0 Demonstrate an understanding of fundamental security design principles and their role in limiting points of vulnerability.
- 52.0 Demonstrate an understanding of how to configure host systems to guard against cyber intrusion.
- 53.0 Demonstrate an understanding of authentication methods and strategies.
- 54.0 Demonstrate an understanding of methods and strategies for controlling access to computer networks.
- 55.0 Demonstrate an understanding of key network services, their operation, vulnerabilities, and ways in which they may be secured.
- 56.0 Demonstrate an understanding of the processes involved in hardening a computer system or network.
- 57.0 Demonstrate an understanding of Public Key Infrastructure (PKI) management functions, key states, and life cycle/transition considerations.
- 58.0 Demonstrate an understanding of the processes associated with assessing vulnerabilities and risks within an organization.
- 59.0 Demonstrate an understanding of penetration testing, the types of tests and metrics, testing methodologies, and reporting processes.
- 60.0 Demonstrate an understanding of the Incident Response Life Cycle and the activities comprising each phase.
- 61.0 Demonstrate proficiency in cybersecurity risk mitigation planning.
- 62.0 Demonstrate proficiency in establishing a risk management framework.
- 63.0 Demonstrate proficiency in creating a corporate security policy.
- 64.0 Demonstrate proficiency in addressing process risks.
- 65.0 Demonstrate proficiency in addressing physical security risks.
- 66.0 Demonstrate proficiency in cybersecurity contingency planning.
- 67.0 Demonstrate proficiency in cybersecurity disaster recovery planning.
- 68.0 Demonstrate proficiency in cybersecurity business continuity planning.
- 69.0 Demonstrate proficiency in the essential elements of forensic analysis.
- 70.0 Demonstrate an understanding of database design, structure, and operation.
- 71.0 Demonstrate a fundamental understanding of Structured Query Language (SQL).
- 72.0 Demonstrate an understanding of database security policies.
- 73.0 Demonstrate an understanding of database access control, functions, methods, and verification.
- 74.0 Demonstrate an understanding of database vulnerabilities, attack vectors, and associated countermeasures.
- 75.0 Demonstrate an understanding of pre- and post-intrusion actions to facilitate database recovery.
- 76.0 Demonstrate an understanding of software design, structure, and operation.
- 77.0 Demonstrate a fundamental understanding of common software attack vectors.
- 78.0 Demonstrate an understanding input syntax validation.
- 79.0 Demonstrate an understanding of best practices for processing input data to ensure safe and secure program code.
- 80.0 Demonstrate an understanding of the role of environment variables in the operation of software applications.
- 81.0 Demonstrate an understanding of program design strategies for inhibiting elevated privilege attacks.
- 82.0 Demonstrate an understanding of the primary security services used in Internet and intranet environments.

- 83.0 Demonstrate a fundamental understanding of the SSL protocol stack and its elements.
- 84.0 Demonstrate an understanding of IPsec, including its uses, elements, and mechanisms.
- 85.0 Demonstrate an understanding of S/MIME, including its uses, functions, cryptographic algorithms, and key certificates.
- 86.0 Demonstrate an understanding of Kerberos and its role in third-party authentication in a distributed network.
- 87.0 Demonstrate an understanding of identity management and ways in which secure identity information is exchanged across different domains.
- 88.0 Complete a safety skills inventory.
- 89.0 Demonstrate acceptable project values.
- 90.0 Demonstrate the ability to detect and resolve system vulnerabilities.
- 91.0 Plan, organize, and carry out a penetration testing plan.
- 92.0 Demonstrate proficiency in conducting forensic analysis.
- 93.0 Successfully work as a member of a team.
- 94.0 Manage time according to a plan.
- 95.0 Keep acceptable records of progress problems and solutions.
- 96.0 Manage resources.
- 97.0 Use tools, materials, and processes in an appropriate and safe manner.
- 98.0 Research content related to the project and document the results.
- 99.0 Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience.
- 100.0 Demonstrate competency in the area of expertise related to the Applied Cybersecurity education program previously completed that this project is based upon.

Florida Department of Education
Student Performance Standards

Program Title: Applied Cybersecurity
Career Certificate Program Number: Y100300

Course Number: CTS0018
Occupational Completion Point: A
Cybersecurity Associate – 600 Hours – SOC Code 15-1122

01.0	Demonstrate knowledge, skill, and application of computer systems. The student will be able to:
01.01	Describe and use current and emerging computer technology and software to perform personal and business related tasks.
01.02	Describe the types of communications and networking systems used in workplace environments.
01.03	Locate and use software application reference materials such as on-line help, vendor bulletin boards, tutorials, and manuals.
01.04	Troubleshoot problems with computer hardware peripherals.
01.05	Describe ethical, privacy, and security issues and problems associated with computers and information systems.
01.06	Demonstrate proficiency in using the basic features of GUI browsers.
02.0	Demonstrate knowledge of different operating systems. The student will be able to:
02.01	Identify the most common computer operating systems.
02.02	Describe and use industry accepted file naming conventions, particularly in NTFS and FAT file systems.
02.03	Demonstrate proficiency with file management tasks (e.g., folder creation, file creation, backup, copy, delete, open, save).
02.04	Demonstrate a working knowledge of standard file formats.
02.05	Compare and contrast various operating systems (e.g., Android iOS, Windows, Mac, Linux).
02.06	Differentiate between different operating systems and applications.
02.07	Compare and contrast open source and proprietary software.
02.08	Explain how system utilities are used to maintain computer performance.
02.09	Evaluate criteria for selecting an operating system.
03.0	Develop a familiarity with the information technology industry. The student will be able to:

03.01	Explain how information technology impacts the operation and management of business and society.
03.02	Identify and describe the various ways of segmenting the IT industry (e.g., hardware vs. software, server vs. client, business vs. entertainment, stable vs. mobile).
03.03	Describe how digital technologies (social media) are changing both work and personal lifestyles.
04.0	Develop an awareness of microprocessors and digital computers. The student will be able to:
04.01	Explain software hierarchy and its impact on microprocessors.
04.02	Explain the need for and use of peripherals.
04.03	Demonstrate proficiency installing and using plug-and-play peripherals.
04.04	Identify the basic concepts of computer maintenance and upgrades.
05.0	Develop an awareness of programming languages. The student will be able to:
05.01	Explain the need for and use of compilers.
05.02	Identify the three types of programming design approaches (e.g., top-down, structured, object-oriented).
05.03	Compare the various types or classes of programming languages (e.g., compiled, interpretive).
05.04	Differentiate among source code, machine code, interpreters, and compilers.
05.05	Characterize the major categories of programming languages and how they are used.
05.06	Create a model flowchart for a computer program using software applications like RAPTOR or MS VISIO.
05.07	Describe the stages in the software development life cycle and explain how to successfully implement them.
06.0	Develop an awareness of emerging technologies. The student will be able to:
06.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
06.02	Adhere to published best practices for protecting personal identifiable information when using the Internet.
06.03	Identify trends related to the use of information technology in people's personal and professional lives.
06.04	Characterize how the rapid pace of change in information technology impacts our society.
07.0	Demonstrate an understanding of the Open Systems Interface (OSI) model. The student will be able to:
07.01	Explain the interrelations of the seven layers of the Open Systems Interface (OSI) as it relates to hardware and software.
07.02	Describe the purpose of the OSI model and each of its layers.
07.03	Explain specific functions belonging to each OSI model layer.

07.04	Understand how two network nodes communicate through the OSI model.
07.05	Discuss the structure and purpose of data packets and frames.
07.06	Describe the two types of addressing covered by the OSI model.
08.0	Identify computer components and their functions. The student will be able to:
08.01	Identify the internal components of a computer (e.g., power supply, hard drive, mother board, I/O cards/ports, cabling).
08.02	Use common computer and programming terminology.
09.0	Demonstrate proficiency using the Internet to locate information. The student will be able to:
09.01	Identify and describe web terminology.
09.02	Define Universal Resource Locators (URLs) and associated protocols (e.g., http, ftp, telnet, mailto).
09.03	Compare and contrast the types of Internet domains (e.g., .com, .org, .edu, .gov, .net, .mil).
09.04	Demonstrate proficiency using search engines, including Boolean search strategies.
09.05	Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, PDF).
09.06	Compare and contrast the roles of web servers and web browsers.
09.07	Compare MS Web Servers and Linux Web Servers.
10.0	Demonstrate an understanding of Internet safety and ethics. The student will be able to:
10.01	Describe cyber-bullying and its impact on perpetrators and victims.
10.02	Differentiate between viruses and malware, specifically their sources, ploys, and impact on personal privacy and computer operation, and ways to avoid infection.
10.03	Describe risks associated with sexting, including related legal issues, social engineering aspects, prevention methods, and reporting of offenses.
10.04	Describe the risks associated with online gaming and ways to reduce these risks.
10.05	Describe the intellectual property rights, ethics and legalities of downloading music or videos from the Internet.
10.06	Describe various risks associated with social networking sites and ways to reduce these risks.
10.07	Describe the risks associated with various conferencing programs and ways to reduce these risks.
10.08	Adhere to cyber safety practices with regard to conducting Internet searches, email, chat rooms, and other social network websites.
11.0	Demonstrate proficiency using common software applications. The student will be able to:

11.01	Compare and contrast the appropriate use of various software applications (e.g., word processing, desktop publishing, graphics design, web browser, email, presentation, database, scheduling, financial management, Java applet, music).
11.02	Demonstrate proficiency in the use of various software applications (e.g., word processing, desktop publishing, graphics design, web browser, email, presentation, database, scheduling, financial management, Java applet, music).
12.0	Perform email activities. The student will be able to:
12.01	Describe email capabilities and functions.
12.02	Identify components of an email message.
12.03	Identify the components of an email address.
12.04	Identify when to use different email options.
12.05	Attach a file to an email message.
12.06	Forward an email message.
12.07	Use an address book if an address book is available via the school's Outlook server for the student to use.
12.08	Reply to an email message.
12.09	Use the Internet to perform email activities.
12.10	Identify the appropriate use of email and demonstrate related email etiquette.
12.11	Recognize a fraudulent email and deal with it appropriately.
12.12	Identify common problems associated with widespread use of email.
12.13	Create folders to organize email.
13.0	Demonstrate proficiency in using presentation software and equipment. The student will be able to:
13.01	Produce a presentation that includes music, animation, and digital photography and present it using appropriate technology.
13.02	Using presentation software, create a multimedia presentation that incorporates shot and edited video, animation, music, narration and adheres to good design principles, use of transitions, and effective message conveyance.
13.03	Demonstrate knowledge of the roles and responsibilities of a multimedia production team (e.g. project manager, creative or design director, content experts, writers, graphic designers, animators, sound designers, videographer, interface designers/programmers).
13.04	Collaborate with team members to plan, edit, evaluate, and present a multimedia presentation where individuals on the team function in specific production roles.
13.05	Create a self-running presentation with synchronized audio, convert presentation slides (e.g., PowerPoint) into streaming ASF files for use on the web.
14.0	Perform decision-making activities in a multimedia environment. The student will be able to:

14.01	Determine work priorities, the audience, project budgets, project specifications and the production schedule.
14.02	Evaluate and select appropriate software packages and multimedia tools to complete assigned tasks.
14.03	Present and defend design projects.
17.0	Demonstrate an understanding of cybersecurity, including its origins, trends, culture, and legal implications. The student will be able to:
17.01	Define cybersecurity.
17.02	Describe how information security evolved into cybersecurity and the impact of the Internet on the pace and nature of the evolution.
17.03	Describe the individual elements that comprise the CIA triad (i.e., Confidentiality, Integrity, Availability).
17.04	Define and explain the various types of hackers and the role each plays in cybersecurity.
17.05	Describe various methodologies used by hackers and the basis for their employment.
18.0	Describe the national agencies and supporting initiatives involved in cybersecurity. The student will be able to:
18.01	Describe the role of the National Security Agency.
18.02	Describe current trends in cyber attacks and strategies for combating them.
18.03	Describe the legal implications of computer hacking and other forms of cyber attacks.
18.04	Understand the importance of the weekly bulletins distributed by the United States Computer Emergency Readiness Team (US-CERT).
18.05	Determine if any software or hardware on a given network has vulnerabilities outlined in the most recent US-CERT bulletin.
19.0	Discuss the underlying concepts of terms used in cybersecurity. The student will be able to:
19.01	Differentiate between cybersecurity and information assurance.
19.02	Define confidentiality and give examples of security breaches.
19.03	Define integrity and give examples of security breaches.
19.04	Define authenticity and give examples of security breaches.
19.05	Define accountability (non-repudiation) and give examples of security breaches.
20.0	Demonstrate an understanding of basic computer components, their functions, and their operation. The student will be able to:
20.01	Describe the internal components of a computer (e.g., power supply, hard drive, mother board, I/O cards/ports, cabling).

20.02	Demonstrate and understanding of common computer and programming terminology.
20.03	Explain the physical and logical architecture of a microcomputer system.
20.04	Describe the file types used in the operation of a computer.
20.05	Compare and contrast memory technologies (e.g., RAM, ROM, virtual memory, memory management).
21.0	Demonstrate knowledge of different operating systems. The student will be able to:
21.01	Compare operating system file naming conventions.
21.02	Describe the common elements that comprise the architecture of an operating system (e.g., kernel, file manager, memory manager, device manager, network manager).
21.03	Demonstrate proficiency with file management and structure (e.g., folder creation, file creation, backup, copy, delete, open, save).
21.04	Demonstrate a working knowledge of standard file formats.
21.05	Describe the purpose of various operating systems (e.g., Windows, Mac, iOS, Android and Linux).
21.06	Describe the difference between client and network operating systems.
21.07	Differentiate between different operating systems and applications and Macros.
21.08	Explain the basics of boot sequences, methods and startup utilities.
21.09	Compare and contrast open source and proprietary software.
21.10	Describe common system utilities used in performing computer maintenance.
22.0	Demonstrate an understanding of the Open Systems Interface (OSI) model. The student will be able to:
22.01	Explain the interrelations of the seven layers of the Open Systems Interface (OSI) as it relates to hardware and software.
22.02	Describe the purpose of the OSI model and each of its layers.
22.03	Explain specific functions belonging to each OSI model layer.
22.04	Understand how two network nodes communicate through the OSI model.
22.05	Discuss the structure and purpose of data packets and frames.
22.06	Describe the two types of addressing covered by the OSI model.
23.0	Describe the services and protocols that operate in the application, transport, network, and link layers of the OSI Model. The student will be able to:
23.01	Describe the services and protocols used in the OSI Application Layer (i.e., DHCP, DNS, FTP, HTTP, SMTP, Telnet, IMAP).

23.02	Describe the services and protocols used in the OSI Transport Layer (i.e., TCP, TSL/SSL, UDP).
23.03	Describe the services and protocols used in the OSI Network Layer (i.e., IP, ICMP, IGMP, IPSec).
23.04	Describe the services and protocols used in the OSI Link Layer (i.e., ARP, OSPF, L2TP, PPP).
24.0	Demonstrate proficiency using computer networks. The student will be able to:
24.01	Define networking and describe the purpose of a network.
24.02	Describe the conceptual background of digital networks including terminology and basics.
24.03	Describe various types of networks and the advantages and disadvantages of each (e.g. peer to peer, client/server, ROI).
24.04	Describe the use, advantages, and disadvantages of various network media (e.g. thinnet cable, coaxial, twisted pair (cat 5), fiber optics).
24.05	Describe the function of various network devices (e.g. hub, switched hub or switch, router bridge, gateway, access points).
24.06	Describe how network devices are identified (i.e., IP addressing).
24.07	Explain the protocols commonly used in a network environment.
24.08	Differentiate between public and private IP addresses.
24.09	Describe the common ports and corresponding protocols used in a network.
24.10	Describe the difference between the Internet and intranet.
24.11	Compare and contrast IP Version 6 and IP Version 4.
24.12	Compare and contrast the different methods for network connectivity (e.g. broadband, wireless, Bluetooth, cellular).
24.13	Discuss the differences between Local Area Network (LAN), Wide Area Network (WAN), Metropolitan Area Network (MAN), and Virtual Private Network (VPN).
25.0	Demonstrate an understanding of basic security concepts. The student will be able to:
25.01	Distinguish between vulnerability and a threat.
25.02	Discuss the different types of attacks (e.g., active, passive).
25.03	Define security policy and explain its role in cybersecurity.
25.04	Describe the basic methods of authentication (e.g., password, biometrics, smart cards, 2-factor authentication, multifactor authentication).

25.05	Describe the various forms of encryption methodologies (e.g., symmetric, asymmetric, block cipher, stream cipher).
25.06	Describe hash functions and their role in authentication.
25.07	Describe various method of access control used in computer security (e.g., policies, Groups, Access Control List (ACL)).
26.0	Demonstrate an understanding of legal and ethical issues in cybersecurity. The student will be able to:
26.01	Define cyber crime and discuss the challenges facing law enforcement.
26.02	Identify the key legislative acts that impact cybersecurity.
26.03	Describe the Federal criminal code related to computers and give examples of cyber crimes and penalties, particularly those involving inappropriate access.
26.04	Discuss digital forensics and its role in cybersecurity.
26.05	Distinguish among the Intellectual Property Rights of trademark, patent, and copyright.
26.06	Explain digital rights management and the implications of the Digital Millennium Copyright Act.
26.07	Describe the implications of various social media on the safeguarding of personal or sensitive information.
26.08	Describe various safeguards that can be employed to help ensure that sensitive or confidential information is not inadvertently divulged or obtained.
27.0	Demonstrate an understanding of virtualization technology. The student will be able to:
27.01	Define virtual computing.
27.02	Explain the benefits of virtual computing.
27.03	Differentiate between guest and host operating systems.
27.04	Install desktop virtualization software.
27.05	Describe the role of the hypervisor.
27.06	Create and upgrade a virtual machine.
27.07	Optimize the performance of a virtual machine.
27.08	Preserve the state of a virtual machine.
27.09	Clone, move and share virtual machines.
27.10	Use basic(static) and dynamic virtual disks and disk drives.

27.11	Configure a virtual network.
27.12	Connect devices to a virtual machine.
27.13	Enable security settings on a virtual machine.
28.0	Recognize and understand the administration of the following types of remote access technologies. The student will be able to:
28.01	Configure 802.1x authentication for a given scenario.
28.02	Connect clients to a VPN.
28.03	Understand Authentication, Authorization and Accounting (AAA) management.
28.04	Differentiate between TACACS+ (Terminal Access Controller Access Control System) and RADIUS.
28.05	Differentiate between L2TP and PPTP (Layer Two Tunneling Protocol/Point to Point Tunneling Protocol) protocols as they apply to VPN options.
28.06	Implement the use of SSH (Secure Shell).
28.07	Implement the use of IPSEC (Internet Protocol Security).
28.08	Identify vulnerabilities associated with authentication.
28.09	Understand ways to implement VOIP technologies.
29.0	Understand the application of the following concepts of physical security. The student will be able to:
29.01	Configure access controls including biometric devices, keypads and security tokens.
29.02	Recognize social engineering attempts.
29.03	Evaluate environmental controls (e.g., EMI shielding, temperature, humidity and fire suppression).
29.04	Develop a method of training users to recognize, report and avoid social engineering attempts.
29.05	Identify components of physical security including: mantraps, motion detection, alarm systems, locks, video surveillance and fences/barricades.
29.06	Install a camera for a video surveillance system.
29.07	Configure an alarm system including a keypad and motion detector.
29.08	Recognize vulnerabilities associated with physical security.
29.09	Explain how a mantrap is used as a counter measure against tailgating.
30.0	Understand security concerns and concepts of the following types of devices. The student will be able to:

30.01	Configure software and hardware firewalls.
30.02	Configure and secure routers.
30.03	Apply security settings to switches.
30.04	Configure and secure wireless devices.
30.05	Secure a LAN connected to a DSL/cable modem.
30.06	Configure a RAS (Remote Access Server) for remote connectivity.
30.07	Securely deploy a PBX (Private Branch Exchange).
30.08	Explain the benefits of implementing a VPN (Virtual Private Network).
30.09	Deploy IDS (intrusion detection system) and IPS (intrusion prevention systems).
30.10	Analyze the performance, efficiency and security of the network based on network monitoring and diagnostic software.
30.11	Employ techniques used to lock down workstations.
30.12	Configure and secure servers for a given scenario.
30.13	Understand and assess the security of mobile devices including but not limited to those using the Android, iOS and Windows platforms.
31.0	Recognize and be able to differentiate and explain the following access control models. The student will be able to:
31.01	Understand access control as it applies to MAC (Mandatory Access Control).
31.02	Understand access control as it applies to DAC (Discretionary Access Control).
31.03	Understand access control as it applies to RBAC (Role Based Access Control).
32.0	Understand the security concerns for the following types of media. The student will be able to:
32.01	Understand and identify security concerns with the use of Coaxial Cable.
32.02	The student should be able to identify and understand security concerns for UTP/STP (Unshielded Twisted Pair / Shielded Twisted Pair).
32.03	Identify and understand security concerns fiber optic cable.
32.04	Identify security concerns associated with removable media.
32.05	Address pitfalls associated with tape backups.
32.06	Address pitfalls associated with CD-R (Recordable Compact Disks).

32.07	Apply drive encryption to hard drives.
32.08	Diskettes.
32.09	Secure flash drives.
32.10	Smartcards. Secure USB memory.
33.0	Explain the following security topologies as they relate to cybersecurity. The student will be able to:
33.01	Determine Security Zones.
33.02	Point out vulnerabilities on a DMZ (Demilitarized Zone).
33.03	Explain the security benefits of using an intranet.
33.04	Explain the security benefits of using an extranet.
33.05	Secure a VLAN (Virtual Local Area Network).
33.06	Describe the security benefits associated with NAT (Network Address Translation).
33.07	Justify the implementation of tunneling, for security purpose.
34.0	Demonstrate an understanding of the technical underpinnings of cybersecurity and its taxonomy, terminology, and challenges. The student will be able to:
34.01	Explain the various elements that make up the security taxonomy used by the U.S. Computer Emergency Readiness Team (CERT).
34.02	Describe the challenges associated with achieving and maintaining computer security.
34.03	Discuss the range of potential consequences of various forms of security breaches.
34.04	Describe various defense mechanisms, techniques, and methodologies (e.g., antivirus, anti-malware, protocol analyzers and scans, analyzing email headers, patch management).
34.05	Compare and contrast mechanisms employed in passive and active cyber attacks.
34.06	Describe the difference between an inside and an outside attack.
34.07	Describe vulnerabilities associated with each element of the CIA Triad.
34.08	Explain the differences between hardware, software, data, and network assets susceptible to cyber attack.
34.09	Describe the tools and technologies used in cybersecurity.
34.10	Define intrusion detection and discuss its role in cybersecurity (e.g., HIDS and NIDS).
34.11	Explain what is meant by the term countermeasures (e.g., NIPS and HIPS).

34.12	Describe the role recovery plays in cybersecurity (e.g., Business Continuity Plan).
35.0	Demonstrate an understanding of common information and computer system security vulnerabilities. The student will be able to:
35.01	Describe the basic categories of vulnerabilities associated with cybersecurity (i.e., hardware, software, network, human, physical, organizational).
35.02	Describe the ways in which various social networks are cybersecurity targets.
35.03	Describe footprinting and explain how it is used to reveal system vulnerabilities.
35.04	Explain why default values and technical controls are points of vulnerability and describe the hardening efforts being taken by government and industry.
35.05	Describe the process of port scanning and explain why it is so prevalent in cybersecurity.
35.06	Describe what is meant by password strength and explain its relationship to vulnerability.
35.07	Distinguish between a weak and a strong password.
35.08	Describe some of the ways in which intruders are able to cover their tracks.
35.09	Describe the circumstances under which a computer system is vulnerable to a denial of service attack.
36.0	Demonstrate an understanding of common cyber attack mechanisms, their consequences, and motivation for their use. The student will be able to:
36.01	Describe spoofing as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.02	Describe the introduction of malware or spyware as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.03	Describe the use of grayware as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.04	Describe the use of computer viruses or worms as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.05	Describe Logic Bombs as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.06	Describe botnet and rootkit as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.07	Describe the introduction of a Trojan Horse as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.08	Describe DNS poisoning as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.09	Describe buffer overflow as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.10	Understand the risk associated with a zero-day exploit.
36.11	Understand risks associated with P2P networking including the Gnutella protocol and Torrents.

37.0	Be able to identify and explain the following different kinds of cryptographic algorithms. The student will be able to:
37.01	Hashing Functions.
37.02	Symmetric Keys.
37.03	Asymmetric Keys.
37.04	Kerberos.
38.0	Demonstrate an understanding of the following kinds of steganographic techniques and their use in cybersecurity. The student will be able to:
38.01	Network steganographic methods (e.g., WLAN).
38.02	Digital steganographic methods (e.g., image encryption, audio, mimic functions, video, packet manipulation).
39.0	Understand how cryptography and digital signatures address the following security concepts. The student will be able to:
39.01	Confidentiality.
39.02	Integrity.
39.03	Authentication.
39.04	Non-Repudiation.
39.05	Access Control.
40.0	Understand and be able to explain the following concepts of PKI (Public Key Infrastructure). The student will be able to:
40.01	Certificates (e.g., policies, practice statements).
40.02	Revocation.
40.03	Trust Models.
41.0	Demonstrate an understanding of certificates and their role in cybersecurity. The student will be able to:
41.01	Describe the role of a Certificate Authority (CA).
41.02	Describe Registration Authority (RA) and its relevance to security certificates.
41.03	Compare and contrast SSL/TLS X.509-compliant certificates with PGP-compliant certificates.
41.04	Describe the events that make up the lifecycle of a certificate.
41.05	Describe how root certificate distribution works.

42.0	Demonstrate an understanding of intrusion, the types of intruders, their techniques, and their motivation. The student will be able to:
42.01	Define intrusion.
42.02	Describe the classes of intruders (i.e., masquerader, misfeator, clandestine user).
42.03	Describe what is meant by a hacker and discuss their role in cybersecurity.
42.04	Compare and contrast the “black hat”, “white hat”, “blue hat”, and “grey hat” hacker cultures (i.e., computer criminal versus computer security expert).
42.05	Describe various techniques used by hackers to achieve intrusion.
43.0	Demonstrate an understanding of Intrusion Detection Systems (IDS). The student will be able to:
43.01	Describe the three logical components that comprise an IDS (i.e., sensors, analyzers, user interface).
43.02	Explain how user behavior relates to the detection of an intruder.
43.03	Describe the essential requirements for any IDS.
44.0	Describe host-based IDS, its capabilities, and its approaches to detection (i.e., anomaly, signature). The student will be able to:
44.01	Describe anomaly detection, specifically threshold and profile-based approaches.
44.02	Describe the types of audit records employed in intrusion detection (i.e., native, detection-specific).
44.03	Describe signature detection, specifically rule-based anomaly and penetration identification approaches.
45.0	Describe network-based IDS, its capabilities, and its approaches to detection (i.e., anomaly, signature). The student will be able to:
45.01	Describe the primary approach for intrusion detection in a network.
45.02	Compare and contrast inline and passive sensors.
45.03	Discuss typical placement of sensors in a network-based IDS environment and explain the rationale for each.
46.0	Demonstrate an understanding of IDS applications. The student will be able to:
46.01	Describe the operation, typical activities, and outputs of an intrusion detection system.
46.02	Describe some of the limitations of intrusion detection systems.
46.03	Differentiate between an intrusion detection system (passive) and an intrusion prevention (reactive) system.
46.04	Compare and contrast several of the intrusion detection systems available on the current market.
47.0	Demonstrate an understanding of port scanning and network traffic monitoring employed as intrusion detection techniques. The student will be able to:

47.01	Describe the process of monitoring/detecting port scanning attacks and associated patterns.
47.02	Explain how the monitoring and analysis of network traffic can be used to detect intrusion.
47.03	Utilize network monitoring and analysis tools to detect intrusion and anomalies.
48.0	Demonstrate an understanding of firewalls and other means of intrusion prevention. The student will be able to:
48.01	Describe the purpose and limitations of firewalls.
48.02	Describe the four types of firewalls (i.e., packet filtering, stateful inspection, application-level gateway, circuit-level gateway).
48.03	Describe the use of honeypots as an intrusion prevention technique.
48.04	Explain how security policies are used to prevent intruders.
48.05	Explain how Access Control Lists (ACLs) are used to prevent intrusion.
49.0	Demonstrate an understanding of vulnerabilities unique to virtual computing environments. The student will be able to:
49.01	Describe the limitations of traffic monitoring within virtual networks.
49.02	Discuss the primary vulnerability of virtual operating systems.
49.03	Describe the “hypervisor” and explain its role in securing a virtual environment.
50.0	Demonstrate an understanding of social engineering and its implications to cybersecurity. The student will be able to:
50.01	Define social engineering and describe its role in cybersecurity.
50.02	Discuss common mechanisms that constitute social engineering (e.g., phishing, baiting, quid pro quo, pretexting).
50.03	Describe the variety of attacks targeting the human element.
50.04	Describe countermeasures that can be used to counter social engineering attacks.
51.0	Demonstrate an understanding of fundamental security design principles and their role in limiting points of vulnerability. The student will be able to:
51.01	Discuss the three over-arching security design principles (i.e., only necessary, simple, ease of use).
51.02	Describe the principle of least privilege as it relates to computer security.
51.03	Describe the principle of separation of duties as it relates to computer security.
51.04	Describe the principle of defense in depth as it relates to computer security.
51.05	Describe the principle of fail secure or fail safe and false positive or false negative as it relates to computer security.

51.06	Describe the principle of economy of mechanism as it relates to computer security.
51.07	Describe the principle of complete mediation as it relates to computer security.
51.08	Describe the principle of open design as it relates to computer security.
51.09	Describe the principle of least common mechanism as it relates to computer security.
51.10	Describe the principle of psychological acceptability as it relates to computer security.
51.11	Describe the principle of leveraging existing components as it relates to computer security.
51.12	Describe the principle of weakest link as it relates to computer security.
51.13	Describe the principle of single point of failure as it relates to computer security.
52.0	Demonstrate an understanding of how to configure host systems to guard against cyber intrusion. The student will be able to:
52.01	Describe the security features and options available for configuring network routers to prevent intrusion.
52.02	Describe the various types of firewalls (i.e., packet filtering, stateful, application-level gateway, circuit-level gateway) and how each can be used to prevent intrusion.
52.03	Explain the configuration and operation of a Demilitarized Zone (DMZ) host, including the key services contained within the zone.
52.04	Describe the role of security zones, content filters, subnets, and trusted zones in configuring a network infrastructure.
53.0	Demonstrate an understanding of authentication methods and strategies. The student will be able to:
53.01	Describe the strengths, vulnerabilities, and countermeasures related to the use of passwords for authentication.
53.02	Describe ways in which passwords are compromised and techniques/models for strengthening.
53.03	Explain token authentication methods (e.g., memory cards, smart cards) and limitations.
54.0	Demonstrate an understanding of methods and strategies for controlling access to computer networks. The student will be able to:
54.01	Compare and contrast the three primary categories of access control (i.e., discretionary, mandatory, role-based).
54.02	Describe the underlying principles of authorization as an access control mechanism applicable to individuals, system services, subjects, objects.
54.03	Discuss the key features of an access control system (i.e., reliable input, granularity, least privilege, separation of duty, open/close policies, conflict resolution, administration).
54.04	Describe the three elements of access control (i.e., subject, object, rights).
54.05	Describe access rights (i.e., read, write, execute, delete, create, search) and their use in establishing individual and group access control policies.
54.06	Compare and contrast the use, operation, and limitations of Access Control Matrix (ACM), Access Control Lists (ACLs), and Capability Tickets in a network environment.

54.07	Describe the UNIX file access control schema.
54.08	Explain the relationship between security policies and access control.
54.09	Describe the use and conceptual operation of formal security policy models (e.g., Bell-La Padula (BLP), Chinese Wall Model (CWM), Harrison Ruzzo Ullman (HRU)).
54.10	Describe the use, strengths, and vulnerabilities of group policies in access control and strategies for ensuring safety.
54.11	Describe the key entities, relationships, and functions that comprise Role-Based Access Control (RBAC), including privilege management considerations.
55.0	Demonstrate an understanding of key network services, their operation, vulnerabilities, and ways in which they may be secured. The student will be able to:
55.01	Describe the operation of Dynamic Host Configuration Protocol (DHCP), its vulnerabilities, typical cyber attacks, and potential countermeasure strategies.
55.02	Describe the operation of the Domain Name System (DNS) service, its role in a network environment, its vulnerabilities, typical cyber attacks, and potential countermeasure strategies.
55.03	Describe the operation of the Simple Mail Transport Protocol (SMTP), its role in a network environment, its vulnerabilities, typical cyber attacks, and potential countermeasure strategies.
55.04	Describe the operation of the File Transfer Protocol (FTP) and Telnet, their role in a network environment, their vulnerabilities, typical cyber attacks, and potential countermeasure strategies.
56.0	Demonstrate an understanding of the processes involved in hardening a computer system or network. The student will be able to:
56.01	Describe hardening and some of the general approaches for securing a computer network.
56.02	Describe and apply the process by which a web server is hardened against their typical cyber attacks.
56.03	Describe and apply the process by which a mail server is hardened against their typical cyber attacks.
56.04	Describe and apply the process by which a FTP server is hardened against their typical cyber attacks.
56.05	Describe and apply the process by which a file/print server is hardened against their typical cyber attacks.
56.06	Describe and apply the process by which data repositories are hardened against their typical cyber attacks.
56.07	Describe and apply the process by which Directory Services is hardened against their typical cyber attacks.
56.08	Describe and apply the process by which various network appliances are hardened against their typical cyber attacks.
57.0	Demonstrate an understanding of Public Key Infrastructure (PKI) management functions, key states, and life cycle/transition considerations. The student will be able to:
57.01	Compare and contrast the forms, limitations, and vulnerabilities associated with centralized and decentralized key management schemas, including the PKI web of trust model.
57.02	Describe key escrow, its role in key management, its advantages, and its risks.
57.03	Differentiate between key backup and key escrow.

57.04	Explain the role of a key's expiration date, its implications on the key's validity, and its relationship to deactivation.
57.05	Describe the circumstances under which a key might be revoked, who has authority to revoke a key, and how revocation is communicated.
57.06	Compare and contrast key suspension and key revocation.
57.07	Describe ways in which key recovery might be achieved, who is authorized to recover keys, and associated vulnerabilities to attack.
57.08	Compare and contrast key renewal and key replacement, who is authorized to initiate renewal or replacement, and associated vulnerabilities to attack.
57.09	Describe the circumstances under which a key might be destroyed, the considerations prior to destruction, and associated vulnerabilities to compromise or attack.
58.0	Demonstrate an understanding of the processes associated with assessing vulnerabilities and risks within an organization. The student will be able to:
58.01	Describe the process of asset identification relative to risk assessment and the considerations or criteria used in identifying assets requiring protection.
58.02	Describe the process of threat identification, including identifying the types of threats, asset vulnerabilities, and threat sources.
58.03	Describe the process of risk assessment, including determination of attack probability, attack consequences, and assignment of risk priorities.
58.04	Evaluate an existing security posture and identify gaps and vulnerabilities in security.
59.0	Demonstrate an understanding of penetration testing, the types of tests and metrics, testing methodologies, and reporting processes. The student will be able to:
59.01	Describe the types of penetration tests (i.e., human, physical, wireless, data networks, telecommunications), the goals of each type, the metrics tested, and the value of their results.
59.02	Compare and contrast the processes of black box versus white box penetration testing, including their characteristics, limitations, and appropriateness.
59.03	Define attack vector and explain its relationship and importance to penetration testing.
59.04	Describe common testing methodologies and standards used in penetration testing.
59.05	Describe the salient points, structure, detail, and documentation typically addressed in reporting and debriefing the results of penetration testing.
59.06	Detect malicious and abnormal activities through logs, intrusion detection systems, and other utilities and appliances.
59.07	Reproduce methods that intruders use to gain unauthorized access to a network system for purposes of compromising information assets.
59.08	Deploy proprietary and/or open source tools to test known technical vulnerabilities in networked systems.
59.09	Determine which vulnerabilities are exploitable and estimate the risk and impact of potential exploitations.
59.10	Recommend appropriate mitigation procedures against discovered vulnerabilities and security gaps.

59.11	Model the ethics of a licensed Penetration Tester or Computer Security Specialist.
60.0	Demonstrate an understanding of the Incident Response Life Cycle and the activities comprising each phase. The student will be able to:
60.01	Describe the activities that make up the Preparation Phase of the Incident Response Life Cycle, including identification of useful tools and resources.
60.02	Describe the activities that make up the Detection and Analysis Phase of the Incident Response Life Cycle, including identification of indication sources, analysis of resulting signs of an intrusion event, documentation and notification of the incident.
60.03	Describe the factors to consider when prioritizing an incident.
60.04	Describe the activities that make up the Containment, Eradication, and Recovery Phase of the Incident Response Life Cycle, including selecting a containment strategy, collecting and preserving evidence for forensic analysis, identifying the attacker, re-securing the system and system restoration.
60.05	Describe the activities that make up the Post Incident Activity Phase of the Incident Response Life Cycle, including identification of lessons learned and evidence retention.

Course Number: CTS0019
Occupational Completion Point: B
Information Security Manager – 150 Hours – SOC Code 15-1122

61.0	Demonstrate proficiency in cybersecurity risk mitigation planning. The student will be able to:
61.01	Describe the major activities and security controls that are implemented as part of a sound risk management program.
61.02	Discuss the rationale for executive sponsorship and delineated management responsibilities in successfully implementing a risk management program.
62.0	Demonstrate proficiency in establishing a risk management framework. The student will be able to:
62.01	Describe the importance of creating a system definition for use in assessing vulnerabilities and risks.
62.02	Describe the major elements of a system definition.
62.03	Differentiate among critical assets, cyber assets, and critical cyber assets.
62.04	Explain why cyber assets are classified as public, restricted, confidential, or private and why this plays a role in creating a risk management framework.
62.05	Compare and contrast the classes of cyber assets (i.e., public, restricted, confidential, private) and give examples of each.
62.06	Create a system definition that identifies all cyber assets, their class, and their risk category (e.g., critical).
62.07	Describe an Electronic Security Perimeter (ESP) and discuss its role in formulating a risk management framework.
62.08	Describe the process and goals of a vulnerability assessment of ESP access points.
62.09	Define risk level and explain the variabilities of its components.
62.10	Describe ways in which system vulnerability may be ranked according to impact (e.g., safety, outage, privacy, monetary).
62.11	Describe some of the security controls (e.g., access control, training, audit, configuration, maintenance) that come into play when determining the appropriate risk mitigation strategy.
62.12	Compare and contrast a top-down and a bottoms-up analysis approach for identifying and mitigating risks.
62.13	Describe the range of testing/evaluation and associated tools used to monitor mitigation control effectiveness.
62.14	Create a risk management framework.
63.0	Demonstrate proficiency in creating a corporate security policy. The student will be able to:
63.01	Describe the best practices and security controls that typify a sound corporate security policy.
63.02	Discuss the elements of a corporate security policy, including policy management, personnel and training, critical asset management, ESP, physical security, incident reporting and response, disaster recovery and business continuity plans.
63.03	Describe the need for specific implementation and enforcement processes as part of a corporate security policy.

63.04	Explain the controls required for addressing personnel risks in a corporate security policy (e.g., training, hiring due diligence, enforcement of “least privilege,” access revocation).
64.0	Demonstrate proficiency in addressing process risks. The student will be able to:
64.01	Describe the best practices and security controls typically implemented for assessing and mitigating operational risks, including:
64.01.1	Periodic risk assessment.
64.01.2	Enforce access control, monitoring, and logging.
64.01.3	Perform disposal/redeployment of assets.
64.01.4	Enforce change control and configuration management.
64.01.5	Conduct vulnerability assessments.
64.01.6	Control, Monitor, and log all access to assets.
64.01.7	Configuration and maintenance.
64.01.8	Ensure incident handling processes.
64.01.9	Provide for contingency planning.
64.02	Create an organized mitigation table that identifies operational or process risks, the potential impact of the risk, and specific actions required to mitigate the risk.
65.0	Demonstrate proficiency in addressing physical security risks. The student will be able to:
65.01	Describe the best practices and security controls that ensure good physical security of critical infrastructure and assets.
65.02	Discuss the resulting potential for compromise once physical security is breached.
65.03	Create an organized mitigation table that identifies physical security risks, the potential impact of the risk, and specific actions required to mitigate the risk.
66.0	Demonstrate proficiency in cybersecurity contingency planning. The student will be able to:
66.01	Define resiliency and its relationship to contingency planning.
66.02	Describe the purpose and scope of an Information Systems Contingency Plan (ISCP).
66.03	Identify the five main components of a contingency plan (i.e., Supporting Information, Activation and Notification, Recovery, Reconstitution, and Appendices).
66.04	Describe the contingency planning process and the rationale for each step in the process.
66.05	Explain the three step process for conducting a business impact analysis (i.e., determine recovery criticality, identify resource requirements, identify recovery priorities).

66.06	Compare and contrast Maximum Tolerable Downtime (MTD), Recovery Time Objective (RTO), and Recovery Point Objective (RPO).
66.07	Discuss the criteria typically used to activate the contingency plan.
66.08	Discuss the role of backup and recovery considerations in contingency planning.
66.09	Create a contingency plan that includes roles and responsibilities, a business impact analysis with contingency strategies/solutions, outage assessment, resource recovery priorities, backup and recovery strategies, and testing/training considerations.
67.0	Demonstrate proficiency in cybersecurity disaster recovery planning. The student will be able to:
67.01	Describe the purpose and scope of a cybersecurity disaster recovery plan.
67.02	Describe various recovery strategies according to their appropriateness.
67.03	Explain the key considerations when formalizing a disaster recovery plan.
67.04	Discuss the role of data collection relative to disaster recovery.
67.05	Identify the types, purposes, and role of documentation during disaster recovery.
67.06	Discuss the role of testing in a disaster recovery plan.
68.0	Demonstrate proficiency in cybersecurity business continuity planning. The student will be able to:
68.01	Describe the purpose and scope of a cybersecurity business continuity plan.
68.02	Explain the concept of fault tolerance and discuss its role in business continuity planning.
68.03	Identify and use various utilities employed for the purpose of business continuity.
68.04	Describe the role of backups for ensuring business continuity.
69.0	Demonstrate proficiency in the essential elements of forensic analysis. The student will be able to:
69.01	Describe the four phases of forensic analysis and discuss the activities performed in each phase.
69.02	Describe the forensic and evidentiary considerations when determining containment.
69.03	Describe the types and sources of data collected for forensic analysis.
69.04	Explain the various forms of data and associated collection/retrieval tools for the application transport, IP, and link layers.
69.05	Explain the processes by which data is collected for analysis.
69.06	Describe the role of system event logs in data collection.
69.07	Describe the role of the process log in data collection.

69.08 Describe the processes associated with preserving evidence collected for forensic purposes.

69.09 Describe how the chain of custody can be maintained for evidence collected during a forensic analysis effort.

Course Number: CTS0021
Occupational Completion Point: B
Data Security Specialist – 150 Hours – SOC Code 15-1122

70.0 Demonstrate an understanding of database design, structure, and operation. The student will be able to:

70.01 Describe a relational database and its key elements.

70.02 Describe the Entity Relationship Model (ERM) and relate how it is a factor in database security.

70.03 Describe the process of normalization and explain its role in database security.

70.04 Differentiate between one-to-many, many-to-many and one-to-one relationships.

70.05 Define referential integrity and describe its implications on database security.

70.06 Discuss the role of authentication in database security.

71.0 Demonstrate a fundamental understanding of Structured Query Language (SQL). The student will be able to:

71.01 List the capabilities of SQL SELECT statements.

71.02 Execute basic SQL statements, including SELECT, INSERT, and UPDATE.

71.03 Apply the concatenation operator to link columns to other columns, arithmetic expressions, or constant values to create a character expression.

71.04 Use column aliases to rename columns in the query result.

71.05 Use SQL to display the structure of a table.

71.06 Apply SQL syntax to restrict the rows returned from a query.

71.07 Demonstrate application of the WHERE clause syntax.

71.08 Apply the proper comparison operator to return a desired result.

71.09 Create, drop, rename and truncate tables using SQL.

71.10 Create and remove an index using a SQL statement.

71.11 Create or modify users and roles using SQL statements.

71.12 Use the GRANT and REVOKE SQL statements to control access.

71.13 Differentiate between Data Definition Language (DDL) and Data Manipulation Language (DML) SQL statements and discuss their respective implications to database security.

72.0 Demonstrate an understanding of database security policies. The student will be able to:

72.01	Explain the role of the Database Management System (DBMS) in maintaining database security.
72.02	Describe three aspects of system level security related to databases (i.e., user privilege schema, user authentication, operating system level privileges).
72.03	Describe the mechanisms that control access to and use of the database at the object level.
72.04	Explain how role-based privilege assignment can be used as a data security model.
72.05	Compare and contrast the implications of connecting to a database with administrator versus user privileges.
73.0	Demonstrate an understanding of database access control, functions, methods, and verification. The student will be able to:
73.01	Compare and contrast rights and privileges as they relate to database security.
73.02	Describe the manner in which database user rights and privileges are controlled (e.g., granted, revoked).
73.03	Describe application access rights and discuss their role in a database security schema.
73.04	Compare and contrast table, column, and row level security, including VIEW implications.
73.05	Describe fine-grained access control and its use in database security.
73.06	Describe the operation of a database firewall and explain its role in a database security schema.
73.07	Describe how database security policies may be used to trigger security auditing events.
73.08	Describe the various types of auditing (e.g., statement, privilege, object, fine-grained) and associated records.
74.0	Demonstrate an understanding of database vulnerabilities, attack vectors, and associated countermeasures. The student will be able to:
74.01	Describe the SQL Injection attack vector and explain its potential consequences (e.g., privilege escalation, data compromise, data destruction).
74.02	Describe database inference as a vulnerability and explain how sensitive information can be compromised inadvertently.
74.03	Discuss ways in which to prevent or limit database inference at design time and query time.
74.04	Compare and contrast the various countermeasures and strategies to prevent an SQL injection from being successful.
74.05	Compare and contrast the ways in which encryption might be applied to a database (i.e., database, fields, records, columns) and discuss the tradeoffs of each.
75.0	Demonstrate an understanding of pre- and post-intrusion actions to facilitate database recovery. The student will be able to:
75.01	Describe the criteria which might be employed to trigger an intrusion or breach alarm.
75.02	Identify the sources for confirming and tracking intrusion.
75.03	Describe the tools and methodologies used to determine the scope of data compromise.

75.04 Assess an intrusion, determine the scope of compromise, and restore compromised data.

75.05 Describe the appropriate actions related to database recovery during incidence response.

Course Number: CTS0060
Occupational Completion Point: B
Software Security Specialist – 150 Hours – SOC Code 15-1122

76.0	Demonstrate an understanding of software design, structure, and operation. The student will be able to:
76.01	Describe a typical software application and its key elements.
76.02	Compare and contrast software quality and software security in terms of development time, testing, and implementation.
76.03	Explain how security can be a software design parameter and discuss the inherent trade-offs during the development life cycle.
76.04	Describe the common failings in software security (e.g., input handling, inadequate testing, incomplete/incorrect algorithms, memory misuse, holes for privilege escalation).
77.0	Demonstrate a fundamental understanding of common software attack vectors. The student will be able to:
77.01	Describe how buffer overflow attacks can be prevented through input validation and proper interpretation.
77.02	Describe a command injection attack, how it can occur, and the potential consequences.
77.03	Describe an SQL injection attack, how it can occur, and the potential consequences.
77.04	Describe a code injection attack, including PHP remote code injection, how it can occur, and the potential consequences.
77.05	Describe cross-site scripting attack, how it can occur, and the potential consequences.
78.0	Demonstrate an understanding input syntax validation. The student will be able to:
78.01	Explain the need for validating input syntax to ensure proper input handling.
78.02	Describe canonicalization and its role in handling alternate encoding schemas.
78.03	Discuss the risks associated with improper handling of signed or unsigned numeric input (e.g., very large data length versus negative number).
79.0	Demonstrate an understanding of best practices for processing input data to ensure safe and secure program code. The student will be able to:
79.01	Explain why any input processing algorithm must correctly handle all problem variants.
79.02	Explain why debug or test code should be removed from all production bound software.
79.03	Describe the need for ensuring that machine instructions correctly implement the intended actions of the high-level language code.
79.04	Describe the concept of a strongly typed programming language and explain its role in correct data interpretation.
79.05	Describe memory leak as it pertains to dynamically allocated memory, its causes, and potential consequences (e.g., DOS attack).
79.06	Describe the race condition associated with shared memory access, its causes, and potential consequences (e.g., DOS attack causing deadlock).

80.0	Demonstrate an understanding of the role of environment variables in the operation of software applications. The student will be able to:
80.01	Describe how the PATH, IFS, and LD_LIBRARY_PATH environment variables can be exploited.
80.02	Explain how dynamic libraries can be subverted through the use of environment variables and describe the potential consequences (e.g., elevated privileges).
80.03	Describe the principle of “least privilege” relative to the operation of software applications, particularly as it relates to file/directory ownership management.
81.0	Demonstrate an understanding of program design strategies for inhibiting elevated privilege attacks. The student will be able to:
81.01	Describe a Root/Admin program and explain the development and operational benefits of partitioning the program into smaller modules.
81.02	Identify the sources for confirming and tracking intrusion.
81.03	Describe the tools and methodologies used to determine the scope of data compromise.
81.04	Assess an intrusion, determine the scope of compromise, and restore compromised data.
81.05	Describe the appropriate actions related to database recovery during incidence response.

Course Number: CTS0085
Occupational Completion Point: B
Web Security Specialist – 150 Hours – SOC Code 15-1122

82.0 Demonstrate an understanding of the primary security services used in Internet and intranet environments. The student will be able to:

82.01 Describe Secure Sockets Layer (SSL) security service.

82.02 Compare and contrast SSL with Transport Layer Security (TLS) as a security service.

82.03 Describe Internet Protocol Security (IPSec) and discuss its benefits and three functional areas (i.e., authentication, confidentiality, key management).

82.04 Describe Secure/Multipurpose Internet Mail Extension (S/MIME) and discuss its role in achieving secure Internet-based communications.

83.0 Demonstrate a fundamental understanding of the SSL protocol stack and its elements. The student will be able to:

83.01 Compare and contrast SSL Connection and SSL Session.

83.02 Describe SSL Record Protocol services and discuss their role in managing SSL exchanges (i.e., message integrity, confidentiality).

83.03 Describe the operation of the SSL Record Protocol, including the key steps that ensure security (e.g., adding message authentication code, encryption).

83.04 Explain the role of the SSL Change Cipher Spec Protocol in ensuring secure transactions.

83.05 Explain the role of the SSL Alert Protocol.

83.06 Describe the SSL Handshake Protocol and explain the role of each phase of communication (i.e., establish security capability, server authentication/key exchange, client authentication/key exchange, complete secure connection).

84.0 Demonstrate an understanding of IPSec, including its uses, elements, and mechanisms. The student will be able to:

84.01 Compare and contrast IPSec with SSL and TSL.

84.02 Compare and contrast security services provided under IPv4 and IPv6.

84.03 Differentiate between the three facilities available under IPSec (i.e., Authentication Header, Encapsulating Security Payload, key exchange).

84.04 Describe the concept of Security Association (SA) and explain the roles of its three parameters (i.e., Security Parameters Index, IP Destination Address, Security Protocol Identifier).

84.05 Describe the purpose, structure, and criteria of the Authentication Header (AH).

84.06 Describe the purpose, structure, and elements of the Encapsulating Security Protocol (ESP).

84.07 Describe the structure and operation of the key management facility of IPSec.

85.0	Demonstrate an understanding of S/MIME, including its uses, functions, cryptographic algorithms, and key certificates. The student will be able to:
85.01	Describe the role of S/MIME in conducting email communications.
85.02	Compare and contrast the four new security functions provided by S/MIME (i.e., enveloped data, signed data, clear-signed data, signed and enveloped data).
85.03	Outline the process of using S/MIME during email processing.
85.04	Describe the various cryptographic algorithms used by S/MIME and discuss their applicability (i.e., DSS, RSA, SHA-1, MD5, ElGamal, AES, 3DES, HMAC).
85.05	Describe memory leak as it pertains to dynamically allocated memory, its causes, and potential consequences (e.g., DOS attack).
85.06	Describe the need for using x.509 v3 public key certificates with S/MIME.
86.0	Demonstrate an understanding of Kerberos and its role in third-part authentication in a distributed network. The student will be able to:
86.01	Compare and contrast the roles and operation of a Kerberos Authentication Server (AS) and a Ticket Granting Server (TGS).
86.02	Describe a Kerberos realm and the mechanism for inter-realm authentication.
87.0	Demonstrate an understanding of identity management and ways in which secure identify information is exchanged across different domains. The student will be able to:
87.01	Describe the key components of identity management architecture.
87.02	Describe the concept of identity federation and explain its benefits.
87.03	Describe the standards used in federated identity management (i.e., XML, SOAP, WS-Security, SAML).

Course Number: CTS0089
Occupational Completion Point: B
Information Security Administrator – 150 Hours – SOC Code 15-1122

88.0 Complete a safety skills inventory. The student will be able to:

88.01 Practice safety procedures while enrolled in this course.

88.02 Demonstrate an understanding of safety and general policies and procedures.

89.0 Demonstrate acceptable project values. The student will be able to:

89.01 Maintain a positive relationship with peers.

89.02 Demonstrate adaptive self-management skills.

89.03 Adhere to industry accepted, legal, and ethical standards of cyber conduct.

89.04 Rotate through a wide variety of increasingly responsible experiences.

89.05 Apply superior skills in communications, mathematics, and science appropriate to technological content and learning activities.

90.0 Demonstrate the ability to detect and resolve system vulnerabilities. The student will be able to:

90.01 Prepare a vulnerability matrix to identify and record weak points, the type of vulnerability, significance of the vulnerability, the priority, and the solution.

90.02 Determine possible solutions for each vulnerability.

90.03 Research each detected vulnerability.

90.04 Document solutions as they are devised.

90.05 Prepare an alternative for any solution that is not successful.

90.06 Continue the process until a workable solution is found for each vulnerability.

91.0 Plan, organize, and carry out a penetration testing plan. The student will be able to:

91.01 Determine the scope and attack vectors for the test.

91.02 Organize the team according to individual strengths.

91.03 Assign specific tasks within a team.

91.04 Prioritize the attack vectors and sequence the test.

91.05 Identify required resources.

91.06	Carry out the testing plan to successful completion.
91.07	Create the test report detailing the goals, tests, findings, and results.
92.0	Demonstrate proficiency in conducting forensic analysis. The student will be able to:
92.01	Create security incident handling and response policies.
92.02	Recover deleted, encrypted, or damaged file information as evidence for prosecution in computer crimes.
92.03	Deploy proprietary and/or open source tools to identify intruder footprints.
92.04	Coordinate incident response activities.
92.05	Prepare proper documentation of chain of custody, including accounting for evidence source, destination, and possession.
92.06	Preserve forensic integrity of evidence.
92.07	Model highest moral and ethical standards in conducting digital forensic investigations.
93.0	Successfully work as a member of a team. The student will be able to:
93.01	Accept responsibility for specific tasks in a given situation.
93.02	Document progress, and provide feedback on work accomplished in a timely manner.
93.03	Complete assigned tasks in a timely and professional manner.
93.04	Reassign responsibilities when the need arises.
93.05	Complete daily tasks as assigned on one's own initiative.
94.0	Manage time according to a plan. The student will be able to:
94.01	Set realistic time frames and schedules.
94.02	Record time worked in the daily journal.
94.03	Meet goals and objectives set by the team.
94.04	Identify individual priorities.
94.05	Complete a weekly evaluation of accomplishments, and reevaluate goals, objectives and priorities as needed.
95.0	Keep acceptable records of progress problems and solutions. The student will be able to:
95.01	Develop a record keeping system in the form of a log book or journal to record daily progress.

95.02	Use a project journal to identify problem statement.
95.03	Develop a portfolio of work accomplished to include design drawings, research, drawings and plans, storyboards, models, mock-ups and prototypes.
96.0	Manage resources. The student will be able to:
96.01	Identify required resources for each stage of the project plan.
96.02	Determine the methods needed to acquire needed resources.
96.03	Demonstrate good judgment in the use of resources.
96.04	Recycle and reuse resources where appropriate.
96.05	Demonstrate an understanding of proper legal and ethical treatment of copyrighted material.
97.0	Use tools, materials, and processes in an appropriate and safe manner. The student will be able to:
97.01	Identify the proper tool for a given job.
97.02	Use tools and machines in a safe manner.
97.03	Adhere to laboratory or job site safety rules and procedures.
97.04	Identify the application of processes appropriate to the task at hand.
97.05	Identify materials appropriate to their application.
98.0	Research content related to the project and document the results. The student will be able to:
98.01	Identify the basic research needed to develop the project plan.
98.02	Identify available resources for completing background research required in the project plan.
98.03	Demonstrate the ability to locate resource materials in a library, data base, internet and other research resources.
98.04	Demonstrate the ability to organize information retrieval.
98.05	Demonstrate the ability to prepare a topic outline.
98.06	Write a draft of the design and testing report.
98.07	Edit and proof the respective report.
98.08	Prepare an electronically composed report in proper form.
99.0	Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience. The student will be able to:
99.01	Prepare a multi-media presentation on the completed project.

99.02	Make an oral presentation, using multi-media materials.
99.03	Review the presentation, and make changes in the delivery method(s) to improve presentation skills.
100.0	Demonstrate competency in the area of expertise related to the Applied Cybersecurity education program previously completed that this project is based upon. The student will be able to:
100.01	Demonstrate a mastery of the content of the selected subject area.
100.02	Demonstrate the ability to use related technological tools, materials and processes related to the specific program area.
100.03	Demonstrate the ability to apply the knowledge, experience and skill developed in the previous program completion to the successful completion of this demonstration.
100.04	Demonstrate the acquisition of additional knowledge, skill and experience in one area of the selected field of study beyond the performance standards of the initial program standards.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Cloud Computing & Virtualization
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y100400
CIP Number	0511100303
Grade Level	30, 31
Standard Length	900 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1142 – Network and Computer Systems Administrators
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as a Computer Support Assistant, Network Support Technician, Cloud Specialist, Cloud Virtualization Engineer in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to instruction in computer literacy; software application support; basic hardware configuration and troubleshooting; networking technologies, troubleshooting, security, and administration; and customer service and human relations skills.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of five occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	EEV0504	Computer Support Assistant	BUS ED 1 @2 COMPU SCI 6 COMP SVC 7G CYBER TECH 7G INFO TECH 7G	150 hours	15-1151
C	CTS0026	Network Support Technician		150 hours	15-1142
D	CTS0054	Cloud Analyst		150 hours	15-1142
E	CTS0056	Cloud Virtualization Specialist		300 hours	15-1142

Note: OTA0040 is a core.

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 16.0 Identify, install, configure, and upgrade desktop and server computer modules and peripherals, following established basic procedures for system assembly and disassembly of field replaceable modules.
- 17.0 Diagnose and troubleshoot common module problems and system malfunctions of computer software, hardware, peripherals, and other office equipment.
- 18.0 Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace.
- 19.0 Identify specific terminology, facts, ways and means of dealing with classifications, categories and principles of motherboards, processors and memory in desktop and server computer systems.
- 20.0 Demonstrate knowledge of basic types of printers, basic concepts, printer components, how they work, how they print onto a page, paper path, care and service techniques, and common problems.
- 21.0 Identify and describe basic network concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring network interface cards, and knowledge of the ramifications of repairs when a computer is networked.
- 22.0 Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, internet, remote access, or direct contact.
- 23.0 Demonstrate proficiency using graphical user interface (GUI) operating systems.

- 24.0 Demonstrate language arts knowledge and skills.
- 25.0 Demonstrate mathematics knowledge and skills.
- 26.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 27.0 Participate in work-based learning experiences.
- 28.0 Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, remote access, or direct contact.
- 29.0 Perform installation and configuration activities.
- 30.0 Demonstrate proficiency using computer networks.
- 31.0 Demonstrate proficiency in configuring and troubleshooting hardware devices and drivers.
- 32.0 Demonstrate proficiency in managing, monitoring, and optimizing system performance, reliability and availability.
- 33.0 Demonstrate proficiency in managing, configuring and troubleshooting storage use.
- 34.0 Demonstrate proficiency in configuring and troubleshooting network connections.
- 35.0 Demonstrate proficiency in implementing, monitoring, and troubleshooting security.
- 36.0 Evaluate and analyze cloud principles used in cloud computing.
- 37.0 Identify the components of cloud based services.
- 38.0 Evaluate cloud based services.
- 39.0 Use cloud-based services.
- 40.0 Evaluate and analyze techniques and methods of cloud deployment.
- 41.0 Evaluate the risks of cloud-based systems.
- 42.0 Demonstrate an awareness of cloud implementation.
- 43.0 Demonstrate an understanding of virtualization concepts.
- 44.0 Install and configure the virtualization server platform.
- 45.0 Install, configure and manage virtualized clients.
- 46.0 Demonstrate proficiency in managing a virtualization infrastructure.
- 47.0 Demonstrate an understanding of storage technologies and storage configuration.
- 48.0 Demonstrate proficiency in network optimization using network protocols, ports, and topologies.
- 49.0 Understand security in a virtualized environment.

Florida Department of Education
Student Performance Standards

Program Title: Cloud Computing & Virtualization
Career Certificate Program Number: Y100400

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: EEV0504
Occupational Completion Point – B
Computer Support Assistant – 150 Hours – SOC Code 15-1151

15.0	Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. The student will be able to:
15.01	Develop strategies for resolving customer conflicts.
16.0	Identify, install, configure, and upgrade desktop and server computer modules and peripherals, following established basic procedures for system assembly and disassembly of field replaceable modules. The student will be able to:
16.01	Identify and describe the functions of main processing boards (e.g., CPUs, RAM, ROM, bus architecture).
16.02	Identify and describe the functions of communication ports (e.g., serial and parallel ports).
16.03	Identify and describe the functions of peripheral devices (e.g., scanners, modems, hard drives, printers).
16.04	Identify and describe the components of portable systems (e.g., battery, LCD, AC adapter, PDAs).
16.05	Troubleshoot, install and upgrade computers and peripherals.
16.06	Perform system hardware setup Demonstrate an understanding of input/output devices.
16.07	Install and configure of applications software, hardware, and device drivers.
16.08	Demonstrate an understanding of the operation and purpose of hardware components.
16.09	Install operating system software.
16.10	Customize operating systems.
16.11	Install application software.
16.12	Perform storage formatting and preparation activities.
16.13	Identify data measurement (e.g., bits, bytes, kilobytes).
16.14	Install and configure RAID.
16.15	Recognize and report on server room environmental issues (temperature, humidity/ESD/power surges, back-up).
17.0	Diagnose and troubleshoot common module problems and system malfunctions of computer software, hardware, peripherals, and other office equipment. The student will be able to:
17.01	Troubleshoot a personal computer system.
17.02	Identify configuration problems.
17.03	Identify software problems.

17.04	Identify hardware malfunctions.
17.05	Identify network malfunctions.
17.06	Resolve computer error messages.
17.07	Understand and troubleshoot memory and cache systems.
17.08	Verify that drives are the appropriate type.
17.09	Describe knowledge database search procedures used to identify possible solutions when troubleshooting software and hardware problems.
18.0	Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace. The student will be able to:
18.01	Apply basic rules for hardware safety.
18.02	Demonstrate proficiency in basic preventative hardware maintenance.
18.03	Apply special disposal procedures that comply with environmental guidelines for batteries, CRTs, toner kits/cartridges, chemical solvents and cans, and MSDS.
18.04	Apply ergonomic principles applicable to the configuration of computer workstations.
18.05	Describe ethical issues and problems associated with computers and information systems.
19.0	Identify specific terminology, facts, ways and means of dealing with classifications, categories and principles of motherboards, processors and memory in desktop and server computer systems. The student will be able to:
19.01	Identify EDO RAM, DRAM, SRAM, RIMM, VRAM, SDRAM, and WRAM.
19.02	Identify memory banks, memory chips (8-bit, 16-bit, and 32-bit), SIMMS (Single In-line Memory Module), DIMMS (Dual In-line Memory Module), parity chips versus non-parity chips.
19.03	Identify printer parallel port, COM/serial port, floppy drive, hard drive, Memory, and Boot sequence.
20.0	Demonstrate knowledge of basic types of printers, basic concepts, printer components, how they work, how they print onto a page, paper path, care and service techniques, and common problems. The student will be able to:
20.01	Identify types of printers—Laser, Inkjet, Dot Matrix.
20.02	Identify care and service techniques and common problems with primary printer types.
20.03	Implement and manage printing on a network.
21.0	Identify and describe basic network concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring network interface cards, and knowledge of the ramifications of repairs when a computer is networked. The student will be able to:

21.01	Define networking and describe the purpose of a network.
21.02	Identify the purposes and interrelationships among the major components of networks (e.g., servers, clients, transmission media, network operating system, network boards).
21.03	Describe the various types of network topologies.
21.04	Identify and describe the purpose of standards, protocols, and the Open Systems Interconnection (OSI) reference model.
21.05	Configure network and verify network connectivity.
21.06	Discuss the responsibilities of the network administrator (e.g., rights and responsibilities).
21.07	Develop user logon procedures.
21.08	Utilize network management infrastructures (e.g., network monitoring, alerting, security) to perform administrative tasks.
21.09	Identify common backup strategies and procedures.
21.10	Select and use appropriate electronic communications software and hardware for specific tasks.
21.11	Compare and contrast Internet software and protocols.
21.12	Diagnose and resolve electronic communications operational problems.
21.13	Design and implement directory tree structures.
21.14	Install services tools (SNMP, backup software).
21.15	Perform full backup and verify backup.
21.16	Identify bottlenecks (e.g., processor, bus transfer, I/O, disk I/O, network I/O, memory).
21.17	Use the concepts of fault tolerance/fault recovery to create a disaster recovery plan.
21.18	Document and test disaster recovery plan regularly, and update as needed.
22.0	Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, internet, remote access, or direct contact. The student will be able to:
22.01	Apply call center vocabulary.
22.02	Listen and input information simultaneously.
22.03	Apply first response assistance for minor repair work.
23.0	Demonstrate proficiency using graphical user interface (GUI) operating systems. The student will be able to:
23.01	Identify parts of GUI windows.

23.02	Create and use icons.
23.03	Demonstrate proficiency in using menu systems.
23.04	Demonstrate proficiency in using pointing and selection devices.
23.05	Identify keyboard shortcuts and special function keys.
23.06	Demonstrate proficiency in manipulating windows.
23.07	Utilize help systems and hypertext links.
23.08	Create, organize, and maintain file system directories.
23.09	Organize desktop objects.
23.10	Run multiple applications.
24.0	Demonstrate language arts knowledge and skills. The student will be able to
24.01	Locate, comprehend and evaluate key elements of oral and written information.
24.02	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
24.03	Present information formally and informally for specific purposes and audiences.
25.0	Demonstrate mathematics knowledge and skills. The student will be able to
25.01	Demonstrate knowledge of arithmetic operations.
25.02	Analyze and apply data and measurements to solve problems and interpret documents.
25.03	Construct charts/tables/graphs using functions and data.

Course Number: CTS0026
Occupational Completion Point – C
Network Support Technician – 150 Hours – SOC Code 15-1142

26.0	Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. The student will be able to:
26.01	Develop diplomatic methods to communicate with customers.
27.0	Participate in work-based learning experiences. The student will be able to:
27.01	Participate in work-based learning experiences in a network support services environment.
27.02	Discuss the use of technology in a network environment.
28.0	Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, remote access, or direct contact. The student will be able to:
28.01	Apply first response assistance for minor repair work.
29.0	Perform installation and configuration activities. The student will be able to:
29.01	Configure the operating system environment.
29.02	Connect client workstation running similar operating system to the network.
29.03	Configure Internet access for a network.
29.04	Configure a web server.
29.05	Use remote server to deploy operating system.
29.06	Troubleshoot failed installations.
29.07	Install and configure network services for interoperability.
29.08	Monitor, configure, troubleshoot and control access to printers.
29.09	Monitor, configure, troubleshoot and control access to files, folders, and shared folders.
29.10	Monitor, configure, troubleshoot and control access to websites.
30.0	Demonstrate proficiency using computer networks. The student will be able to:
30.01	Identify and describe the purpose of standards; protocols; and the Open Systems Interconnection (ISO) reference model.
31.0	Demonstrate proficiency in configuring and troubleshooting hardware devices and drivers. The student will be able to:
31.01	Configure hardware devices.
31.02	Configure driver signing options.

	31.03 Update device drivers.
	31.04 Troubleshoot problems with hardware.
32.0	Demonstrate proficiency in managing, monitoring, and optimizing system performance, reliability and availability. The student will be able to:
	32.01 Monitor and optimize usage of system resources.
	32.02 Manage processes.
	32.03 Optimize disk performance.
	32.04 Manage and optimize availability of system data and user data.
	32.05 Recover systems and user data.
33.0	Demonstrate proficiency in managing, configuring and troubleshooting storage use. The student will be able to:
	33.01 Configure and manage user profiles.
	33.02 Monitor, configure and troubleshoot disks and volumes.
	33.03 Configure data compression.
	33.04 Monitor and configure disk quotas.
	33.05 Recover from disk failures.
34.0	Demonstrate proficiency in configuring and troubleshooting network connections. The student will be able to:
	34.01 Install, configure and troubleshoot shared access.
	34.02 Install, configure and troubleshoot a virtual private network.
	34.03 Install, configure and troubleshoot network protocols.
	34.04 Install and configure network services.
	34.05 Configure, monitor and troubleshoot remote access.
	34.06 Install, configure, monitor and troubleshoot Terminal Services.
	34.07 Configure the properties of a connection.
	34.08 Install, configure and troubleshoot network adapters and drivers.
35.0	Demonstrate proficiency in implementing, monitoring, and troubleshooting security. The student will be able to:

35.01	Encrypt data on a hard disk by using Encrypting File System.
35.02	Implement, configure, manage and troubleshoot policies in an operating system environment.
35.03	Implement, configure, manage and troubleshoot auditing.
35.04	Implement, configure, manage and troubleshoot local accounts.
35.05	Implement, configure, manage and troubleshoot account policy.
35.06	Implement, configure, manage and troubleshoot security by using the Security Configuration Tool Set.

Course Number: CTS0054
Occupational Completion Point – D
Cloud Analyst – 150 Hours SOC Code 15-1142

36.0 Evaluate and analyze cloud principles used in cloud computing. The student will be able to:

36.01 Demonstrate an understanding of the evolution of cloud computing.

36.02 Compare and contrast drivers and limitations of cloud computing.

36.03 Compare and contrast the four main deployment models for cloud computing, public, private, community, and hybrid.

36.04 Describe the three main service models for cloud computing (SaaS, PaaS, and IaaS).

36.05 Describe the role of the Internet and virtualization in cloud computing.

36.06 Understand and identify managed services in cloud computing.

37.0 Identify the components of cloud based services. The student will be able to:

37.01 Demonstrate proficiency in accessing web applications through web browser.

37.02 Describe, identify and use thin clients to complete business tasks.

37.03 Describe, identify and use thick clients to complete business tasks.

37.04 Describe, identify and use mobile clients to complete business tasks.

37.05 Demonstrate an awareness of application hosting.

37.06 Demonstrate an awareness of multipurpose architecture.

38.0 Evaluate cloud based services. The student will be able to:

38.01 Perform calculations to identify the costs and savings of different cloud based models for an organization.

38.02 Compare and contrast cloud based services used in industry.

38.03 Identify the impacts to current and future staffing and operational needs.

38.04 Evaluate performance of cloud-based solutions using performance indicators.

39.0 Use cloud-based services. The student will be able to:

39.01 Compare and contrast outsourcing and cloud computing as alternatives for business.

39.02 Identify and use cloud based services to improve productivity.

39.03	Compare and contrast cloud based services for consumer and business.
39.04	Use cloud based services to perform collaboration online.
39.05	Demonstrate an awareness of the user experience in using a cloud-based service as compared to traditional business model.
40.0	Evaluate and analyze techniques and methods of cloud deployment. The student will be able to:
40.01	Demonstrate an awareness of networking for cloud-based solutions.
40.02	Demonstrate an awareness of the role of automation and self-service in regard to cloud-based solutions.
40.03	Demonstrate an awareness of deployment and management of internal and external cloud services to complete business task.
40.04	Demonstrate an awareness of the role standardization in cloud-based solutions.
40.05	Demonstrate the impact of time to market, distribution over the Internet in cloud deployment.
41.0	Evaluate the risks of cloud-based systems. The student will be able to:
41.01	Identify and evaluate compliance risks relating to software and vendors in cloud-based systems.
41.02	Demonstrate an understanding of user privacy rights and privacy risks in cloud-based systems.
41.03	Demonstrate an understanding of legal risks in cloud based systems.
41.04	Understand the role of vendors and dependencies in cloud-based solutions.
41.05	Demonstrate an understating of the risks of hardware independence.
41.06	Identify the main aspects of identity management.
42.0	Demonstrate an awareness of cloud implementation. The student will be able to:
42.01	Describe the use of a Virtual Private network access to Local Area Network.
42.02	Describe the risk of connecting a local cloud network to the public Internet.
42.03	Identify and describe the components of cloud environment.
42.04	Demonstrate an understanding of networking topologies in cloud environment.
42.05	Demonstrate an understanding of serves, switches, and routers in cloud-based architecture.
42.06	Demonstrate an understanding of the role of the datacenter in cloud-based architecture.

Course Number: CTS0056
Occupational Completion Point – E
Cloud Virtualization Specialist – 300 Hours – SOC Code 15-1142

43.0 Demonstrate an understanding of virtualization concepts. The student will be able to:

43.01 Demonstrate an understanding of the role of the virtual CPU in virtualization.

43.02 Demonstrate an understanding of the role of virtual memory in virtual component.

43.03 Demonstrate an understanding of system patching for virtual environment.

43.04 Demonstrate an understanding of virtual desktops.

43.05 Evaluate the components of networking topology including (servers, network, storage).

43.06 Compare and contrast traditional desktops and servers to virtual counterpart.

43.07 Demonstrate an understanding of the hardware requirements to create and scale a virtual infrastructure.

43.08 Demonstrate the differences between traditional virtualization and para-virtualization.

43.09 Identify, describe and use guest operating system in a virtualization environment.

43.10 Identify, define and use virtual machine monitor in virtual environment.

43.11 Perform virtual partitioning through the Hypervision.

43.12 Demonstrate an awareness of the bare metal approach for virtualization portioning.

43.13 Demonstrate an awareness of hosted virtualization as a virtualization approach.

43.14 Understand and use industry standards for hardware support for virtualization.

43.15 Demonstrate an understanding of high-level language virtual machines.

43.16 Describe the benefits of server consolidation and containment acquired through migration to virtualization.

43.17 Describe the benefits of test and development optimization gained through virtualization.

43.18 Demonstrate how virtualization reduces cost and complexity of high availability and disaster recovery.

43.19 Demonstrate how virtualization can enhance security in the enterprise.

44.0 Install and configure the virtualization server platform. The student will be able to:

44.01 Demonstrate an understanding of a virtual image and compare that to a golden image.

44.02 Create a virtual image using a virtualization platform using a base operating system.

44.03	Create a virtual template in which the golden image is configured with the software packages and application.
44.04	Configure the virtual template to ensure software settings and organizational policies are implemented.
44.05	Manage inventory objects licenses using the virtual infrastructure ensure to comply with enterprise requirements.
44.06	Demonstrate how a virtual switch is used to create communication between virtual machines.
44.07	Perform communication between two virtual machines through the use of a virtual switch.
44.08	Create, manage and configure virtual switches to enable communication of virtual machines in different hosts.
44.09	Use virtual system management to remotely manage the allocation in a virtual network.
44.10	Perform and manage user roles and permission in a virtual environment.
44.11	Perform server patching on a virtual environment both on traditional servers as well virtual servers.
44.12	Create a patching baseline.
45.0	Install, configure and manage virtualized clients. The student will be able to:
45.01	Demonstrate an awareness of peripheral redirection.
45.02	Demonstrate proficiency in configuring virtual client to enable both USB and monitor redirection.
45.03	Compare and contrast the use of peripherals in a traditional and virtual environment.
45.04	Demonstrate an understanding of the types of virtual clients used in a virtualization infrastructure.
45.05	Demonstrate proficiency in performing tasks using thin, thick and mobile virtualization clients.
45.06	Compare and contrast the performance, ease of use and efficiency of different clients in completing business tasks.
45.07	Analyze business tasks that are better aligned to a particular virtualization client type.
45.08	Demonstrate proficiency in managing user sessions and policies of virtual clients.
46.0	Demonstrate proficiency in managing a virtualization infrastructure. The student will be able to:
46.01	Demonstrate an understanding of the process of cloning virtual machines.
46.02	Identify the benefits of cloning in a virtual infrastructure.
46.03	Compare and contrast full clones and linked clones.
46.04	Demonstrate proficiency in identifying situations in which cloning is a proper solution.

46.05	Demonstrate proficiency in deploying virtual machines using cloning.
46.06	Demonstrate an understating of virtual migration.
46.07	Demonstrate an understanding of the situational needs that require a virtual migration.
46.08	Identify the role of network bandwidth and resource allocation needed for virtual migration.
46.09	Demonstrate an understanding of automating migration to the host server.
46.10	Identify the process that migration affect virtual disk storage in particular SANS.
46.11	Demonstrate proficiency in developing action steps to execute a virtual migration.
47.0	Demonstrate an understanding of storage technologies and storage configuration. The student will be able to:
47.01	Demonstrate an awareness of the evolution of storage architecture and data center components.
47.02	Describe, identify and use data center elements host, connectivity and storage.
47.03	Identify describe, and use RAID technology in an enterprise environment.
47.04	Identify the impact to application performance based on RAID implementation.
47.05	Demonstrate an awareness of intelligent storage system.
47.06	Compare and contrast storage systems for a virtualization infrastructure.
47.07	Demonstrate an awareness of storage network technologies (Fibre Channel Storage Network FC Scan, IP Scan, Fibre Channel over Ethernet, Network Attached Storage, Object Based, Unified Storage).
47.08	Identify the appropriate storage network solutions based on client requirements.
47.09	Demonstrate proficiency in creating and managing data stores.
47.10	Demonstrate proficiency in configuring and managing resource pools.
48.0	Demonstrate proficiency in network optimization using network protocols, ports, and topologies. The student will be able to:
48.01	Demonstrate an awareness of disaster recovery (business continuity) information availability for virtualized and non-virtualized environments.
48.02	Demonstrate proficiency in backup and recovery in both virtualized and non-virtualized environments.
48.03	Demonstrate an awareness of deduplication technology for backup optimization.
48.04	Demonstrate an awareness of fixed content storage requirements and archival solutions.
48.05	Demonstrate an awareness of continuous data replication and remote replication in virtualized and non-virtualized environments.

48.06	Demonstrate proficiency in integrating Active Directory to a virtual environment.
48.07	Demonstrate proficiency in CPU and memory optimization.
48.08	Demonstrate proficiency using remote desktops and display protocols to optimize network infrastructure.
48.09	Demonstrate an awareness of fault tolerance and acceptable levels tolerated based on the infrastructure.
49.0	Understand security in a virtualized environment. The student will be able to:
49.01	Compare and contrast hosted and Bare-Metal virtualization implementations vulnerability to threats and attacks.
49.02	Demonstrate an awareness of data leakage and malicious code intrusion.
49.03	Demonstrate proficiency in securing data between guest and host environments.
49.04	Demonstrate proficiency in managing resource allocation in a virtualized environment to reduce system crash.
49.05	Demonstrate proficiency in creating images that are secure for client deployment.
49.06	Demonstrate an awareness of software security levels and digital signatures.
49.07	Demonstrate proficiency in using, configuring and managing host firewall in a virtualized infrastructure.
49.08	Demonstrate proficiency in using command line to configure and manage the host firewall.
49.09	Demonstrate proficiency in using logging tools to monitor activity in the virtual environment.
49.10	Identify, describe and provide solutions to threats based on scalability and high availability.
49.11	Demonstrate proficiency in securing mobile, thin and thick clients.
49.12	Demonstrate an awareness of threats to network authentication in a virtualized environment.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Database and Programming Essentials
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program	
Program Number	Y300100
CIP Number	0511080207
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1141 – Database Administrators
Basic Skills Level	Mathematics: 11 Language: 11 Reading: 11

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and entry-level database and internet/web related careers; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, and technical skills related to database and Internet technologies skills using the latest industry tools. This curriculum is project-based and modeled after the Oracle Academy.

Additional Information related to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of one occupational completion point. It is recommended that students complete Algebra I and a programming/flow-charting course concurrently or prior to taking this program.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
	CTS0046	Database Fundamentals	BUS ED 1 @2	150 hours	15-1141
	CTS0047	Specialized Database Programming	COMPU SCI 6	150 hours	15-1141
	CTS0067	Specialized Database Applications	COMP PROG 7G	150 hours	15-1141

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Develop an awareness of the changes taking place in the information age and how they fit into an evolving society.
- 16.0 Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs.
- 17.0 Develop the process of creating an entity by identifying relationships.
- 18.0 Formulate and assemble initial entity relationship by expanding on modeling concepts.
- 19.0 Consider the degree and optionality of relationships of entities.
- 20.0 Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and Many-to-Many (M:M) relationships for building entity relationship diagrams.
- 21.0 Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships.
- 22.0 Demonstrate proficiency in designing and adding complexity to a logical relationship.
- 23.0 Apply the complex logical information by fine tuning entities and the process for relating them.
- 24.0 Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved.
- 25.0 Demonstrate proficiency in the technique of normalization by labeling and organizing all items in a database in such a way as to prevent any confusion of mistakes.
- 26.0 Demonstrate proficiency in table normalization by combining the techniques of an entity relationship model or a top-down, business approach to data with normalization or a bottom-up mathematical approach to data.
- 27.0 Apply blueprint principles to begin designing a tool for creating a web-based interface access to a database.
- 28.0 Extend the logical presentation model by normalizing the data and mapping the management system.
- 29.0 Apply techniques for building a storage management system by creating a website using templates and wizards.

- 30.0 Demonstrate storage closet design and functionality by constructing a group business presentation.
- 31.0 Demonstrate comprehension of database modeling competency through group presentation.
- 32.0 Demonstrate comprehension that the database management software is a system for organizing the storage unit (or database) according to business needs and rules, through data integrity constraints.
- 33.0 Demonstrate comprehension of aspects of SQL Language interface by writing basic SQL statements.
- 34.0 Demonstrate proficiency working with columns, characters, and rows in SQL.
- 35.0 Demonstrate proficiency in using SQL comparison operators.
- 36.0 Demonstrate proficiency in using logical comparisons and precedence rules.
- 37.0 Demonstrate proficiency using SQL single row functions.
- 38.0 Demonstrate proficiency displaying data from multiple tables.
- 39.0 Demonstrate proficiency aggregating data using GROUP functions.
- 40.0 Demonstrate proficiency utilizing subqueries.
- 41.0 Demonstrate proficiency producing readable output with SQL language interface, reporting tool and manipulating data.
- 42.0 Demonstrate proficiency creating and managing database objects.
- 43.0 Demonstrate proficiency altering tables and constraints implementing views.
- 44.0 Demonstrate mastery of creating and implementing views, synonyms, indexes and other database objects.
- 45.0 Demonstrate ability to control user access and SQL language interface and reporting tool.
- 46.0 Demonstrate comprehension of bundling features of SQL.
- 47.0 Demonstrate comprehension working with composite data types by writing executable script files.
- 48.0 Describe the differences between SQL and PL/SQL.
- 49.0 Create SQL blocks.
- 50.0 Use variables in PL/SQL.
- 51.0 Recognize lexical units.
- 52.0 Recognize data types.
- 53.0 Use scalar data types.
- 54.0 Use various types of joins.
- 55.0 Use SQL group functions and subqueries.
- 56.0 Write SQL executable statements.
- 57.0 Use nested blocks and variable scope.
- 58.0 Use good programming practices.
- 59.0 Write DML statements to manipulate data.
- 60.0 Retrieve data using SQL.
- 61.0 Manipulate data using SQL.
- 62.0 Use transaction control statements.
- 63.0 Use IF conditional control statements.
- 64.0 Use CASE conditional control statements.
- 65.0 Use basic loop iterative control statements.
- 66.0 Use WHILE and FOR loop iterative control statements.
- 67.0 Use nested loop iterative control statements.
- 68.0 Use explicit cursors.
- 69.0 Use explicit cursor attributes.
- 70.0 Use cursor for loops.

- 71.0 Use cursors with parameters.
- 72.0 Use cursors for update transactions.
- 73.0 Use multiple cursors.
- 74.0 Handle exceptions.
- 75.0 Trap database server exceptions.
- 76.0 Trap user-defined exceptions.
- 77.0 Create procedures.
- 78.0 Use parameters in procedures.
- 79.0 Pass parameters.
- 80.0 Create stored functions.
- 81.0 Use functions in SQL statements.
- 82.0 Manage procedures and functions.
- 83.0 Manage object privileges.
- 84.0 Use invoker's rights.
- 85.0 Create packages.
- 86.0 Manage package constructs.
- 87.0 Use advanced package concepts.
- 88.0 Manage persistent state of package variables.
- 89.0 Use vendor-supplied packages.
- 90.0 Understand dynamic SQL.
- 91.0 Understand triggers.
- 92.0 Create DML triggers.
- 93.0 Create DDL and database event triggers.
- 94.0 Manage triggers.
- 95.0 Use large object data types.
- 96.0 Manage binary types.
- 97.0 Manage indexes.
- 98.0 Manage dependencies.
- 99.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 100.0 Solve problems using critical thinking skills, creativity and innovation.
- 101.0 Use information technology tools.
- 102.0 Describe the roles within teams, work units, departments, organizations, interorganizational systems, and the larger environment.
- 103.0 Describe the importance of professional ethics and legal responsibilities.
- 104.0 Understand network systems.
- 105.0 Program a database application.
- 106.0 Utilize the basic concepts of database design.
- 107.0 Utilize SQL and UNION queries.
- 108.0 Implement program statements using objects.
- 109.0 Utilize debugging tools and write error handlers.
- 110.0 Demonstrate file I/O.
- 111.0 Create forms and identify all the properties of a form.
- 112.0 Manipulate data using object models.

- 113.0 Develop custom controls.
- 114.0 Utilize API functions.
- 115.0 Demonstrate database replication and implement database replication using programming tools.
- 116.0 Analyze and implement security options.
- 117.0 Implement client/server applications.
- 118.0 Optimize the performance of a database.
- 119.0 Perform application distribution.
- 120.0 Test and debug databases.
- 121.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 122.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 123.0 Explain the importance of employability skill and entrepreneurship skills.
- 124.0 Responsible use of technology and information.

Florida Department of Education
Student Performance Standards

Program Title: Database and Programming Essentials
Career Certificate Program Number: Y300100

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: CTS0046
Occupational Completion Point: A
Database Fundamentals – 150 Hours – SOC Code 15-1141

15.0	Develop an awareness of the changes taking place in the information age and how they fit into an evolving society. The student will be able to:
15.01	Cite examples of jobs, salary, and opportunities he/she will have as a result of participating in the Academy.
15.02	Describe the role a database plays in a business and predict its evolution.
15.03	Demonstrate the difference between "data" and "information."
15.04	Understand the importance of clear communication when discussing business informational requirements.
15.05	Identify important historical contributions in database development and design.
16.0	Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs. The student will be able to:
16.01	Identify and analyze the phases of the database development process.
16.02	Explain what conceptual data modeling and database design involve.
16.03	Compare database development process with that of the application development process.
16.04	Distinguish between a conceptual model and a physical implementation.
17.0	Develop the process of creating an entity by identifying relationships. The student will be able to:
17.01	Identify and model various types of entities.
17.02	Identify naming and drawing conventions for entities.
17.03	Sequence the steps that are necessary for creation of an entity.
17.04	Analyze and model the relationships between entities.
18.0	Formulate and assemble initial entity relationship by expanding on modeling concepts. The student will be able to:
18.01	Analyze and model attributes.
18.02	Identify unique identifiers for each entity.
18.03	Develop an entity relationship diagram tagging attributes with optionality.
19.0	Consider the degree and optionality of relationships of entities. The student will be able to:
19.01	Create entity relationship models based on information requirements and interviews.
19.02	Differentiate between one-to-many, many-to-many and one-to-one relationships.

19.03	Identify relationship between two entities by reading a given diagram.
19.04	Create a relationship between instances of the same entity.
19.05	Read an entity relationship model in order to validate it.
20.0	Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams. The student will be able to:
20.01	Identify the significance of an attribute that has more than one value for each entity instance.
20.02	Evaluate appropriate methods of storing validation rules for attributes.
20.03	Recognize unique identifiers inherited from other entities.
20.04	Sequence the steps involved in resolving a many-to-many relationship.
21.0	Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships. The student will be able to:
21.01	Validate that an attribute is properly placed based upon its dependence on its entity's unique identifier (UID).
21.02	Resolve many-to-many relationships with intersection entities.
21.03	Model advanced data constructs including recursive relationships, subtypes, and exclusive relationships.
21.04	Create exclusive entities and relationships by using subtypes and arcs, respectively.
21.05	Identify initial layout for presentation and generate a list of action items for members of group.
21.06	Develop an entity relationship model using subtypes, supertypes and an exclusive arc.
22.0	Demonstrate proficiency in designing and adding complexity to a logical relationship. The student will be able to:
22.01	Revise an entity relationship model according to the diagramming techniques covered in this course.
22.02	Define and give examples of hierarchical and recursive relationships.
22.03	Differentiate between transferable and non-transferable relationships.
22.04	Deliver a professional, formal business style presentation.
22.05	Evaluate and critique presentation layout, design and performance.
22.06	Construct a model using both recursion and hierarchies to express the same conceptual meaning.
22.07	Distinguish between using date as an attribute and DAY as an entity.
23.0	Apply complex logical information by fine-tuning entities and the process for relating them. The student will be able to:
23.01	Describe a relational database and how it differs from other database systems.

23.02	Define primary keys and foreign keys and describe their purpose.
23.03	Describe what data integrity refers to and list some constraints.
23.04	Explain how database design fits into the database development process.
23.05	Translate an entity-relationship model into a relational database design.
24.0	Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved. The student will be able to:
24.01	Demonstrate ability to implement steps for mapping entity relationship models.
24.02	Document an initial database design on table instance charts.
24.03	Recognize raw data and evaluate the steps for creating a data group in unnormalized form.
25.0	Demonstrate proficiency in the technique of normalization by labeling and organizing all items in a database in such a way as to prevent any confusion or mistakes. The student will be able to:
25.01	Differentiate between normalized and unnormalized data.
25.02	Move data from an unnormalized form through to a third normal form.
25.03	Demonstrate ability to test data groups for third normal form compliance.
25.04	Identify optimized data groups from given groups of normalized data.
26.0	Demonstrate proficiency in table normalization by combining the techniques of an entity relationship model or a top-down, business approach to data with normalization or a bottom-up mathematical approach to data. The student will be able to:
26.01	Compare the normalization and logical techniques in terms of strengths and weaknesses.
26.02	Further define normalization and explain its benefits.
26.03	Place tables in third normal form.
26.04	Explain how conceptual data modeling rules ensure normalized tables.
26.05	Specify referential integrity constraints and design indexes.
27.0	Apply blueprint principles to begin designing a tool for creating a web-based interface access to a database. The student will be able to:
27.01	Evaluate the transformation of business requirements into an initial layout and design for a database.
27.02	Construct simple webpage design for personal work folder.
27.03	Evaluate existing websites and determine quality of design.
28.0	Extend the logical presentation model by normalizing the data and mapping the management system. The student will be able to:
28.01	Formulate a plan of action for the Database Project using skills previously learned in this course.

28.02	Normalize a logical to the third normal form (3NF).
28.03	Create a table in the database using a database authoring tool.
28.04	Demonstrate ability to edit tables using a database authoring tool.
28.05	Create forms that will display the table components created with a database authoring tool.
29.0	Apply techniques for building a storage management system by creating a website using templates and wizards. The student will be able to:
29.01	Create a website that displays the database project home.
29.02	Link a website to create a web-enabled interface to the industry database.
29.03	Edit the forms created and specify appropriate field labels for data entry.
30.0	Demonstrate storage closet design and functionality by constructing a group business presentation. The student will be able to:
30.01	Evaluate and generate criteria for a formal, business presentation.
30.02	Construct a persuasive group presentation using the guidelines set forth in class.
31.0	Demonstrate comprehension of database modeling competency through group presentation. The student will be able to:
31.01	Deliver a formal business presentation for the class that discusses an entity-relationship model and initial database design.
31.02	Demonstrate the functionality of the database and the layout/design capabilities of a database authoring tool.
31.03	Self-assess learning experience through the presentation and demonstration of their final database project.
31.04	Prepare appropriate end user documentation.
32.0	Demonstrate comprehension that the database management software is a system for organizing the storage unit (or database) according to business needs and rules, through data integrity constraints. The student will be able to:
32.01	Identify the structural elements of a relational database table.
32.02	List and describe the system development life cycle.
32.03	Describe the industry implementation of the relational database management system (RDBMS) and object relational database management system (ORDBMS).
32.04	Explain how SQL and languages that extend SQL are used in the industry product set.
32.05	Identify the advantages of a database management system.
33.0	Demonstrate comprehension of aspects of SQL language interface by writing basic SQL statements. The student will be able to:
33.01	List the capabilities of SQL SELECT statements.
33.02	Execute a basic select statement.

33.03	Differentiate between SQL statements and language commands that extend SQL.
34.0	Demonstrate proficiency working with columns, characters, and rows in SQL. The student will be able to:
34.01	Apply the concatenation operator to link columns to other columns, arithmetic expressions, or constant values to create a character expression.
34.02	Use column aliases to rename columns in the query result.
34.03	Eliminate duplicate rows in the query result.
34.04	Display the structure of a table.
34.05	Apply SQL syntax to restrict the rows returned from a query.
34.06	Demonstrate application of the WHERE clause syntax.
34.07	Construct and produce output using a SQL query containing character strings and date values.
35.0	Demonstrate proficiency in using SQL comparison operators. The student will be able to:
35.01	Apply the proper comparison operator to return a desired result.
35.02	Demonstrate proper use of BETWEEN, IN, and LIKE conditions to return a desired result.
35.03	Distinguish between zero and the value of NULL as unavailable, unassigned, unknown, or inapplicable.
35.04	Explain the use of comparison conditions and NULL.
36.0	Demonstrate proficiency in using logical comparisons and precedence rules. The student will be able to:
36.01	Evaluate logical comparisons to restrict the rows returned based on two or more conditions.
36.02	Apply the rules of precedence to determine the order in which expressions are evaluated and calculated.
36.03	Construct a query to order a results set for single or multiple columns.
36.04	Construct a query to sort a results set in ascending or descending order.
37.0	Demonstrate proficiency using SQL single row functions. The student will be able to:
37.01	Perform calculations on data.
37.02	Modify individual data items.
37.03	Use character, number and date functions in SELECT statements.
37.04	Format data and numbers for display purposes.
37.05	Convert column data types.

38.0	Demonstrate proficiency displaying data from multiple tables. The student will be able to:
38.01	Construct select statements to access data from more than one table using equality and non-equality joins.
38.02	Use outer joins through viewing data that generally does not meet a join condition.
38.03	Join a table to itself.
39.0	Demonstrate proficiency aggregating data using GROUP functions. The student will be able to:
39.01	Identify the available group functions and describe their use.
39.02	Demonstrate the ability to group data through the use of the GROUP BY clause.
39.03	Demonstrate the ability to include or exclude grouped rows by using the HAVING clause.
40.0	Demonstrate proficiency utilizing subqueries. The student will be able to:
40.01	Write a query with an embedded subquery.
40.02	Evaluate and perform a multiple-column subquery.
40.03	Describe and explain the behavior of subqueries when null values are retrieved.
40.04	Create a subquery in a FROM clause.
41.0	Demonstrate proficiency producing readable output with SQL language interface, reporting tool, and data manipulation language. The student will be able to:
41.01	Produce queries that require an input variable.
41.02	Customize the SQL language interface and reporting environment using SET commands for control.
41.03	Produce more readable output through the use of the column and break commands.
41.04	Describe data manipulation language (DML) and describe various DML statements.
41.05	Utilize data manipulation language (DML) through inserting, updating and deleting rows from a table.
41.06	Control transactions using COMMIT and ROLLBACK statements.
42.0	Demonstrate proficiency creating and managing database objects. The student will be able to:
42.01	Describe the main database objects.
42.02	Create tables and alter their definitions.
42.03	Describe the data types that can be used when specifying column definition.
43.0	Demonstrate proficiency altering tables and constraints implementing views. The student will be able to:

43.01	Create, drop, rename and truncate tables using SQL.
43.02	Identify and describe various constraints including not null, unique, primary key, foreign key, and check.
43.03	Create and maintain constraints including adding, dropping, enabling, disabling, and cascading.
43.04	Recognize views and explain how they are created, how they retrieve data and how they perform DML operations.
44.0	Demonstrate mastery of creating and implementing views, synonyms, indexes and other database objects. The student will be able to:
44.01	Create views, retrieve data through a view, alter the definition of a view and drop a view.
44.02	Categorize information by using Top-N queries to retrieve specified data.
44.03	Identify the features of a sequence and display sequence values using a data dictionary view.
44.04	Identify the characteristics of a cached sequence.
44.05	Modify and remove a sequence using a SQL statement.
44.06	Identify the features of private and public synonyms.
44.07	Identify characteristics of an index and describe different types.
44.08	Create and remove an index using a SQL statement.
45.0	Demonstrate ability to control user access and SQL language interface and reporting tool. The student will be able to:
45.01	Identify the features of database security.
45.02	Create users using SQL statements.
45.03	Grant and revoke object privileges using a SQL language interface and reporting tool.
46.0	Demonstrate comprehension of bundling features of SQL. The student will be able to:
46.01	List and describe the benefits of extensions to SQL.
46.02	Recognize the basic SQL block and its sections.
46.03	Declare SQL variables and describe their significance.
46.04	Execute a SQL block.
47.0	Demonstrate comprehension working with composite data types by writing executable script files. The student will be able to:
47.01	Recognize the significance of the executable section and decide when to use it.
47.02	Write statements in the executable section.
47.03	Describe the rules of nested blocks.

47.04 Identify and utilize appropriate coding conventions.

47.05 Create a script that will insert, update, merge and delete data in a table.

Course Number: CTS0047
Occupational Completion Point: A
Specialized Database Programming – 150 Hours – SOC Code 15-1141

48.0 Describe the differences between SQL and PL/SQL. The student will be able to:

48.01 Describe PL/SQL.

48.02 Differentiate between SQL and PL/SQL.

48.03 Explain the need for and benefits of PL/SQL.

49.0 Create SQL blocks. The student will be able to:

49.01 Describe the structure of a SQL block.

49.02 Identify the different types of SQL blocks.

49.03 Identify SQL programming environments.

49.04 Create and execute an anonymous block.

49.05 Output messages in PL/SQL.

50.0 Use variables in PL/SQL. The student will be able to:

50.01 Describe how variables are used in PL/SQL.

50.02 Identify the syntax for using variables.

50.03 Declare and initialize variables.

50.04 Assign new values to variables.

51.0 Recognize lexical units. The student will be able to:

51.01 Describe the types of lexical units in PL/SQL.

51.02 Describe identifiers and identify valid and invalid identifiers.

51.03 Describe and identify reserved words, delimiters, literals, and comments.

52.0 Recognize data types. The student will be able to:

52.01 Describe the data type categories.

52.02 Give examples of scalar, composite, and large object (LOB) data types.

52.03 Identify when an object becomes eligible for garbage collection.

53.0 Use scalar data types. The student will be able to:

53.01	Declare and use scalar data types.
53.02	Define guidelines for declaring and initializing variables.
53.03	Describe the benefits of anchoring data types with the %TYPE attribute.
54.0	Use various types of joins. The student will be able to:
54.01	Construct and execute SELECT statements using an equijoin.
54.02	Construct and execute SELECT statements using a non-equijoin.
54.03	Construct and execute SELECT statements using an outer join.
54.04	Construct and execute SELECT statements that result in a cross join.
55.0	Use SQL group functions and subqueries. The student will be able to:
55.01	Construct and execute an SQL query using group functions to determine a sum total, an average amount, and a maximum value.
55.02	Construct and execute an SQL query that groups data based on specified criteria.
55.03	Construct and execute an SQL query that contains a WHERE clause using a single-row subquery.
55.04	Construct and execute an SQL query that contains a WHERE clause using a multiple-row subquery.
56.0	Write SQL executable statements. The student will be able to:
56.01	Construct variable assignment statements.
56.02	Construct statements using built-in SQL functions.
56.03	Differentiate between implicit and explicit data type conversions.
56.04	Describe when implicit data type conversions take place.
56.05	List the drawbacks of implicit data type conversions.
56.06	Construct statements using functions to explicitly convert data types.
56.07	Construct statements using operators.
57.0	Use nested blocks and variable scope. The student will be able to:
57.01	Understand the scope and visibility of variables.
57.02	Write nested blocks and qualify variables with labels.
57.03	Describe the scope of an exception.
57.04	Describe the effect of exception propagation in nested blocks.

58.0	Use good programming practices. The student will be able to:
58.01	List examples of good programming practices.
58.02	Insert comments into SQL code.
58.03	Follow formatting guidelines when writing code.
59.0	Write DML statements to manipulate data. The student will be able to:
59.01	Construct and execute a DML statement to insert data into a table.
59.02	Construct and execute a DML statement to update data in a table.
59.03	Construct and execute a DML statement to delete data from a table.
59.04	Construct and execute a DML statement to merge data into a table.
60.0	Retrieve data using PL/SQL. The student will be able to:
60.01	Identify SQL statements that can be directly included in an executable block.
60.02	Construct and execute an INTO clause to hold values returned by a single-row SELECT statement.
60.03	Construct statements that retrieve data.
61.0	Manipulate data using PL/SQL. The student will be able to:
61.01	Construct and execute SQL statements that manipulate data with DML statements.
61.02	Describe when to use implicit or explicit cursors.
61.03	Create code to use SQL implicit cursor attributes to evaluate cursor activity.
62.0	Use transaction control statements. The student will be able to:
62.01	Define a transaction and give an example.
62.02	Construct and execute a transaction control statement.
63.0	Use IF conditional control statements. The student will be able to:
63.01	Construct and use an IF statement.
63.02	Construct and use an IF -ELSIF statement.
63.03	Create SQL to handle null conditions in an IF statement.
64.0	Use CASE conditional control statements. The student will be able to:
64.01	Construct and use CASE statements.

64.02	Construct and use CASE expressions.
64.03	Include syntax to handle null conditions in a CASE statement.
64.04	Include syntax to handle Boolean conditions in IF and CASE statements.
65.0	Use basic LOOP iterative control statements. The student will be able to:
65.01	Describe the types of LOOP statements and their uses.
65.02	Create SQL containing a basic loop and an EXIT statement.
65.03	Create SQL containing a basic loop and an EXIT statement with conditional termination.
66.0	Use WHILE and FOR loop iterative control statements. The student will be able to:
66.01	Construct and use the WHILE looping construct.
66.02	Construct and use the FOR looping construct.
66.03	Describe when a WHILE loop is used.
66.04	Describe when a FOR loop is used.
67.0	Use nested loop iterative control statements. The student will be able to:
67.01	Construct and execute SQL using nested loops.
67.02	Evaluate a nested loop construct and identify the exit point.
68.0	Use explicit cursors. The student will be able to:
68.01	List the guidelines for declaring and controlling explicit cursors.
68.02	Create SQL code to open a cursor and fetch a piece of data into a variable.
68.03	Use a simple loop to fetch multiple rows from a cursor.
68.04	Create SQL code to close a cursor.
69.0	Use explicit cursor attributes. The student will be able to:
69.01	Define a record structure.
69.02	Create SQL code to process the row of an active set using record types in cursors.
69.03	Use cursor attributes to retrieve information about the state of an explicit cursor.
70.0	Use cursor FOR loops. The student will be able to:
70.01	List and explain the benefits of using cursor FOR loops.

70.02	Create SQL code to declare a cursor and manipulate it in a FOR loop.
70.03	Create SQL code containing a cursor FOR loop using a subquery.
71.0	Use cursors with parameters. The student will be able to:
71.01	List the benefits of using parameters with cursors.
71.02	Create SQL code to declare and manipulate a cursor with a parameter.
72.0	Use cursors for UPDATE transactions. The student will be able to:
72.01	Create SQL code to lock rows before an update using the appropriate clause.
72.02	Explain the effect of using NOWAIT in an update cursor declaration.
72.03	Create SQL code to use the current row of the cursor in an UPDATE or DELETE statement.
73.0	Use multiple cursors. The student will be able to:
73.01	Explain the need for using multiple cursors to produce multilevel reports.
73.02	Create SQL code to declare and manipulate multiple cursors within nested loops.
73.03	Create SQL code to declare and manipulate multiple cursors using parameters.
74.0	Handle exceptions. The student will be able to:
74.01	Describe the advantages of including exception handling code.
74.02	Describe the purpose of an EXCEPTION section in a SQL block.
74.03	Create SQL code to include an EXCEPTION section.
74.04	List the guidelines for exception handling.
75.0	Trap database server exceptions. The student will be able to:
75.01	Distinguish between errors defined by the database server and those defined by the programmer.
75.02	Differentiate between errors that are handled implicitly and explicitly by the database server.
75.03	Write SQL code to trap a predefined server error.
75.04	Write SQL code to trap a non-predefined database server error.
75.05	Write SQL code to identify an exception by error code and by error message.
76.0	Trap user-defined exceptions. The student will be able to:
76.01	Write SQL code to name a user-defined exception.

76.02	Write SQL code to raise an exception.
76.03	Write SQL code to handle a raised exception.
76.04	Write SQL code to use RAISE_APPLICATION_ERROR.
77.0	Create procedures. The student will be able to:
77.01	Differentiate between anonymous blocks and subprograms.
77.02	Identify the benefits of using subprograms.
77.03	Describe a stored procedure.
77.04	Create a procedure.
77.05	Describe how a stored procedure is invoked.
78.0	Use parameters in procedures. The student will be able to:
78.01	Describe how parameters contribute to a procedure.
78.02	Define a parameter.
78.03	Create a procedure using a parameter.
78.04	Invoke a procedure that has parameters.
78.05	Distinguish between formal and actual parameters.
79.0	Pass parameters. The student will be able to:
79.01	List the types of parameter modes.
79.02	Create a procedure that passes parameters.
79.03	Identify three methods for passing parameters.
79.04	Describe the DEFAULT option for parameters.
80.0	Create stored functions. The student will be able to:
80.01	Describe the difference between a stored procedure and a stored function.
80.02	Create a SQL block containing a function.
80.03	Identify ways in which functions may be invoked.
80.04	Create a SQL block that invokes a function that has parameters.
81.0	Use functions in SQL statements. The student will be able to:

81.01	Describe where user-defined functions can be called from within an SQL statement.
81.02	Describe the restrictions on calling functions from SQL statements.
81.03	Describe the purpose of the Data Dictionary.
81.04	Differentiate between the three types of Data Dictionary views.
81.05	Write SQL SELECT statements to retrieve information from the Data Dictionary.
81.06	Explain the use of DICTIONARY as a Data Dictionary search engine.
82.0	Manage procedures and functions. The student will be able to:
82.01	Describe how exceptions are propagated.
82.02	Remove a function and a procedure.
82.03	Use Data Dictionary views to identify and manage stored procedures.
83.0	Manage object privileges. The student will be able to:
83.01	List and explain several object privileges.
83.02	Explain the function of the EXECUTE object privilege.
83.03	Write SQL statements to grant and revoke object privileges.
84.0	Use invoker's rights. The student will be able to:
84.01	Contrast invoker's rights with definer's rights.
84.02	Create a procedure that uses invoker's rights.
85.0	Create packages. The student will be able to:
85.01	Describe a package, its components, and the reasons for use.
85.02	Create packages containing related variables, cursors, constants, exceptions, procedures, and functions.
85.03	Create a SQL block that invokes a package construct.
86.0	Manage package constructs. The student will be able to:
86.01	Explain the difference between public and private package constructs.
86.02	Designate a package construct as either public or private.
86.03	Specify the syntax to drop a package.
86.04	Identify Data Dictionary views used to manage packages.

86.05	Identify the guidelines for using packages.
87.0	Use advanced package concepts. The student will be able to:
87.01	Write packages that use the overloading feature.
87.02	Write packages that use forward declarations.
87.03	Explain the purpose of a package initialization block.
87.04	Identify restrictions on using packaged functions in SQL statements.
88.0	Manage persistent state of package variables. The student will be able to:
88.01	Identify persistent states of package variables.
88.02	Control the persistent state of a package cursor.
89.0	Use vendor-supplied packages. The student will be able to:
89.01	Describe common uses for the vendor-supplied package.
89.02	Use the syntax to specify messages for the vendor-supplied package.
89.03	Describe the purpose for the vendor-supplied package.
89.04	Identify the exceptions used in conjunction with the vendor-supplied package.
90.0	Understand dynamic SQL. The student will be able to:
90.01	Identify the stages through which all SQL statements pass.
90.02	Describe the reasons for using dynamic SQL to create an SQL statement.
90.03	List four SQL statements supporting Native Dynamic SQL.
90.04	Describe the benefits of Execute Immediate over Dynamic SQL.
91.0	Understand triggers. The student will be able to:
91.01	Describe database triggers and their uses.
91.02	Differentiate between a database trigger and an application trigger.
91.03	List the guidelines for using triggers.
91.04	Compare and contrast database triggers and stored procedures.
92.0	Create DML triggers. The student will be able to:
92.01	Create a DML trigger and identify its components.

92.02	Create a statement level trigger.
92.03	Describe the trigger firing sequence options.
92.04	Create a DML trigger that uses conditional predicates.
92.05	Create a row level trigger.
92.06	Create a row level trigger that uses OLD and NEW qualifiers.
92.07	Create an INSTEAD OF trigger.
93.0	Create DDL and database event triggers. The student will be able to:
93.01	Describe the events that cause DDL and database event triggers to fire.
93.02	Create a trigger for a DDL statement.
93.03	Create a trigger for a database event.
93.04	Describe the functionality of the CALL statement.
93.05	Describe the cause of a mutating table.
94.0	Manage triggers. The student will be able to:
94.01	View trigger information in the Data Dictionary.
94.02	Disable and enable a database trigger.
94.03	Remove a trigger from the database.
95.0	Use large object data types. The student will be able to:
95.01	Compare and contrast LONG and LOB data types.
95.02	Describe LOB data types and how they are used.
95.03	Differentiate between internal and external LOBs.
95.04	Create and maintain LOB data types.
95.05	Migrate data from LONG to LOB.
96.0	Manage binary types. The student will be able to:
96.01	Define binary types and the binary types column data type.
96.02	Create directory objects and view them in the Data Dictionary.
96.03	Manage and manipulate binary types.

97.0	Manage indexes. The student will be able to:
97.01	Create and manipulate user-defined SQL records.
97.02	Create an INDEX.
97.03	Describe the difference between records, tables, and tables of records.
98.0	Manage dependencies. The student will be able to:
98.01	Describe the implications of procedural dependencies.
98.02	Contrast dependent objects and referenced objects.
98.03	View dependency information in the Data Dictionary.
98.04	Use a script to create the objects required to display dependencies.
98.05	Use views to display dependencies.
98.06	Describe when automatic recompilation occurs.
98.07	Describe how to minimize dependency failures.
99.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
99.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
99.02	Locate, organize and reference written information from various sources.
99.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
99.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
99.05	Apply active listening skills to obtain and clarify information.
99.06	Develop and interpret tables and charts to support written and oral communications.
99.07	Exhibit public relations skills that aid in achieving customer satisfaction.
99.08	Evaluate program designs and implementations written by others for readability and usability.
100.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
100.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
100.02	Employ critical thinking and interpersonal skills to resolve conflicts.
100.03	Identify and document workplace performance goals and monitor progress toward those goals.
100.04	Conduct technical research to gather information necessary for decision-making.

101.0	Use information technology tools. The student will be able to:
101.01	Use personal information management (PIM) applications to increase workplace efficiency.
101.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
101.03	Employ computer operations applications to access, create, manage, integrate, and store information.
101.04	Employ collaborative/groupware applications to facilitate group work.
102.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. The student will be able to:
102.01	Describe the nature and types of business organizations.
102.02	Explain the effect of key organizational systems on performance and quality.
102.03	List and describe quality control systems and/or practices common to the workplace.
102.04	Explain the impact of the global economy on business organizations.
103.0	Describe the importance of professional ethics and legal responsibilities. The student will be able to:
103.01	Evaluate and justify decisions based on ethical reasoning.
103.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
103.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
103.04	Interpret and explain written organizational policies and procedures.
104.0	Understand network systems. The student will be able to:
104.01	Identify and select the most appropriate file format based on trade-offs (e.g., open file formats, text, proprietary and binary formats, compression and encryption formats).
104.02	Describe the issues that impact network functionality (e.g., latency, bandwidth, firewalls and server capability).
104.03	Describe common network protocols, such as IP, TCP, SMTP, HTTP, and FTP, and how these are applied by client-server and peer-to-peer networks.

Course Number: CTS0067
Occupational Completion Point: A
Specialized Database Applications – 150 Hours – SOC Code 15-1141

105.0 Program a database application. The student will be able to:

105.01 Utilize loop statements.

105.02 Given a scenario, use arithmetic, comparison, and pattern-matching operators.

105.03 Create user-defined functions.

105.04 Utilize common built-in functions.

105.05 Declare variables in modules and procedures.

105.06 Declare arrays, and initialize elements of arrays.

105.07 Declare and use object variables and collections, and use their associated properties and methods.

105.08 Declare symbolic constants, and make them available locally or publicly.

105.09 Respond to events.

106.0 Utilize the basic concepts of database design. The student will be able to:

106.01 Apply basic concepts of normalization.

106.02 Utilize the cascade update and cascade delete options.

107.0 Utilize SQL and UNION queries. The student will be able to:

107.01 Utilize SQL to write common queries.

107.02 Refer to objects by using SQL.

107.03 Utilize union queries.

108.0 Implement program statements using objects. The student will be able to:

108.01 Determine when to use data access objects.

108.02 Differentiate between objects and collections.

108.03 Write statements that access and modify database objects.

108.04 Utilize data access objects.

108.05	Select appropriate methods and property settings for use with specified objects.
109.0	Utilize debugging tools and write error handlers. The student will be able to:
109.01	Trap errors.
109.02	Utilize debugging tools to suspend program execution, and to examine, step through, and reset execution of code.
109.03	Debug code samples.
109.04	Utilize the Debugger to monitor variable values.
109.05	Write an error handler.
110.0	Demonstrate file I/O. The student will be able to:
110.01	Read from files.
110.02	Write to files.
110.03	Utilize record locking.
111.0	Create forms and identify all the properties of a form. The student will be able to:
111.01	Choose form-specific and report-specific properties to set.
111.02	Choose control properties to set.
111.03	Assign event-handling procedures to controls in a form.
111.04	Define and create form and report modules.
111.05	Identify the scope of a form or report module.
111.06	Open multiple instances of a form, and refer to them.
111.07	Assign values to form properties.
111.08	Use form methods.
112.0	Manipulate data using object models. The student will be able to:
112.01	Connect to a data source.
112.02	Open a recordset.
112.03	Insert, update, delete and find data.

113.0	Develop custom controls. The student will be able to:
113.01	Set properties for custom controls.
113.02	Customize user interface controls.
114.0	Utilize API functions. The student will be able to:
114.01	Properly declare functions.
114.02	Use the by value and by reference parameters.
115.0	Demonstrate database replication and implement database replication using programming tools. The student will be able to:
115.01	Make a database replicable.
115.02	View a synchronization schedule.
115.03	Explain the purpose of the Replication ID.
115.04	Explain how synchronization conflicts are resolved.
115.05	Identify the advantages of using replication of synchronization.
115.06	Identify the changes that the database engine makes when it converts a nonreplicable database into replicable database.
116.0	Analyze and implement security options. The student will be able to:
116.01	Analyze a scenario, and recommend an appropriate type of security.
116.02	Explain the steps for implementing security.
116.03	Analyze code to ensure that it sets security options.
116.04	Write code to implement security options.
117.0	Implement client/server applications. The student will be able to:
117.01	Demonstrate SQL pass through queries and application queries.
117.02	Access external data.
117.03	Trap errors that are generated by the server.
117.04	Optimize connections.
117.05	Optimize performance for a given client/server application.

118.0	Optimize the performance of a database. The student will be able to:
118.01	Differentiate between single-field and multiple-field indexes.
118.02	Optimize queries.
118.03	Restructure queries to allow faster execution.
118.04	Optimize performance in distributed applications.
118.05	Optimize performance for client/server applications.
119.0	Perform application distribution. The student will be able to:
119.01	Prepare an application for distribution.
119.02	Analyze various methods to distribute a client/server application.
119.03	Distribute custom controls with an application.
119.04	Provide online help.
120.0	Test and debug databases. The student will be able to:
120.01	Implement error handling.
120.02	Test and debug library databases.
121.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. The student will be able to:
121.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
121.02	Explain emergency procedures to follow in response to workplace accidents.
121.03	Create a disaster and/or emergency response plan.
122.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
122.01	Employ leadership skills to accomplish organizational goals and objectives.
122.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
122.03	Conduct and participate in meetings to accomplish work tasks.
122.04	Employ mentoring skills to inspire and teach others.
123.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:

123.01 Identify and demonstrate positive work behaviors needed to be employable.
123.02 Develop personal career plan that includes goals, objectives, and strategies.
123.03 Examine licensing, certification, and industry credentialing requirements.
123.04 Maintain a career portfolio to document knowledge, skills, and experience.
123.05 Evaluate and compare employment opportunities that match career goals.
123.06 Identify and exhibit traits for retaining employment.
123.07 Identify opportunities and research requirements for career advancement.
123.08 Research the benefits of ongoing professional development.
123.09 Examine and describe entrepreneurship opportunities as a career planning option.
124.0 Responsible use of technology and information. The student will be able to:
124.01 Compare and contrast appropriate and inappropriate social networking behaviors.
124.02 Describe and demonstrate ethical and responsible use of modern communication media and devices.
124.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 11, Language 11, and Reading 11. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Applied Information Technology
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y300400
CIP Number	0511010302
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to computer application skills including computer hardware, software applications, web applications, computer programming, webpage design and advanced web tools, systems support and maintenance, network concepts, relational database concepts, multimedia tools, cybersecurity ; extensive exploration of information technology careers; strategies for success including goal setting, study skills, organizing skills, learning styles, employability skills, and service learning; and core academic skills with a strong emphasis on effective communication skills.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of eight occupational completion points. To complete this program, students must complete OCP A and OCP B, plus one or more of the subsequent OCPs (C-H).

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0072	IT & Web Systems	BUS ED 1 @2 COMPU SCI 6 INFO TECH 7G	300 hours	15-1151
C	CTS0063	Database Essentials		150 hours	15-1151
D	CTS0030	Programming Fundamentals		150 hours	15-1151
E	CTS0073	Web Development Fundamentals		150 hours	15-1151
F	CTS0075	Multimedia Systems		150 hours	15-1151
G	CTS0025	Computer Networking		150 hours	15-1151
H	CTS0068	Cybersecurity Essentials		150 hours	15-1151

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Demonstrate proficiency on the principles of design.
- 16.0 Demonstrate proficiency planning an effective website.
- 17.0 Demonstrate proficiency using web development tools and techniques.
- 18.0 Demonstrate proficiency using specialized web design software.
- 19.0 Demonstrate proficiency gathering and preparing web content.
- 20.0 Demonstrate an awareness of preparing a website for launch.
- 21.0 Explain motherboard components, types and features.
- 22.0 Explain the purpose and characteristics of CPUs and their features.
- 23.0 Perform installation and configuration activities.
- 24.0 Perform the process for problem diagnostics and problem resolution through wireless, infrared, telephone, e-mail, remote access, or direct contact.
- 25.0 Demonstrate knowledge of presentation production issues.
- 26.0 Demonstrate proficiency using computer networks.
- 27.0 Demonstrate proficiency communicating over the Internet.
- 28.0 Demonstrate proficiency in troubleshooting, repair and maintenance of hardware.
- 29.0 Demonstrate proficiency in the basic principles of security concepts and technologies.
- 30.0 Demonstrate proficiency in operational procedures as they relate to computer equipment and components.
- 31.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.

- 32.0 Solve problems using critical thinking skills, creativity and innovation.
- 33.0 Use information technology tools.
- 34.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
- 35.0 Describe the importance of professional ethics and legal responsibilities.
- 36.0 Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs.
- 37.0 Develop the process of creating an entity by identifying relationships.
- 38.0 Formulate and assemble initial entity relationship by expanding on modeling concepts.
- 39.0 Consider the degree and optionality of relationships of entities.
- 40.0 Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams.
- 41.0 Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships.
- 42.0 Apply the complex ERM information by fine-tuning entities and the process for relating them.
- 43.0 Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved.
- 44.0 Manipulating data.
- 45.0 Building and modifying tables.
- 46.0 Performing queries and filtering records.
- 47.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 48.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 49.0 Explain the importance of employability skill and entrepreneurship skills.
- 50.0 Demonstrate personal money-management concepts, procedures, and strategies.
- 51.0 Plan program design.
- 52.0 Code programs.
- 53.0 Test programs.
- 54.0 Perform program maintenance.
- 55.0 Create and maintain documentation.
- 56.0 Develop an awareness of software quality assurance.
- 57.0 Develop an understanding of programming techniques and concepts.
- 58.0 Design structured programs.
- 59.0 Demonstrate proficiency in page design applicable to the WWW.
- 60.0 Demonstrate proficiency in webpage design applicable to the WWW.
- 61.0 Demonstrate proficiency in using a WYSIWG editor, web design, or web animation software for webpage design.
- 62.0 Demonstrate proficiency in using digital photography and digital imaging.
- 63.0 Design and create webpages suitable for publishing to the Internet.
- 64.0 Describe how website performance is monitored and analyzed.
- 65.0 Demonstrate proficiency in hosting a website.
- 66.0 Demonstrate the ability to attract and track traffic for a website.
- 67.0 Demonstrate knowledge of presentation production issues.
- 68.0 Demonstrate proficiency in using digital photography and digital imaging.
- 69.0 Demonstrate basic video production.
- 70.0 Demonstrate set-up and configuration of a computer for video applications.
- 71.0 Demonstrate the basic operation of a video workstation.

- 72.0 Demonstrate basic audio production.
- 73.0 Set-up and configure a computer for audio applications.
- 74.0 Operate an audio workstation.
- 75.0 Demonstrate proficiency in using presentation software and equipment.
- 76.0 Demonstrate understanding of network technologies.
- 77.0 Understand, install and configure network hardware.
- 78.0 Understand, install and configure networking devices.
- 79.0 Understand, install and configure network management software.
- 80.0 Understand, install and configure networking tools.
- 81.0 Install, configure, and manage network security hardware and software devices.
- 82.0 Demonstrate an understanding of cybersecurity, the terminology used, its history and culture, and trends.
- 83.0 Recognize the following types of malicious code and specify the appropriate actions to take to mitigate vulnerability and risk.
- 84.0 Recognize and be able to differentiate and explain the following access control models.
- 85.0 Compare and contrast methods of authentication.
- 86.0 Recognize the following attacks and specify the appropriate actions to take to mitigate vulnerability and risk.
- 87.0 The processes and risks associated with the following security concerns and tasks.
- 88.0 The administration of the following types of remote access technologies.
- 89.0 The administration of the following email security concepts.
- 90.0 The administration of the following Internet security concepts.
- 91.0 The administration of the following vulnerabilities.
- 92.0 The administration of the following directory security concepts.
- 93.0 The administration of the following file transfer protocols and concepts.
- 94.0 The administration of the following wireless technologies and concepts.
- 95.0 Compare and contrast the following types of intrusion detection in terms of implementation and configuration.
- 96.0 Be able to identify the following different kinds of cryptographic algorithms.
- 97.0 Understand how cryptography and digital signatures address the following security concepts.
- 98.0 Understand the following concepts of PKI (Public Key Infrastructure).
- 90.0 Understand the following concepts of Key Management and Certificate Lifecycles.

Florida Department of Education
Student Performance Standards

Program Title: Applied Information Technology
Career Certificate Program Number: Y300400

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: CTS0072
Occupational Completion Point: B
IT & Web Systems – 300 Hours – SOC Code 15-1151

15.0 Demonstrate proficiency on the principles of design. The student will be able to:

15.01 Identify industry best practices in visual design (e.g., color schemes, fonts, navigation methods, pagination).

15.02 Explain the key concepts of meeting client needs.

15.03 Apply the principles of Human Computer Interface (HCI) to design and develop an effective look and feel for a website.

15.04 Design and create a webpage for optimal display in multiple browsers.

16.0 Demonstrate proficiency planning an effective website. The student will be able to:

16.01 Compare and contrast site maps and wireframes.

16.02 Develop an effective site map for a website.

16.03 Create page layout wireframes for a website.

16.04 Classify web development tasks according to when they are performed during the web development cycle.

16.05 Describe the different types of business requirements that apply to website design.

16.06 Design business requirements to help ensure success for a specific website.

16.07 Demonstrate ability to use effective designer-client communication skills.

17.0 Demonstrate proficiency using web development tools and techniques. The student will be able to:

17.01 Compare and contrast writing HTML using a text editor versus using a WYSIWYG editor.

17.02 Design and create an effective webpage template.

17.03 Create attractive, engaging, and efficient webpages using a WYSIWYG editor.

17.04 Create an appropriate directory structure, naming convention protocol, and file organization for a website.

17.05 Create DHTML and XML documents using editors or converters.

18.0 Demonstrate proficiency using specialized web design software. The student will be able to:

18.01 Compare and contrast various specialized web design software (e.g., Photoshop, Dreamweaver).

18.02 Demonstrate proficiency using various specialized web design software (e.g., Photoshop, Dreamweaver).

19.0 Demonstrate proficiency gathering and preparing and evaluating web content. The student will be able to:

19.01	Characterize effective writing styles and conventions for the web.
19.02	Create effective written content for the web.
19.03	Prepare various types of graphical content for use on a webpage.
19.04	Access and digitize graphics through various resources (e.g., scanner, digital cameras, on-line graphics, clipart, CD-ROMs).
19.05	Create and edit images using image or graphic design software.
19.06	Compare and contrast static versus dynamic web content.
19.07	Evaluate sources for accuracy of content.
20.0	Demonstrate an awareness of preparing a website for launch. The student will be able to:
20.01	Evaluate a website for basic usability and accessibility issues.
20.02	List the steps that are necessary to determine when a website is ready to launch.
20.03	Develop a User Testing Plan.
20.04	Demonstrate the ability to organize and execute a user testing of a website in multiple browsers.
21.0	Explain motherboard components, types and features. The student will be able to:
21.01	Identify different motherboard form factors (ATX/BTX and micro ATX).
21.02	Identify input/output interfaces (e.g. USB, serial, NIC).
21.03	Identify the different types of bus slots (e.g. PCI, AGP, PCMCIA).
21.04	Identify the BIOS/CMOS/Firmware (e.g. POST, CMOS battery).
22.0	Explain the purpose and characteristics of CPUs and their features. The student will be able to:
22.01	Identify types of CPUs (e.g. AMD, Intel).
22.02	Define hyper threading.
22.03	Explain multi core (e.g. dual, triple, quad).
22.04	Explain the difference between onboard cache (e.g. L1, L2, L3).
22.05	Compare and contrast between real and actual speed.
22.06	Compare and contrast between 32 bit and 64 bit processing.
23.0	Perform installation and configuration activities. The student will be able to:
23.01	Install and configure software including device drivers.

23.02	Install and configure operating system software.
23.03	Install and configure application software.
23.04	Install and configure peripherals including device drivers (e.g., scanners, cameras, printers).
23.05	Supervise the testing of operating system management systems (e.g., registry, INI files).
23.06	Prepare the hard disk and related issues for operating system installation (e.g., BIOS, disk controllers).
23.07	Format and partition the hard disk.
23.08	Verify the proper operation of the system (e.g., physical inspection, tests, utilities).
23.09	Compare and contrast memory technologies (e.g., RAM, ROM, virtual memory, memory management).
23.10	Demonstrate proficiency using various memory technologies (e.g., RAM, ROM, virtual memory, memory management).
23.11	Demonstrate proper use of user interfaces, command utilities and troubleshooting utilities.
23.12	Explain the basics of boot sequences, methods and startup utilities.
24.0	Perform the process for problem diagnostics and problem resolution through wireless, infrared, telephone, e-mail, remote access, or direct contact. The student will be able to:
24.01	Identify, troubleshoot and propose solutions for configuration problems.
24.02	Identify, troubleshoot and propose solutions for software problems.
24.03	Identify, troubleshoot and propose solutions for hardware malfunctions.
24.04	Identify, troubleshoot and propose solutions for network malfunctions.
24.05	Plan and implement a system upgrade and downgrade.
24.06	Evaluate data recovery using various techniques (e.g., MBR repair tools, rescue disks, disk image, backup).
24.07	Organize and perform system maintenance activities (e.g., management console, SNMP, system monitors, diagnostics, virus management).
24.08	Demonstrate corporate interaction proficiency (e.g., responsibility, interaction, communication).
25.0	Demonstrate knowledge of presentation production issues. The student will be able to:
25.01	Demonstrate knowledge of copyright laws including copyright statute, disclaimers, and filing procedure.
25.02	Demonstrate an understanding of graphic and other file formats (e.g., EPS, TIFF, JPEG, PNG, ASCII, MPEG, MIDI, AVI, WAV,) and knowledge of image size when scanning and saving files for use in different presentation types (web, computer, print).
25.03	Identify display device connectors and types.
25.04	Define refresh rate, resolution, multi-monitor and Degauss.

25.05	Demonstrate knowledge of presentation vocabulary/terms.
25.06	Compare and contrast and utilize various audio/video output solutions and devices.
25.07	Compare and contrast removable storage.
26.0	Demonstrate proficiency using computer networks. The student will be able to:
26.01	Define networking and describe the purpose of a network.
26.02	Describe the conceptual background of digital networks including terminology and basics.
26.03	Describe various types of networks and the advantages and disadvantages of each.
26.04	Describe the use, advantages, and disadvantages of various network media.
26.05	Describe the function of various network devices.
26.06	Describe the difference between the internet and intranet.
26.07	Compare and contrast IP Version 6 and IP Version 4.
26.08	Compare and contrast the different network types.
26.09	Compare and contrast various implementation models.
27.0	Demonstrate proficiency communicating over the Internet. The student will be able to:
27.01	Display understanding of how Internet Service Providers (ISP) operate and what role they play in enabling users to connect to the Internet.
27.02	Explain how the Internet works and how documents are connected and transferred.
27.03	Configure an email client for SMTP and POP3 servers, including port assignment.
27.04	Explain how the primary modes of Internet communication are used.
28.0	Demonstrate proficiency in troubleshooting, repair and maintenance of hardware. The student will be able to:
28.01	Determine the troubleshooting methods and tools for peripheral devices.
28.02	Explain and interpret common device issues and basic troubleshooting methods.
28.03	Integrate common preventative maintenance techniques.

29.0	Demonstrate proficiency in the basic principles of security concepts and technologies. The student will be able to:
29.01	Evaluate encryption technologies, software firewall, authentication technologies, and data security.
29.02	Summarize the following security features (e.g. encryption, malicious software protection BIOS security, password management, biometrics).
30.0	Demonstrate proficiency in operational procedures as they relate to computer equipment and components. The student will be able to:
30.01	Compare and contrast ESD, EMI, RFI, and electrical safety.
30.02	Demonstrate proficiency in the use of state regulations for hazardous materials.
31.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
31.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
31.02	Locate, organize and reference written information from various sources.
31.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
31.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
31.05	Apply active listening skills to obtain and clarify information.
31.06	Develop and interpret tables and charts to support written and oral communications.
31.07	Exhibit public relations skills that aid in achieving customer satisfaction.
32.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
32.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
32.02	Employ critical thinking and interpersonal skills to resolve conflicts.
32.03	Identify and document workplace performance goals and monitor progress toward those goals.
32.04	Conduct technical research to gather information necessary for decision-making.
33.0	Use information technology tools. The student will be able to:
33.01	Use personal information management (PIM) applications to increase workplace efficiency.
33.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email and internet applications.

33.03	Employ computer operations applications to access, create, manage, integrate and store information.
33.04	Employ collaborative/groupware applications to facilitate group work.
34.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. The student will be able to:
34.01	Describe the nature and types of business organizations.
34.02	Explain the effect of key organizational systems on performance and quality.
34.03	List and describe quality control systems and/or practices common to the workplace.
34.04	Explain the impact of the global economy on business organizations.
35.0	Describe the importance of professional ethics and legal responsibilities. The student will be able to:
35.01	Evaluate and justify decisions based on ethical reasoning.
35.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
35.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace or on social media.
35.04	Interpret and explain written organizational policies and procedures.

Course Number: CTS0063
Occupational Completion Point: C
Database Essentials – 150 Hours – SOC Code 15-1151

36.0 Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs. The student will be able to:

36.01 Identify and analyze the phases of the database development process.

36.02 Explain what conceptual data modeling and database design involves.

36.03 Compare database development process with that of the application development process.

36.04 Identify the need for databases and why they are used.

36.05 Explain the various types of databases (i.e., flat file, relational) and the appropriate use of each.

36.06 Demonstrate proficiency in design methodology by completing appropriate tasks during the appropriate time of the developmental life cycle.

36.07 Demonstrate proficiency in design methodology by considering where the database will reside.

37.0 Develop the process of creating an entity by identifying relationships. The student will be able to:

37.01 Identify and model various types of entities.

37.02 Identify naming and drawing conventions for entities.

37.03 Sequence the steps that are necessary for creation of an entity.

37.04 Analyze and model the relationships between entities.

38.0 Formulate and assemble initial entity relationship by expanding on modeling concepts. The student will be able to:

38.01 Analyze and model attributes.

38.02 Identify unique identifiers for each entity.

38.03 Develop an entity relationship diagram tagging attributes with optionality.

39.0 Consider the degree and optionality of relationships of entities. The student will be able to:

39.01 Create models and entity relationship information requirements and interviews.

39.02 Begin to differentiate between one-to-many, many-to-many and one-to-one relationships.

39.03 Identify relationship between two entities by reading a given diagram.

39.04 Create a relationship between instances of the same entity.

39.05	Read an entity relationship model in order to validate it.
40.0	Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams. The student will be able to:
40.01	Identify the significance of an attribute that has more than one value for each entity instance.
40.02	Evaluate appropriate methods of storing validation rules for attributes.
40.03	Recognize unique identifiers inherited from other entities.
40.04	Sequence the steps involved in resolving a many-to-many relationship.
41.0	Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships. The student will be able to:
41.01	Validate that an attribute is properly placed based upon its dependence on its entity's unique identifier (UID).
41.02	Model advanced data constructs including recursive relationships, subtypes, and exclusive relationships.
41.03	Enforce referential integrity.
42.0	Apply the complex ERM information by fine-tuning entities and the process for relating them. The student will be able to:
42.01	Describe a relational database and how it is different from other database systems.
42.02	Define primary keys and foreign keys and describe their purpose.
42.03	Describe what data integrity refers to and list some constraints.
42.04	Explain how database design fits into the database development process.
42.05	Translate an entity-relationship model into a relational database design.
43.0	Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved. The student will be able to:
43.01	Recognize raw data and evaluate the steps for creating a data group in unnormalized form (UNF).
44.0	Manipulating data. The student will be able to:
44.01	Determine appropriate data inputs and outputs for an existing database.
44.02	Demonstrate proficiency in record management (i.e., entering, editing, finding, selecting, sorting, deleting records).
44.03	Change the layout of a datasheet.
44.04	Create forms, reports, mailing labels, and charts using a database.

44.05	Export data to appropriate software applications.
44.06	Demonstrate proficiency in coordinating databases with appropriate software applications.
45.0	Building and modifying tables. The student will be able to:
45.01	Create a database table.
45.02	Create table structures and establish table relationships.
45.03	Determine fields and assign data types in a database table.
45.04	Demonstrate appropriate manipulation of database tables (i.e., enter data, add, delete records).
45.05	Modify a database table by adding, deleting and removing fields.
45.06	Demonstrate proficiency in the appropriate use of database wizards.
46.0	Performing queries and filtering records. The student will be able to:
46.01	Design a query and extract specific data from a database table.
46.02	Create a calculated field.
46.03	Filter data in records by selection and by form.
46.04	Modify a saved query.
46.05	Explain what a Database Warehouse and its uses.
47.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. The student will be able to:
47.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
47.02	Explain emergency procedures to follow in response to workplace accidents.
47.03	Create a disaster and/or emergency response plan.
48.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
48.01	Employ leadership skills to accomplish organizational goals and objectives.
48.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
48.03	Conduct and participate in meetings to accomplish work tasks.
48.04	Employ mentoring skills to inspire and teach others.

49.0	Explain the importance of employability skill and entrepreneurship skills. The student will be able to:
49.01	Identify and demonstrate positive work behaviors needed to be employable.
49.02	Develop personal career plan that includes goals, objectives and strategies.
49.03	Examine licensing, certification and industry credentialing requirements.
49.04	Maintain a career portfolio to document knowledge, skills and experience.
49.05	Evaluate and compare employment opportunities that match career goals.
49.06	Identify and exhibit traits for retaining employment.
49.07	Identify opportunities and research requirements for career advancement.
49.08	Research the benefits of ongoing professional development.
49.09	Examine and describe entrepreneurship opportunities as a career planning option.
50.0	Demonstrate personal money-management concepts, procedures, and strategies. The student will be able to:
50.01	Identify and describe the services and legal responsibilities of financial institutions.
50.02	Describe the effect of money management on personal and career goals.
50.03	Develop a personal budget and financial goals.
50.04	Complete financial instruments for making deposits and withdrawals.
50.05	Maintain financial records.
50.06	Read and reconcile financial statements.
50.07	Research, compare and contrast investment opportunities.

Course Number: CTSS0030
Occupational Completion Point: D
Programming Fundamentals – 150 Hours – SOC Code 15-1151

51.0 Plan program design. The student will be able to:

51.01 Formulate a plan to determine program specifications individually or in groups.

51.02 Use a graphical representation or pseudocode to represent the structure in a program or subroutine.

51.03 Design programs to meet business needs and requirements using problem-solving strategies.

51.04 Prepare proper input/output layout specifications.

51.05 Manually trace the execution of programs and verify that programs follow the logic of their design as documented.

51.06 Analyze the business needs and requirements.

51.07 Determine what kind of information the desired program must process.

51.08 Formulate concise descriptions of a program's task and purpose.

51.09 Formulate concise descriptions of task and purpose of a program's pieces.

51.10 Organize programs according to the problem analysis.

51.11 Recognize changes in the problem statement.

51.12 Suggest changes in the program organization.

52.0 Code programs. The student will be able to:

52.01 Write programs according to recognized programming standards.

52.02 Write internal documentation statements as needed in the program source code.

52.03 Code programs using logical statements (e.g., If-Then-Else, Do...While).

52.04 Enter and modify source code using a program language editor.

52.05 Code routines within programs that validate input data.

52.06 Code programs using object-oriented languages (techniques).

52.07 Select the essential aspects of a problem statement.

52.08 Provide a solution to a problem.

52.09	Find solutions to an extended problem statement.
52.10	Utilize reference manuals and help systems.
52.11	Use pre-defined functions within programs.
53.0	Test programs. The student will be able to:
53.01	Develop a plan for testing programs.
53.02	Develop data for use in program testing.
53.03	Perform debugging activities.
53.04	Distinguish among the different types of program and design errors.
53.05	Evaluate program test results.
53.06	Execute programs and subroutines as they relate to the total application.
53.07	Develop examples that illustrate the core behavior of each program.
53.08	Develop examples that illustrate the core behavior of each program component.
53.09	Illustrate the behavior of boundary cases.
53.10	Demonstrate an understanding that engineering artifacts requires rigorous and systematic testing.
53.11	Use examples to show that the solution meets pre-determined criteria.
53.12	Demonstrate understanding that testing can expose problems but not prove the correctness of the design in an absolute sense.
53.13	Compile (interpret) and run programs.
54.0	Perform program maintenance. The student will be able to:
54.01	Analyze output to identify and annotate errors or enhancements.
55.0	Create and maintain documentation. The student will be able to:
55.01	Follow established documentation standards.
56.0	Develop an awareness of software quality assurance. The student will be able to:
56.01	Identify the legal and social consequences of errors in software.

56.02	Describe copyright and other laws that relate to software theft and misuse.
56.03	Describe software security measures to protect computer systems and data from unauthorized use and tampering (e.g., physical security, passwords, encryption, virus protection/prevention).
56.04	Develop an awareness of version control systems and Open Source Software.
57.0	Develop an understanding of programming techniques and concepts. The student will be able to:
57.01	Identify the basic constructs used in structured programming.
58.0	Design structured programs. The student will be able to:
58.01	Design programs that model mathematical relationships from application areas (e.g., accounting, economics, multimedia, programming, science, web).
58.02	Design programs that deal with multi-faceted objects (e.g., personnel records, physical objects, attributes of HTML tags).
58.03	Design programs that deal with mixed classes of objects (e.g., a class of geometric shapes containing circles, rectangles, triangles, squares, polygons).
58.04	Design programs that deal with objects of undetermined size (e.g., shopping lists, family trees, file directories on computers, websites).

Course Number: CTS0073
Occupational Completion Point: E
Web Development Fundamentals – 150 Hours – SOC Code 15-1151

59.0 Demonstrate proficiency in page design applicable to the WWW. The student will be able to:

59.01 Identify and convert graphic formats.

59.02 Demonstrate proficiency in adding Java scripts to webpages.

60.0 Demonstrate proficiency in webpage design applicable to the WWW. The student will be able to:

60.01 Determine the objectives and the audience for webpages.

60.02 Identify design strategies to reach and keep an audience.

60.03 Use storyboarding to plan a website.

60.04 Create styles and other design elements (e.g. backgrounds, colors, fonts, buttons).

61.0 Demonstrate proficiency in using a WYSIWG editor, web design, or web animation software for webpage design. The student will be able to:

61.01 Apply style sheets for consistent website design.

61.02 Create and edit images and photographs for webpages using digital imaging software (e.g., ImageReady in Photoshop).

61.03 Insert audio files into a webpage.

61.04 Create, edit and integrate video files into a webpage.

61.05 Create, edit and integrate animation files into a webpage.

61.06 Demonstrate an understanding of photograph compression factors such as transmission speed, color reduction, and browser support.

61.07 Demonstrate knowledge of image formats related to photos and graphics on the Internet (e.g. Graphic formats (TIFF & EPS), Web formats (JPEG, GIF, PNG).

61.08 Save and export a photograph to the web in the format best for image quality and file size.

61.09 Build, optimize, edit, and test web pages for publication.

61.10 Create a webpage that utilizes plug-ins.

61.11 Demonstrate an understanding of network and web implementation issues (e.g., bandwidth, compression, streaming).

61.12 Compare and contrast various methods by which information may be accessed on the Internet/Intranet (e.g., FTP, telnet, browser).

61.13 Demonstrate an understanding of file encryption methods (e.g., secure server, unsecured server).

62.0	Demonstrate proficiency in using digital photography and digital imaging. The student will be able to:
62.01	Demonstrate knowledge of ethics related to digital imaging, legal and consent issues.
62.02	Apply effective design principles in digital photography compositions.
62.03	Illustrate the essence of an event, quote, or slogan through digital photography/imaging.
62.04	Demonstrate skill in using digital imaging software for image manipulation, color correction and special effects to creatively convey a message or literary interpretation.
62.05	Demonstrate skill in scanning and cropping photographs.
63.0	Design and create webpages suitable for publishing to the Internet. The student will be able to:
63.01	Explain the need for web-based applications.
63.02	Evaluate a website for basic usability and accessibility issues.
63.03	Display an understanding of the purposes of site maps and wireframes.
63.04	Develop an effective site map for a website.
63.05	Develop effective wireframes for a website.
63.06	Identify industry best practices in visual design.
63.07	Explain the key concepts of meeting client needs.
63.08	Develop an effective look and feel for a website.
63.09	Develop an effective webpage template.
63.10	Describe a correct directory structure, naming convention protocol and file organization for a website.
63.11	Characterize effective writing for the web.
63.12	Create effective written content for the web.
63.13	Decide how to best prepare various types of graphical content for use on a web page.
63.14	Develop a User Testing Plan.
63.15	List the steps that are necessary to determine when a website is ready to launch.
63.16	Demonstrate the ability to organize and execute a user testing of a website.
64.0	Describe how website performance is monitored and analyzed. The student will be able to:

64.01	Identify issues related to website maintenance.
64.02	Use webpage validation tools.
64.03	Describe website performance metrics (e.g., visits, time-on-page, time-on-site) and discuss their design implications.
64.04	Demonstrate knowledge of accessibility problems and solutions.
64.05	Examine indexing, page ranking, basic Search Engine Optimization techniques.
64.06	Explore common website analytic tools.
64.07	Construct webpages with streaming media content.
65.0	Demonstrate proficiency in hosting a website. The student will be able to:
65.01	Apply professional guidelines to choose, search for and register a domain name.
65.02	Evaluate criteria upon which to select an appropriate web host.
65.03	Make generalizations about optimal download speed for a particular website.
65.04	Demonstrate the ability to upload and download files using FTP protocol.
65.05	Develop a Maintenance Plan for a client.
66.0	Demonstrate the ability to attract and track traffic for a website. The student will be able to:
66.01	Explain and describe the best practices for attracting traffic to websites.
66.02	Evaluate an effective search engine optimization strategy.
66.03	Describe tactics for building online credibility.
66.04	Explain how to use standard techniques to gather and/or track site statistics.

Course Number: CTS0075
Occupational Completion Point: F
Multimedia Systems – 150 Hours – SOC Code 15-1151

67.0 Demonstrate knowledge of presentation production issues. The student will be able to:

67.01 Identify characteristics of various types of presentations (e.g., informing, selling, teaching, entertaining).

67.02 Identify presentation materials (e.g., handouts, seminar notebooks, business cards, coupons) and presentation marketing mediums (i.e., print media such as newspaper, magazines; TV; movies; computer presentations; interactive CD ROM; kiosks, webpages).

67.03 Identify design characteristics (e.g., fonts, size and styles, backgrounds) that are suited for each type of presentation format and material.

67.04 Demonstrate knowledge of copyright laws including copyright statute, disclaimers, and filing procedures.

67.05 Research and identify skills needed for career positions in multimedia.

67.06 Demonstrate an understanding of graphic and other file formats (e.g., EPS, TIFF, JPEG, ASCII, MPEG, MIDI, AVI, WAV) and knowledge of image size when scanning and saving files for use in different presentation types (e.g., web, computer, print).

67.07 Demonstrate knowledge of presentation vocabulary/terms.

68.0 Demonstrate proficiency in using digital photography and digital imaging. The student will be able to:

68.01 Demonstrate knowledge of ethics related to digital imaging, legal and consent issues.

68.02 Apply effective design principles in digital photography compositions.

68.03 Illustrate the essence of an event, quote, or slogan through digital photography/imaging.

68.04 Demonstrate skill in using digital imaging software for image manipulation, color correction, and special effects to creatively convey a message or literary interpretation.

68.05 Demonstrate skill in scanning and cropping photographs.

68.06 Incorporate scanned or digitally taken photographs into documents (poster, brochure, card, photo journalism story, report or book covers, letterhead) that have been designed using desktop publishing software or the desktop publishing features of word processing software.

69.0 Demonstrate basic video production. The student will be able to:

69.01 Use student device or current industry standard production video equipment.

69.02 Operate camera in studio and location (field) production environments.

69.03 Demonstrate understanding of digital video storage concepts and digital storage media.

69.04 Demonstrate knowledge of and the ability to operate digital recording decks, and other digital storage devices.

69.05 Identify and select microphones for production needs.

69.06	Determine appropriate lighting needs for production settings.
69.07	Identify location and studio lighting types, method of use and application.
70.0	Demonstrate set-up and configuration of a computer for video applications. The student will be able to:
70.01	Install basic peripheral devices related to video programs.
70.02	Install and configure software related to video programs.
70.03	Demonstrate basic knowledge of computer system requirements.
70.04	Demonstrate basic knowledge of installing plug-ins or additional audio source material such as beats and or samples.
70.05	Understand the signal flow of a digital video workstation.
71.0	Demonstrate the basic operation of a video workstation. The student will be able to:
71.01	Demonstrate knowledge of the digital video workstation interface.
71.02	Demonstrate a working familiarity and understanding of the function and operation of digital video workstations.
71.03	Describe a full digital media production cycle.
71.04	Demonstrate ability to edit, cut, erase, and insert video utilizing various digital production techniques.
71.05	Record video directly to the digital video workstation.
71.06	Demonstrate knowledge of editing video according to message.
71.07	Demonstrate skill in using video effects and plug-ins.
71.08	Describe a first complete run-through of the video production process.
71.09	Characterize the qualities of effective communication in a completed video.
71.10	Prepare a video project for final compositing and export.
71.11	Transfer video files between various video software applications.
71.12	Export finished video.
71.13	Identify and describe solutions to the challenges and obstacles that arise in a video production.
72.0	Demonstrate basic audio production. The student will be able to:
72.01	Describe digital audio storage concepts and digital storage media.

72.02	Operate digital recording decks and other digital storage devices.
72.03	Describe the function and operation of digital audio workstations.
72.04	Edit, cut, erase and insert sound utilizing various digital production techniques.
72.05	Perform digital noise reduction and noise extraction via spectral display.
73.0	Set-up and configure a computer for audio applications. The student will be able to:
73.01	Install basic peripheral devices related to audio programs.
73.02	Install and configure software related to audio programs.
73.03	Demonstrate basic knowledge of computer system requirements.
73.04	Install plug-ins or additional audio source material such as beats and or samples.
73.05	Diagram the signal flow of a digital audio workstation.
74.0	Operate an audio workstation. The student will be able to:
74.01	Demonstrate knowledge of the digital audio workstation interface.
74.02	Create and arrange a multi-track project.
74.03	Create interest and effect using editing techniques
74.04	Design and edit audio using a waveform editor.
74.05	Record audio directly to the digital audio workstation.
74.06	Mix audio.
74.07	Demonstrate skill in using audio effects and plug-ins.
74.08	Prepare an audio project for finishing and final mix down.
74.09	Transfer audio files between various audio software applications.
74.10	Demonstrate the understanding of audio file bit depth, bandwidth and dithering and be able to explain when and where these apply in various applications of digital audio production.
74.11	Export finished audio.
75.0	Demonstrate proficiency in using presentation software and equipment. The student will be able to:
75.01	Using presentation software, create a multimedia presentation that incorporates shot and edited video, animation, music, narration and adheres to good design principles, use of transitions, and effective message conveyance.

75.02 Demonstrate knowledge of the roles and responsibilities of a multimedia production team (e.g. project manager, creative or design director, content experts, writers, graphic designers, animators, sound designers, videographer, interface designers/programmers).

75.03 Collaborate with team members to plan, edit, evaluate, and present a multimedia presentation.

Course Number: CTS0025
Occupational Completion Point: G
Computer Networking – 150 Hours – SOC Code 15-1151

76.0	Demonstrate understanding of network technologies. The student will be able to:
76.01	Explain the function of common networking protocols such as TCP, FTP, UDP, TCP/IP suite, DHCP, TFTP, DNS, HTTP(S), ARP, SIP (VoIP), RTP (VoIP), SSH, POP3, NTP, IMAP4, TELNET, SMTP, SNMP 2/3, ICMP, IGMP and TLS.
76.02	Identify commonly used TCP and UDP default ports such as the following: TCP ports, FTP – 20, 21, SSH – 22, TELNET – 23, SMTP – 25, DNS – 53, HTTP – 80, POP3 – 110, NTP – 123, IMAP4 – 143, HTTPS – 443, UDP ports TFTP – 69, DNS – 53, BOOTPS/DHCP – 67 and SNMP – 161.
76.03	Identify the following address formats IPv6, IPv4, and MAC Addressing.
76.04	Evaluate the proper use of the following addressing technologies and addressing schemes: Subnetting, Classful vs. classless (e.g. CIDR, Supernetting), NAT, PAT, SNAT, Public vs. private, DHCP (static, dynamic APIPA), Addressing schemes, Unicast and Multicast, Broadcast.
76.05	Identify common IPv4 and IPv6 routing protocols - Link state OSPF, IS-IS, Distance vector, RIP, RIPv2, BGP and Hybrid EIGRP.
76.06	Explain the purpose and properties of routing such as IGP vs. EGP, Static vs. dynamic, Next Hop, Understanding routing tables and how they pertain to path selection, and explain convergence (steady state).
76.07	Compare the characteristics of wireless communication standards such as 802.11 a/b/g/n, speeds, distance, channels, frequency, authentication and encryption such as WPA, WEP, RADIUS and TKIP.
77.0	Understand, install, and configure network hardware. The student will be able to:
77.01	Categorize standard cable types and their properties such as CAT3, CAT5, CAT5e, CAT6, STP, UTP, Multimode fiber, single-mode fiber, coaxial, serial, plenum vs non-plenum, transmission speeds, distance, duplex, noise immunity (security, EMI), and frequency.
77.02	Identify common connector types such as RJ-11, RJ-45, BNC, SC, ST, LC and RS-232.
77.03	Identify common physical network topologies such as Star, Mesh, Bus, Ring, Point to Point, Point to Multipoint, and Hybrid.
77.04	Differentiate and implement appropriate wiring standards such as 568A, 568 B Straight vs cross over, rollover, and Loopback.
77.05	Categorize Wan technologies types and properties such as Frame Relay, E1/T1, ADSL, SDSL, VDSL, Cable modem, Satellite, E3/T3, Oc-x, Wireless, ATM, SONET, MPLS, ISD Bri, ISDN PRI, POTS, PSTN, Circuit, switch, packet switch, speed, transmission media, and Distance.
77.06	Categorize LAN technology types and properties such as Ethernet, 10BaseT, 100BaseTX, 100BaseFX, 1000BaseT, 1000BaseX, 10GbaseSR, 10GBaseLR, 10GBaseER, 10GBaseSW , 10GBaseLW, 10GBaseEW, 10GBaseT and properties of each such as CSMA/CD, Broadcast, Collision, Bonding, Speed, and Distance.
77.07	Explain common logical network topologies and their characteristics such as peer to peer, client/server, VPN and VLAN.
77.08	Install components of wiring distribution such as Vertical and horizontal cross connects, Patch panels, 66 block, MDFs, IDFs, 25 pair, 100 pair, 110 block, Demarc, Demarc extension, Smart jack, verify wiring installation and Verify wiring termination.

78.0	Understand, install and configure networking devices. The student will be able to:
78.01	Install, configure and differentiate between common network devices such as hub, repeater, modem, NIC, media converters, basic switch, bridge, wireless access point, basic router, basic firewall and basic DHCP server.
78.02	Identify the function of specialized network devices such as multilayer switch, Content switch, IDS/IPS, load balancer, multifunction network devices, DNS server Bandwidth shaper, proxy server, and CSU/DSU.
78.03	Explain the advance features of a switch such as PoE, Spanning tree, VLAN, Trunking, Port mirroring, and Port Authentication.
78.04	Implement a basic wireless network using the following technologies installed client, access point placement, access point with encryption, access point with configured channels and frequencies, and a set ESSSID and beacon.
79.0	Understand, install and configure network management software. The student will be able to:
79.01	Explain the function of the OSI layer model such as physical, data link, network, transport, session, presentation and application.
79.02	Identifies types of configuration management documentation such as wiring schematics, physical and logical network diagram, baselines, policies, procedure and configuration and regulations.
79.03	Evaluate the network based on configuration management documentation such as compare wiring schematics, physical and logical network diagrams, baselines, policies and procedures, and configurations to network devices and infrastructure, and update wiring schematics, physical and logical network diagrams, configuration and job logs as needed.
79.04	Conduct network monitoring to identify performance and connectivity issues using the following: network monitoring utilities (packet sniffers, connectivity software, load testing, throughput testers) and system logs, history and event log.
79.05	Conduct network monitoring to identify performance and connectivity issues using the following: network monitoring utilities (packet sniffers, connectivity software, load testing, and throughput testers), system logs, history logs, and event logs.
79.06	Explain different methods and rationales for network performance optimization such as QoS, Traffic shaping, Load balancing, high availability, Caching engines, Fault tolerance, Latency sensitivity, High bandwidth applications, VoIP, Video applications, and Uptime.
79.07	Implement the following network troubleshooting methodology - Information gathering, identify symptoms and problems, Identify the affected areas of the network, determine if anything has changed, Establish the most probable cause, determine if escalation is necessary, create an action plan and solution identifying potential effects, Implement and test the solution, Identify the results and effects of the solution, and Document the solution and the entire process.
79.08	Troubleshoot common connectivity issues and select an appropriate solution Physical issues: Cross talk, Near End crosstalk, Attenuation, collisions, Shorts Open, Impedance mismatch (echo), and Interference - Logical issues: Port speed, Port duplex mismatch, incorrect VLAN, Incorrect IP address, Wrong gateway, Wrong DNS, Wrong subnet mask, Issues that should be identified but escalated: Switching loop, Routing loop, Route problems, Proxy arp, Broadcast storms, Wireless Issues: Interference (bleed, environmental factors), incorrect encryption, Incorrect channel, Incorrect frequency, ESSID mismatch, Standard mismatch (802.11 a/b/g/n), Distance, Bounce, and Incorrect antenna placement.
80.0	Understand, install and configure networking tools. The student will be able to:
80.01	Select the appropriate command line interface tool and interpret the output to verify functionality such as Traceroute, Ipconfig, IFconfig, Ping, Arp ping, Arp, Nslookup, Hostname, Dig, Mtr, Route, and Nbtstat.
80.02	Explain the purpose of network scanners such as Packet sniffers, Intrusion detection software, Intrusion prevention software and Port scanners.

80.03	Utilize the appropriate hardware tools such as Cable testers, Protocol analyzer, Certifiers, TDR, OTDR, Multimeter, Toner probe, Butt set, Punch down tool, Cable stripper, Snips, Voltage event recorder, and Temperature monitor.
81.0	Install, configure, and manage network security hardware and software devices. The student will be able to:
81.01	Explain the function of hardware and software security devices such as Network based firewall, Host based firewall, IDS, IPS, and VPN concentrator.
81.02	Explain common features of a firewall for example: Application layer vs. network layer, Stateful vs. stateless, Scanning services, Content filtering, Signature identification, and Zones.
81.03	Explain the methods of network access security using the following: Filtering: ACL, MAC filtering, IP filtering, Tunneling and encryption, SSL VPN, VPN, L2TP, PPTP, IPSEC, Remote access, RAS, RDP, PPPoE, PPP, VNC, and ICA.
81.04	Explain methods of user authentication using the following methods: PKI, Kerberos, AAA, RADIUS, TACACS+, Network access control, 802.1x, CHAP, MS-CHAP, and EAP.
81.05	Explain issues that affect device security such as the Physical security, Restricting local and remote access, Secure methods vs. unsecure methods, SSH, HTTPS, SNMPv3, SFTP, SCP, and TELNET, HTTP, FTP, RSH, RCP and SNMPv1/2.
81.06	Identify common security threats and mitigation techniques such as Security threats, DoS, Viruses, Worms, Attackers, Man in the middle, murf, Rogue access points, Social engineering (phishing), Mitigation techniques, Policies and procedures, User training, Patches and updates.

Course Number: CTS0068
Occupational Completion Point: H
Cybersecurity Essentials – 150 Hours – SOC Code 15-1151

82.0	Demonstrate an understanding of cybersecurity, the terminology used, its history and culture, and trends. The student will be able to:
82.01	Describe the history of cybersecurity, including the evolution of a hacker culture.
82.02	Discuss the trends and national initiatives related to cybersecurity.
82.03	Distinguish between information assurance and cybersecurity.
82.04	Describe the concepts of confidentiality as it relates to user and data impact.
82.05	Explain authentication and the concept of non-repudiation.
82.06	Describe the concept of “Hacking - The Human Element” and elaborate on its implications to cybersecurity.
83.0	Recognize the following types of malicious code and specify the appropriate actions to take to mitigate vulnerability and risk. The student will be able to:
83.01	Describe viruses.
83.02	Identify Trojan Horses.
83.03	Explain Logic Bombs.
83.04	Describe worms.
83.05	Explain exploit kits.
83.06	Identify kill chains.
84.0	Recognize and be able to differentiate and explain the following access control models. The student will be able to:
84.01	Define MAC (Mandatory Access Control).
84.02	Define DAC (Discretionary Access Control).
84.03	Define RBAC (Role Based Access Control).
85.0	Compare and contrast methods of authentication. The student will be able to:
85.01	Identify Kerberos.
85.02	Explain CHAP (Challenge Handshake Authentication Protocol).
85.03	Define certificates.

85.04	Apply username / password.
85.05	Identify tokens.
85.06	Describe multi-factor.
85.07	Define mutual.
85.08	Define biometrics.
86.0	Recognize the following attacks and specify the appropriate actions to take to mitigate vulnerability and risk. The student will be able to:
86.01	Explain DOS/DDOS (Denial of Service/Distributed Denial of Service).
86.02	Explain Back Door.
86.03	Identify spoofing.
86.04	Describe Man in the Middle.
86.05	Describe replay.
86.06	Explain TCP/IP Hijacking.
86.07	List Weak Keys.
86.08	Design password security measures to eliminate guessing (e.g., Brute Force, Dictionary, Mathematical, Social Engineering, Birthday).
86.09	Describe Software Exploitation.
87.0	The he processes and risks associated with the following security concerns and tasks. The student will be able to:
87.01	Identify non-essential services and protocols and know what actions to take to reduce the risks of those services and protocols.
87.02	Understand the concept of and know how reduce the risks of social engineering.
87.03	Understand the concept and significance of auditing, logging and system scanning.
87.04	Identify and be able to differentiate different cryptographic standards and protocols.
88.0	The administration of the following types of remote access technologies. The student will be able to:
88.01	Recognize 802.1x.
88.02	Understand VPN (Virtual Private Network).
88.03	Discuss RADIUS (Remote Authentication Dial-In User Service).

88.04	Describe TACACS (Terminal Access Controller Access Control System).
88.05	Generalize L2TP/PPTP (Layer Two Tunneling Protocol/Point to Point Tunneling Protocol).
88.06	Define SSH (Secure Shell).
88.07	Give examples of IPSEC (Internet Protocol Security).
88.08	List security vulnerabilities.
89.0	The administration of the following email security concepts. The student will be able to:
89.01	Explain S/MIME (Secure Multipurpose Internet Mail Extensions).
89.02	Describe PGP (Pretty Good Privacy) like technologies.
89.03	List security vulnerabilities.
89.04	Identify SPAM.
89.05	Analyze hoaxes.
89.06	Track SMTP headers.
90.0	The administration of the following Internet security concepts. The student will be able to:
90.01	Recognize SSL/TLS (Secure Sockets Layer/Transport Layer Security).
90.02	Understand HTTP/S (Hypertext Transfer Protocol/Hypertext Transfer Protocol over Secure Sockets Layer).
90.03	List security vulnerabilities.
91.0	The administration of the following vulnerabilities. The student will be able to:
91.01	Discuss Java Script.
91.02	Explain ActiveX.
91.03	Identify Buffer Overflows.
91.04	Understand Cookies.
91.05	Explain Signed Applets.
91.06	Identify CGI (Common Gateway Interface).
91.07	Describe SMTP (Simple Mail Transfer Protocol) Relay.

92.0	The administration of the following directory security concepts. The student will be able to:
92.01	Recognize SSL/TLS (Secure Sockets Layer/Transport Layer Security).
92.02	Recognize LDAP (Lightweight Directory Access Protocol).
93.0	The administration of the following file transfer protocols and concepts. The student will be able to:
93.01	Identify S/FTP (File Transfer Protocol).
93.02	Identify Blind FTP (File Transfer Protocol)/Anonymous.
93.03	Understand File Sharing.
93.04	List security vulnerabilities.
94.0	The administration of the following wireless technologies and concepts. The student will be able to:
94.01	Recognize WTLS (Wireless Transport Layer Security).
94.02	Recognize 802.11 and 802.11x.
94.03	Recognize WEP/WAP (Wired Equivalent Privacy/Wireless Application Protocol).
94.04	List security vulnerabilities.
95.0	Compare and contrast the following types of intrusion detection in terms of implementation and configuration. The student will be able to:
95.01	Discuss Network Based – Active and Passive.
95.02	Discuss Host Based – Active and Passive.
95.03	Explain Honey Pots.
95.04	Describe Incident Response.
96.0	Be able to identify and explain the following different kinds of cryptographic algorithms. The student will be able to:
96.01	Explain Hashing.
96.02	Explain Symmetric.
96.03	Explain Asymmetric.
97.0	Understand how cryptography and digital signatures address the following security concepts. The student will be able to:
97.01	Discuss confidentiality.

97.02	Evaluate integrity.
97.03	Determine authentication.
97.04	Ensure non-repudiation.
97.05	Evaluate access control.
98.0	Understand the following concepts of PKI (Public Key Infrastructure). The student will be able to:
98.01	Explain certificates (e.g., policies, practice statements).
98.02	Discuss revocation.
98.03	Identify trust models.
99.0	Understand the following concepts of Key Management and Certificate Lifecycles. The student will be able to:
99.01	Compare and contrast centralized versus decentralized.
99.02	Compare and contrast hardware versus software key storage.
99.03	Explain private key storage.
99.04	Identify escrow.
99.05	Explain expiration.
99.06	Compare and contrast revocation versus suspension (e.g., status checking).
99.07	Interpret recovery authorization schema (e.g., M-of-N Control - Of M appropriate individuals, N must be present to authorize recovery).
99.08	Explain renewal.
99.09	Give examples of destruction.
99.10	Discuss key usage.
99.11	Compare and contrast multiple key pairs (Single, Dual).

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

**Florida Department of Education
Curriculum Framework**

Program Title: Enterprise Network and Server Support Technology
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program	
Program Number	Y300500
CIP Number	0511100123
Grade Level	30, 31
Standard Length	750 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	SkillsUSA Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1122 Information Security Analysts 15-1142 Network and Computer Systems Administrators 15-1152 Computer Network Support Specialists
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

The purpose of this program is to prepare students for employment or advanced training in a variety of occupations in the Information Technology industry.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Information Technology industry; technical and product skills, underlying principles of technology, planning, management, finance, labor issues, community issues and health, safety, and environmental issues.

The content includes but is not limited to communication, leadership skills, human relations and employability skills; and safe, efficient work practices.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points. When the recommended sequence is followed, the structure is intended to prepare students to complete the CompTIA Security+, the Certified Ethical Hacker, Cisco Certified Network Associate and the Microsoft Certified System Administrator industry certifications. A student who completes the applicable competencies at any occupational completion point may either continue with the training or become an occupational completer.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0099	Advanced Networking Fundamentals	BUS ED 1 @2	150 hour	15-1152
B	CTS0066	Information Technology Security Specialist OR	COMPU SCI 6	600 hour	15-1122
	CTS0094	Interconnecting Cisco Network Devices OR	COMP SVC 7G	600 hour	15-1142
	CTS0048	Microsoft Certified Systems Administrator	INFO TECH 7 G CYBER TECH 7 G ELECTRONIC @7 ?7 G	600 hour	15-1142

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Identify networks and components.
- 02.0 Describe the role of an Information Technology Security Specialist.
- 03.0 Describe the role of a Cisco Engineer.
- 04.0 Describe the role of a Microsoft Certified Systems Administrator.
- 05.0 Understand Cloud services.
- 06.0 Explore career options.
- 07.0 Demonstrate an understanding of Network Security.
- 08.0 Demonstrate Compliance and Operational Security.
- 09.0 Demonstrate an understanding of threats and vulnerabilities.
- 10.0 Demonstrate Use of Application, Data and Host Security.
- 11.0 Demonstrate proficiency and understanding of Access Control and Identity Management.
- 12.0 Demonstrate proficiency and understanding in Cryptography.
- 13.0 Demonstrate use of Ethical Hacking.
- 14.0 Demonstrate proficiency in Understanding the technical foundations of hacking.
- 15.0 Demonstrate an understanding of foot printing and scanning.
- 16.0 Demonstrate proficiency and understanding of enumeration and system hacking.
- 17.0 Demonstrate proficiency Linux and automated assessment tools.
- 18.0 Demonstrate understanding of Trojans and backdoors.
- 19.0 Demonstrate understanding of Sniffers, session hijacking, and denial of service.
- 20.0 Demonstrate understanding and proficiency in web server hacking, web application and database attack.
- 21.0 Demonstrate understanding and proficiency in wireless technologies, mobile security and attacks.
- 22.0 Demonstrate understanding and proficiency in configuring IDS, Firewalls, and Honeypots.
- 23.0 Explain use of buffer overflows, viruses, and worms.
- 24.0 Employing cryptographic attacks and defenses.
- 25.0 Demonstrate use of physical security and social engineering.
- 26.0 Describe the operation of data networks.
- 27.0 Demonstrate proficiency in LAN Switching Technologies.
- 28.0 Understand, IP addressing (IPv4/IPv6).
- 29.0 Demonstrate proficiency in IP Routing Technologies.
- 30.0 Demonstrate proficiency in IP Services.
- 31.0 Demonstrate proficiency in Network Device Security.
- 32.0 Demonstrate proficiency in Troubleshooting VLANs, Trunking and ACLs.
- 33.0 Demonstrate proficiency in LAN Switching Technologies.
- 34.0 Demonstrate proficiency in IP Routing Technologies.
- 35.0 Demonstrate proficiency in IP Services.
- 36.0 Demonstrate proficiency in troubleshooting network problems.
- 37.0 Demonstrate proficiency in WAN Technologies.
- 38.0 Demonstrate knowledge and skills in installing and configuring servers.
- 39.0 Demonstrate knowledge and skills in configuring server roles and features.

- 40.0 Demonstrate knowledge and skills in configuring Hyper-V.
- 41.0 Demonstrate knowledge and skills in deploying and configuring core network services.
- 42.0 Demonstrate knowledge and skills in installing and administering active Directory.
- 43.0 Demonstrate knowledge and skills in creating and managing Group Policy.
- 44.0 Demonstrate knowledge and skills in administering Windows Server.
- 45.0 Demonstrate knowledge and skills in configuring Advanced Windows Server Services.

Florida Department of Education
 Student Performance Standards

Program Title: Enterprise Network and Server Support Technology
 Career Certificate Program Number: Y300600

Course Number: CTS0099
Occupational Completion Point: A
Advanced Networking Fundamentals – 150 Hours – SOC Code 15-1152

1.0	Identify networks and components. The student will be able to:
1.01	Research enterprise scenarios to determine network infrastructure.
1.02	Identify network components and relationships (cables, switches, software, power).
1.03	Identify typical equipment found in a MDF and IDF closet.
1.04	Identify business services that rely on a network or create network traffic (security, marketing, retail).
1.05	Design a network implementation plan for a small business enterprise.
2.0	Describe the role of an Information Technology Security Specialist. The student will be able to:
2.01	Identify network security risks in an organization.
2.02	Analyze security risks for solutions.
2.03	Develop a security plan for a small business network.
2.04	Identify security standards both physical and computer software related.
3.0	Describe the role of a Cisco Engineer. The student will be able to:
3.01	Identify switch and router technology being used in enterprise.
3.02	Investigate the configuration of switches and routers in an enterprise.
3.03	Develop a deployment plan for using network devices in enterprise.
3.04	Explain wireless connections and configuration for switches and routers.
3.05	Analyze (Switch/Router) price vs. performance in an enterprise.

4.0	Describe the role of a Microsoft Certified Systems Administrator. The student will be able to:
4.01	Explain the importance system administration.
4.02	Identify key software and hardware being used for server administration.
4.03	Identify software and hardware considerations before deployment.
4.04	Develop a deployment plan for a small enterprise.
5.0	Understand Cloud services. The student will be able to:
5.01	Identify clouds services currently available.
5.02	Compare and contrast the use of cloud services in an enterprise.
5.03	Identify hardware and software requirements for deploying a cloud service in an enterprise.
5.04	Develop a clouds services plan for a small enterprise.
6.0	Explore career options. The student will be able to:
6.01	Identify job opportunities and qualifications needed to be a network security technician.
6.02	Identify job opportunities and qualifications needed to be a Cisco technician.
6.03	Identify job opportunities and qualifications needed to be Microsoft certified systems administrator.

Course Number: CTS0066
Occupational Completion Point: B
Information Technology Security Specialist – 600 Hours – SOC Code 15-1122

7.0 Demonstrate an understanding of Network Security. The student will be able to:

7.01 Implement security configuration parameters on network devices and other technologies.

7.02 Given a scenario, use secure network administration principles (VLANs, Firewalls).

7.03 Explain various career options within the IT enterprise.

7.04 Given a scenario, implement common protocols and services (FTPS, DNS, Ports – 21-22-25).

7.05 Given a scenario, troubleshoot security issues related to wireless networking.

8.0 Demonstrate Compliance and Operational Security. The student will be able to:

8.01 Explain the importance of risk related concepts.

8.02 Summarize the security implications of integrating systems and data with third parties.

8.03 Given a scenario, implement appropriate risk mitigation strategies.

8.04 Given a scenario, implement basic forensic procedures.

8.05 Summarize common incident response procedures.

8.06 Explain the importance of security related awareness and training.

8.07 Compare and contrast physical security and environmental controls.

8.08 Summarize risk management best practices.

8.09 Given a scenario, select the appropriate control to meet the goals of security (Encryption, Hashing).

9.0 Demonstrate an understanding of threats and vulnerabilities. The student will be able to:

9.01 Explain types of malware (Viruses, Adware).

9.02 Summarize various types of attacks (DoS, DDoS, Smurf attack).

9.03 Summarize social engineering attacks and the associated effectiveness with each attack.

9.04 Explain types of wireless attacks.

9.05 Explain types of application attacks.

9.06	Analyze a scenario and select the appropriate type of mitigation and deterrent techniques.
9.07	Given a scenario, use appropriate tools and techniques to discover security threats and vulnerabilities.
9.08	Explain the proper use of penetration testing versus vulnerability scanning.
10.0	Demonstrate Use of Application, Data and Host Security. The student will be able to:
10.01	Explain the importance of application security controls and techniques.
10.02	Summarize mobile security concepts and technologies.
10.03	Given a scenario, select the appropriate solution to establish host security.
10.04	Implement the appropriate controls to ensure data security.
10.05	Compare and contrast alternative methods to mitigate security risks in static environments.
11.0	Demonstrate proficiency and understanding of Access Control and Identity Management. The student will be able to:
11.01	Compare and contrast the function and purpose of authentication services (RADIUS, TACACAS+, LDAP).
11.02	Given a scenario, select the appropriate authentication, authorization or access control.
11.03	Install and configure security controls when performing account management, based on best practices.
12.0	Demonstrate proficiency and understanding in Cryptography. The student will be able to:
12.01	Given a scenario, utilize general cryptography concepts.
12.02	Given a scenario, use appropriate cryptographic methods.
12.03	Given a scenario, use appropriate PKI, certificate management and associated components.
13.0	Demonstrate use of Ethical Hacking. The student will be able to:
13.01	Demonstrate security fundamentals.
13.02	Perform security testing.
13.03	Differentiate between hackers and crackers.
13.04	Identify ethical hackers.
13.05	Explain and implement testing plans.
13.06	Demonstrate proficiency with ethics and legality.

14.0	Demonstrate proficiency in Understanding the technical foundations of hacking. The student will be able to:
14.01	Explain the Attacker's process.
14.02	Explain the ethical hacker process.
14.03	Compare the relationship between security and the OSI model.
15.0	Demonstrate an understanding of foot printing and scanning. The student will be able to:
15.01	Explain the seven-step information gathering process.
15.02	Identify active machines.
15.03	Demonstrate proficiency in finding open ports and access points.
15.04	Demonstrate use of OS fingerprinting.
15.05	Demonstrate proficiency in mapping the network attack surface.
16.0	Demonstrate proficiency and understanding of enumeration and system hacking. The student will be able to:
16.01	Define enumeration.
16.02	Demonstrate proficiency in system hacking.
17.0	Demonstrate proficiency Linux and automated assessment tools. The student will be able to:
17.01	Manage Linux OS.
17.02	Demonstrate proficiency in hacking Linux.
17.03	Demonstrate proficiency in hardening Linux.
17.04	Explain use of automated exploit tools.
18.0	Demonstrate understanding of Trojans and backdoors. The student will be able to:
18.01	Explain the characteristics of Trojans.
18.02	Demonstrate proficiency in covert communication.
18.03	Explain keystroke logging and spyware characteristics.
18.04	Demonstrate understanding and proficiency in Trojan and backdoor countermeasures.
19.0	Demonstrate understanding of Sniffers, session hijacking, and denial of service. The student will be able to:
19.01	Explain the functions and types of sniffers.

19.02	Explain session hijacking.
19.03	Demonstrate understanding of DoS, DDoS and Botnets.
20.0	Demonstrate understanding and proficiency in web server hacking, web application and database attack. The student will be able to:
20.01	Explain webserver hacks.
20.02	Explain web application hacking.
20.03	Explain database hacking.
21.0	Demonstrate understanding and proficiency in wireless technologies, mobile security and attacks. The student will be able to:
21.01	Explain different wireless technologies and attacks.
21.02	Understand and explain different wireless LANs technologies.
22.0	Demonstrate understanding and proficiency in configuring IDS, Firewalls, and Honeypots. The student will be able to:
22.01	Explain and configure different types of IDSs.
22.02	Explain and configure different types of firewalls.
22.03	Explain and configure different types of honeypots.
23.0	Explain use of buffer overflows, viruses, and worms. The student will be able to:
23.01	Explain buffer overflows, buffer overflows attacks, and prevention.
23.02	Define the use of viruses and worms.
24.0	Employing cryptographic attacks and defenses. The student will be able to:
24.01	Explain functions of cryptography.
24.02	Report the history of cryptography.
24.03	Identify different algorithms.
24.04	Identify digital signature.
24.05	Explain steganography operation.
24.06	Use steganographic tools.
24.07	Create a digital watermark.

24.08	Use digital certificates.
24.09	Explain public key infrastructure.
24.10	Define protocols, standards, and applications.
24.11	Use encryption-cracking tools.
25.0	Demonstrate use of physical security and social engineering. The student will be able to:
25.01	Apply physical security measures.
25.02	Define social engineering types, attacks and preventive measures.

Course Number: CTS0094
Occupational Completion Point: B
Interconnecting Cisco Network Devices - 600 Hours – SOC Code 15-1142

26.0 Describe the operation of data networks. The student will be able to:

26.01 Recognize the purpose and functions of various network devices such as routers, switches, bridges and hubs.

26.02 Select the components required to meet a given network specification.

26.03 Identify common applications and their impact on the network.

26.04 Describe the purpose and basic operation of the protocols in the OSI and TCP/IP models.

26.05 Predict the data flow between two hosts across a network.

26.06 Identify the appropriate media, cables, ports, and connectors to connect Cisco network devices to other network devices and hosts in a LAN.

27.0 Demonstrate proficiency in LAN Switching Technologies. The student will be able to:

27.01 Determine the technology and media access control method for Ethernet networks.

27.02 Identify basic switching concepts and the operation of Cisco switches.

27.03 Configure and verify initial switch configuration including remote access management.

27.04 Describe how VLANs create logically separate networks and the need for routing between them.

27.05 Configure and verify VLANs.

27.06 Configure and verify trunking on Cisco switches.

28.0 Understand, IP addressing (IPv4/IPv6). The student will be able to

28.01 Describe the operation and necessity of using private and public IP addresses for IPv4 addressing.

28.02 Identify the appropriate IPv6 addressing scheme to satisfy addressing requirements in a LAN/WAN environment.

28.03 Identify the appropriate IPv4 addressing scheme using VLSM and summarization to satisfy addressing requirements in a LAN/WAN environment.

28.04 Describe the technological requirements for running IPv6 in conjunction with IPv4.

28.05 Describe IPv6 addresses.

29.0 Demonstrate proficiency in IP Routing Technologies. The student will be able to:

29.01	Describe basic routing concepts.
29.02	Configure and verify utilizing the CLI to set basic Router configuration.
29.03	Configure and verify operation status of an Ethernet interface.
29.04	Verify router configuration and network connectivity using.
29.05	Configure and verify routing configuration for a static or default route given specific routing requirements.
29.06	Differentiate methods of routing and routing protocols.
29.07	Configure and verify OSPF (single area).
29.08	Configure and verify interVLAN routing (router on a stick).
29.09	Configure SVI interfaces.
30.0	Demonstrate proficiency in IP Services. The student will be able to:
30.01	Configure and verify DHCP (IOS router).
30.02	Describe the types, features, and applications of ACLs.
30.03	Configure and verify ACLs in a network environment.
30.04	Identify the basic operation of NAT.
30.05	Configure and verify NAT for given network requirements.
30.06	Configure and verify NTP as a client.
31.0	Demonstrate proficiency in Network Device Security. The student will be able to:
31.01	Configure and verify network device security features.
31.02	Configure and verify switch port security.
31.03	Configure and verify ACLs to filter network traffic.
31.04	Configure and verify ACLs to limit telnet and SSH access to the router.
32.0	Demonstrate proficiency in Troubleshooting VLANs, Trunking and ACLs. The student will be able to:
32.01	Troubleshoot and correct common problems associated with IP addressing and host configurations.

32.02	Troubleshoot and resolve VLAN problems.
32.03	Troubleshoot and resolve trunking problems on Cisco switches.
32.04	Troubleshoot and resolve ACL issues.
33.0	Demonstrate proficiency in LAN Switching Technologies. The student will be able to:
33.01	Identify enhanced switching technologies (RSTP, PRSTP, VSTP, Etherchannels).
33.02	Configure and verify PVSTP operation.
34.0	Demonstrate proficiency in IP Routing Technologies. The student will be able to:
34.01	Describe the boot process of Cisco IOS routers.
34.02	Configure and verify the operation status of a serial interface.
34.03	Manage Cisco IOS files.
34.04	Differentiate methods of routing and routing protocols.
34.05	Configure and verify OSPF (multi-area).
34.06	Configure and verify EIGRP (single AS).
34.07	Passive Interface.
35.0	Demonstrate proficiency in IP Services. The student will be able to:
35.01	Recognize high availability (FHRP).
35.02	Configure and verify syslog.
36.0	Demonstrate proficiency in troubleshooting network problems. The student will be able to:
36.01	Identify and correct common network problems.
36.02	Utilize netflow data.
36.03	Troubleshoot and resolve spanning tree operation issues.
36.04	Troubleshoot and resolve routing issues.
36.05	Troubleshoot and resolve OSPF problems.
36.06	Troubleshoot and resolve EIGRP problems.

36.07	Troubleshoot and resolve inter VLAN routing problems.
36.08	Troubleshoot and resolve WAN implementation issues.
36.09	Monitor NetFlow statistics.
36.10	TS etherchannel problems.
37.0	Demonstrate proficiency in WAN Technologies. The student will be able to:
37.01	Identify different WAN Technologies.
37.02	Configure and verify a basic WAN serial connection.
37.03	Configure and verify a PPP connection between Cisco routers.
37.04	Configure and verify Frame Relay on Cisco routers.
37.05	Implement and troubleshoot PPPoE.

Course Number: CTS0048
Occupational Completion Point: B
Microsoft Certified Systems Administrator – 600 Hours – SOC Code 15-1142

38.0	Demonstrate knowledge and skills in installing and configuring servers. The student will be able to:
38.01	Plan for a server installation, plan for server roles, plan for a server upgrade, install Server Core, optimize resource utilization by using Features on Demand, migrate roles from previous versions of Windows Server.
38.02	Design and configure storage solutions.
39.0	Demonstrate knowledge and skills in configuring server roles and features. The student will be able to:
39.01	Create and configure shares and share permissions.
39.02	Configure and manage print services.
39.03	Configure WinRM, configure down-level server management, configure servers for day-to-day management tasks, configure multi-server management, configure Server Core, configure Windows Firewall, manage non-domain joined servers.
40.0	Demonstrate knowledge and skills in configuring Hyper-V. The student will be able to:
40.01	Create and configure virtual machine settings.
40.02	Create and configure virtual machine storage.
40.03	Create and configure virtual networks.
41.0	Demonstrate knowledge and skills in deploying and configuring core network services. The student will be able to:
41.01	Configure IPv4 and IPv6 addressing.
41.02	Deploy and configure Dynamic Host Configuration Protocol (DHCP) service.
41.03	Deploy and configure DNS service.
41.04	Configure Active Directory integration of primary zones, configure forwarders, configure Root Hints, manage DNS cache, create A and PTR resource records.
42.0	Demonstrate knowledge and skills in installing and administering active Directory. The student will be able to:
42.01	Install and configure domain controllers.
42.02	Create and manage Active Directory users and computers.
42.03	Create and manage Active Directory groups and organizational units (OUs).
43.0	Demonstrate knowledge and skills in creating and managing Group Policy. The student will be able to:

43.01	Create and configure Group Policy objects (GPOs).
43.02	Configure security policies.
43.03	Configure application restriction policies.
43.04	Configure Windows Firewall.
44.0	Demonstrate knowledge and skills in administering Windows Server. The student will be able to:
44.01	Deploy and manage server images.
44.02	Install and configure the Windows Server Update Services (WSUS) role.
44.03	Configure Data Collector Sets (DCS).
44.04	Configure file and print services (DFS).
44.05	Configure file and disk encryption.
44.06	Configure network services and access.
44.07	Configure DNS zones and records.
44.08	Configure virtual private network (VPN) and routing.
44.09	Configure DirectAccess: Implement server requirements, implement client configuration, configure DNS for Direct Access, configure certificates for Direct Access.
44.10	Configure a Network Policy Server (NPS) infrastructure and policies.
44.11	Configure Network Access Protection (NAP).
45.0	Demonstrate knowledge and skills in configuring Advanced Windows Server Services. The student will be able to:
45.01	Configure and manage high availability.
45.02	Configure failover clustering.
45.03	Configure file and storage solutions (Network File System, FSRM).
45.04	Implement business continuity and disaster recovery (Backups, Fault Tolerance).
45.05	Configure Advanced Network services (DHCP, DNS, IPAM).
45.06	Configure the Active Directory Infrastructure (Forests, Multi-Domain).
45.07	Configure Identity Access Solutions (AD FS, AD CS, CA).

45.08 Manage certificates.

45.09 Install and configure Active Directory Rights Management Services (AD RMS).

45.10 Manage and Configure System Center Configuration Manager.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement

(Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

**Florida Department of Education
Curriculum Framework**

Program Title: Enterprise Desktop and Mobile Support Technology
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program	
Program Number	Y300600
CIP Number	0511100124
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the Program Structure section.
CTSO	SkillsUSA Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 Computer User Support Specialists 15-1152 Computer Network Support Specialists
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

The purpose of this program is to prepare students for employment or advanced training in a variety of occupations in the information technology industry.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the information technology industry; technical and product skills, underlying principles of technology, planning, management, finance, labor issues, community issues and health, safety, and environmental issues.

The content includes but is not limited to communication, leadership skills, human relations and employability skills; and safe, efficient work practices.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points. When the recommended sequence is followed, the structure is intended to prepare students to complete the CompTIA A+ and Network+ industry certifications. A student who completes the applicable competencies at any occupational completion point may either continue with the training or become an occupational completer.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0000	Computer Hardware Fundamentals	BUS ED 1 @2 COMPU SCI 6 COMP SVC 7G INFO TECH 7 G CYBER TECH 7 G ELECTRONIC @7 7 G	150 hours	15-1151
	CTS0001	Operating System Fundamentals		150 hours	15-1151
B	CTS0002	Advanced Operating Systems		150 hours	15-1151
	CTS0003	Mobile-Security-Domain Environment Fundamentals		150 hours	15-1151
C	CTS0005	Desktop Support Technician		150 hours	15-1151
D	CTS0020	Network Fundamentals		150 hours	15-1152
	CTS0033	Network Technician		150 hours	15-1152

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Identify characteristics of medium size enterprise information systems as a business unit and its critical role and purpose in successful and efficient business operation.
- 02.0 Demonstrate proficiency using enterprise-class computer/devices connectors, jacks, plugs, cables and their function, versions and purpose.
- 03.0 Demonstrate proficiency with motherboards, CPU options, system components, BIOS types and BIOS-UEFI configurations options.
- 04.0 Demonstrate proficiency with tools, ESD concepts-procedures, personal and equipment safety and chemicals related to maintenance and repair of computers, mobile devices, peripherals, printers and network devices.
- 05.0 Demonstrate an understanding of storage, video, audio, display, and network-cellular found in the business/enterprise.
- 06.0 Demonstrate proficiency in building a basic PC system using standard components, following best practices in equipment and personal safety, following manufactures' procedures and steps for every component involved in the system.
- 07.0 Demonstrate proficiency with installation and configuration of enterprise desktop-laptop operating systems.
- 08.0 Demonstrate proficiency installing and configuring expansion cards, RAM, storage devices, video adapters, audio, and a variety of system components.
- 09.0 Demonstrate proficiency in installing, updating and troubleshooting drivers in desktop-laptop-tablet devices.
- 10.0 Demonstrate proficiency with PC Laptop specification for purchase—Laptop systems for a variety of corporate functions such as, basic desktop user, CAD, CAE, video-audio editing and client-side virtualization.
- 11.0 Demonstrate the importance of health, safety, and environmental procedures in organizations and their importance to organizational and personal performance and regulatory compliance.
- 12.0 Demonstrate proficiency in connecting, configuring and troubleshooting multi-displays, data projectors, smart boards, and document cameras and kiosks systems.
- 13.0 Demonstrate proficiency of installing, configuring and troubleshooting enterprise desktop-laptop operating systems in a network environment.
- 14.0 Demonstrate proficiency of installing and configuring and troubleshooting variety of business applications in a network environment.
- 15.0 Demonstrate proficiency in configuring and troubleshooting basic desktop, laptop network connectivity, including software, services, cables, switches, and access points.
- 16.0 Understanding the fundamentals of active directory domains, organization units, the role of computers and users in that environment and how the technician interacts with this secure environment.
- 17.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
- 18.0 Describe the importance of professional ethics and legal responsibilities.
- 19.0 Explain and demonstrate the basic features of mobile operating systems.
- 20.0 Establish mobile network connectivity and configure email, and applications and configure application synchronization.
- 21.0 Configure, compare and contrast methods for mobile security and hardware platforms.
- 22.0 Identify and enterprise attack vectors, remove malware, viruses, and other security risk software from desktops, laptop, and mobile devices.
- 23.0 Demonstrate proficiency identifying, and mitigating malicious threats using social and human elements in the workplace.
- 24.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 25.0 Identify and compare and contrast business type printers.
- 26.0 Install, configure and troubleshooting directly connected printers and share to the local network.
- 27.0 Install, configure and troubleshooting server-based printers and validate the clients printing functionality.
- 28.0 Demonstrate command-line fundamentals, including hard drive navigation, network tools, basic scripts and the fundamentals of PowerShell.
- 29.0 Demonstrate proficiency in share permissions and file and folder security including fundamentals of domain users, local users, groups in an active directory environment.

- 30.0 Demonstrate the fundamentals of network architectural structure of LANs, fundamentals and roles of the network switch, router and WAN.
- 31.0 Demonstrate proficiency in tools and equipment for troubleshooting network connectivity.
- 32.0 Demonstrate the use of network services including DNS, DHCP, cellular, cloud services and applications.
- 33.0 Demonstrate the fundamentals TCP/IP, OSI and Internet models of network layer addressing.
- 34.0 Setup and configure basic VoIP telephony functionality for business users.
- 35.0 Setup and configure VPN on desktop, tablet, and laptop platforms.
- 36.0 Demonstrate proficiency installing, configuring, and troubleshooting management system agents, anti-virus, group policy objects, operating systems and applications updates.
- 37.0 Demonstrate proficiency in installing, configuring and troubleshooting client-side virtualization.
- 38.0 Demonstrate proficiency with different operating systems.
- 39.0 Demonstrate proficiency of user data backup, configuration, and recovery.
- 40.0 Demonstrate troubleshooting of PC and laptop hardware failures.
- 41.0 Demonstrate troubleshooting of PC-laptop boot failures, BSOD, shutdown, devices failing to start, missing DLL message.
- 42.0 Describe the operation of data networks.
- 43.0 Differentiate between various network media and topologies.
- 44.0 Identify, install, and configure basic network devices.
- 45.0 Implement an IP addressing scheme to meet network requirements.
- 46.0 Demonstrate use of network management tasks and methodologies.
- 47.0 Demonstrate proficiency using basic network tools.
- 48.0 Demonstrate an understanding of network security threats and mitigation techniques.
- 49.0 Configure, verify and troubleshoot a switch with VLANs and interswitch communications.
- 50.0 Implement an IP addressing scheme and IP Services to meet network requirements in a medium-size Enterprise branch office network.
- 51.0 Understand basic router operation.
- 52.0 Demonstrate Proficiency with configuring and troubleshooting a WLAN.
- 53.0 Demonstrate Proficiency with configuring and troubleshooting a Server.
- 54.0 Demonstrate Proficiency with configuring and troubleshooting a VPN.
- 55.0 Demonstrate Proficiency with configuring and troubleshooting a VOIP.
- 56.0 Demonstrate Proficiency with configuring and troubleshooting Virtualization.

Florida Department of Education
 Student Performance Standards

Program Title: Enterprise Desktop and Mobile Support Technology
 Career Certificate Program Number: Y300500

Course Number: CTS0000	
Occupational Completion Point: A	
Computer Hardware Fundamentals – 150 Hours – SOC Code 15-1151	
01.0	Identify characteristics of medium size enterprise information systems as a business unit and its critical role and purpose in successful and efficient business operation. The student will be able to:
01.01	Identify business unit structures (operations, accounting) in most medium and large enterprise.
01.02	Describe the relationship between enterprise business units and IT unit.
01.03	Summarize various career options within the IT enterprise (Help Desk, Tier 1, Tier 2, Server Administrator).
01.04	Analyze and report on IT budgets, project management, IT services, and IT innovation.
01.05	Evaluate and justify the role and importance of IT within medium and large enterprise companies.
02.0	Demonstrate proficiency using enterprise-class computer/devices connectors, jacks, plugs, cables and their function, versions and purpose. The student will be able to:
02.01	Identify legacy and current technology connectors, jacks and cables for PCs, tablets, laptops and smart phones.
02.02	Determine function and identify versions of connectors, jacks and plugs on enterprise type motherboards, laptops, tablets and smart phones.
03.0	Demonstrate proficiency with motherboards, CPU options, system components, BIOS types and BIOS-UEFI configurations options. The student will be able to:
03.01	Classify motherboard form factors, motherboard components, types and features.
03.02	Classify internal power supplies types, characteristics and connectors.
03.03	Explain the purpose CPUs, characteristics and features.
03.04	Compare and contrast CPU cooling technology for components and devices.
03.05	Compare and contrast memory types, characteristics and purpose.
03.06	Identify and explain the functions of internal storage technologies.
03.07	Compare features of BIOS vs UEFI as related to advanced functionality and security.
03.08	Identify and explain the importance of TPM and hardware based security in enterprise devices.

03.09	Demonstrate firmware upgrades, device tracking configuration, and password protection of devices.
04.0	Demonstrate proficiency with tools, ESD concepts-procedures, personal and equipment safety and chemicals related to maintenance and repair of computers, mobile devices, peripherals, printers and network devices. The student will be able to:
04.01	Given a scenario use the appropriate tools in the repair and maintenance of desktops.
04.02	Demonstrate personal safety procedures during the repair of electronic equipment, proper battery handling and storage.
04.03	Demonstrate use of ESD protection including: wrist straps, ESD mats, self-grounding, and equipment grounding.
04.04	Describe chemical SDS forms, demonstrate how to implement safety procedures, and demonstrate steps emergency aid in the event of mistakes in the use of the chemical.
04.05	Identify tools and appropriate use of tools in the repair of mobile devices, peripherals, printers and network devices.
05.0	Demonstrate an understanding of storage, video, audio, display, and network-cellular found in the business/enterprise. The student will be able to:
05.01	Identify and explain the purpose of storage types, technologies and proper implementation of storage types and technology in the support of enterprise users. SATA, SATA express, SAS, SCSI, NVMe, SSD Hard Drive, Hybrid Hard Drives, Spindle-based Hard Drives, Flash-based storage, SD, RAID technologies, Cloud-based storage options, Optical based storage.
05.02	Identify common video display technologies describe use/implementation in enterprise.
05.03	Identify common audio technologies and describe the use/implementation in enterprise.
05.04	Identify common display technologies describe the use/implementation in enterprise. Multi-displays, LCD, LED, OLED.
05.05	Identify common network-cellular technologies and describe the use/implementation in enterprise. WiFi 802.11x, Wired Ethernet, Cellular technologies, Bluetooth, RFID, NFC.
06.0	Demonstrate proficiency in building a basic PC system using standard components, following best practices in equipment and personal safety, following manufactures' procedures and steps for every component involved in the system. The student will be able to:
06.01	Demonstrate the ability to read and understand OEM technical documentation, manuals, diagrams and procedures.
06.02	Demonstrate proper handling and installation of CPU, motherboard, adapters, and power supplies in the PC enclosure/case.
06.03	Demonstrate understanding of thermal monitoring, stress testing of components, and benchmarks for performance.
06.04	Demonstrate installation of a basic operating system on a storage device.

Course Number: CTS0001
Occupational Completion Point: A
Operating System Fundamentals – 150 Hours – SOC Code 15-1151

07.0	Demonstrate proficiency with installation and configuration of enterprise desktop-laptop operating systems. The student will be able to:
07.01	Demonstrate the technology and procedures for network-based, flash drive, and image-based operating system installs.
07.02	Demonstrate the creation and use of answer-file based operating systems installs using either network file shares or flash drives.
07.03	Demonstrate installation of operating systems using sysprep, cloning software and basic scripts to do basic configurations.
08.0	Demonstrate proficiency installing and configuring expansion cards, RAM, storage devices, video adapters, audio, and a variety of system components. The student will be able to:
08.01	Demonstrate proper procedures while following OEM documentation on the installation of variety of expansion cards.
08.02	Demonstrate proper procedures while following OEM documentation when upgrading RAM.
08.03	Demonstrate proper procedures while following OEM documentation when upgrading and configuring a variety of storage devices and storage configurations.
08.04	Compare and contrast RAID scenarios used by enterprise for specialty functions (video editing, CAD, CAE).
08.05	Demonstrate proper procedures while following OEM documentation when upgrading and configuring a variety of video adapters.
09.0	Demonstrate proficiency in installing, updating and troubleshooting drivers in desktop-laptop-tablet devices. The student will be able to:
09.01	Explain the purpose and function of signed drivers, compare generic drivers with OEM drivers and properly choose the correct one given any scenario.
09.02	Demonstrate proficiency with installing configuring, troubleshooting and updating device drivers in desktops, laptops, and other mobile devices.
10.0	Demonstrate proficiency with PC Laptop specification for purchase–Laptop systems for a variety of corporate functions such as, basic desktop user, CAD, CAE, video-audio editing and client-side virtualization. The student will be able to:
10.01	Properly select display adapters, CPU, storage needs, audio functionally, and motherboard for CAD and CAE workstations and laptops.
10.02	Properly select display adapters, CPU, storage needs, audio functionally, and motherboard for video-audio editing workstations and laptops.
10.03	Properly select display adapters, CPU, storage needs, audio functionally, and motherboard for client-side virtualization workstations and laptops.
11.0	Demonstrate the importance of health, safety, and environmental procedures in organizations and their importance to organizational and personal performance and regulatory compliance. The student will be able to:
11.01	Demonstrate knowledge of the business procedures and processes for appropriate personal and equipment safety within the workspace.
11.02	De-energizing equipment, tag-out procedures, lifting techniques, weight limitations, electrical fire safety, removal of personal jewelry.
11.03	Demonstrate knowledge of business and security procedures for disposal of any storage device with corporate or personal data on it.

11.04	Demonstrate knowledge of procedures for disposal of any electronic device, batteries, chemicals that meet local, state and federal compliance regulations.
12.0	Demonstrate proficiency in connecting, configuring and troubleshooting multi-displays, data projectors, smart boards, and document cameras and kiosks systems. The student will be able to:
12.01	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting multi-display systems.
12.02	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting data-projector systems.
12.03	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting smart boards systems.
12.04	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting kiosk systems.
12.05	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting document camera systems.

Course Number: CTS0002

Occupational Completion Point: B

Advanced Operating Systems – 150 Hours – SOC Code 15-1151

13.0	Demonstrate proficiency of installing, configuring and troubleshooting enterprise desktop-laptop operating systems in a network environment. The student will be able to:
13.01	Describe the configuration and setup of network-based operating systems installation, flash drive installation and imaging.
13.02	Demonstrate the installation of an operating system using answer files, sysprep, clone tools and basic scripts for configuration.
13.03	Demonstrate understanding of users and groups configurations, management agents, and user's rights for enterprise desktops and laptops.
13.04	Demonstrate built-in operating system utilities for configuring and managing services, devices, performance, and disks.
13.05	Demonstrate built-in operating system utilities for configuring and managing scheduled tasks.
13.06	Demonstrate built-in operating system utilities user configuration, registry modification, user migration, system configuration and local security policies.
13.07	Employ built-in operating system administrative utilities for configuration and troubleshooting.
13.08	Explain operating system processes, threads, DLLs, security, and parent child relationships within the operating system.
13.09	Troubleshoot locked processes, processes that demand excessive resources, and processes that may need updates or developer intervention.
13.10	Remotely troubleshoot operating systems using RDC, built-in utilities, and web-based remote access tools.
13.11	Demonstrate the bare-metal backup and recovery on an operating system.
14.0	Demonstrate proficiency of installing and configuring and troubleshooting variety of business applications in a network environment. The student will be able to:
14.01	Demonstrate the proper installation of typical user applications.
14.02	Demonstrate basic scripting during the installation of typical applications.
14.03	Demonstrate troubleshooting steps and procedures for typical business applications, including desktop apps, modern apps, and cloud-based applications.
14.04	Compare and explain the differences and similarities of desktop applications, modern applications and cloud-based applications.
15.0	Demonstrate proficiency in configuring and troubleshooting basic desktop, laptop network connectivity, including software, services, cables, switches, and access points. The student will be able to:
15.01	Describe the characteristics and identify various network cables and connectors used in the enterprise.
15.02	Compare wireless standards and configurations needed for accessing APs.
15.03	Describe the fundamentals of an Ethernet based LAN, the role of switches in user connectivity to the LAN.

15.04	Identify fundamental services and key components for networking in the operating system.
15.05	Explain static and dynamic IP addressing, and fundamentals of network connectivity between switches and NICs, wireless NICs and access points.
15.06	Configure and troubleshoot basic network connectivity for both desktops and laptops to wired and wireless network connection.
16.0	Understanding the fundamentals of active directory domains, organization units, the role of computers and users in that environment and how the technician interacts with this secure environment. The student will be able to:
16.01	Explain the fundamental structure, purpose and function of active directory.
16.02	Explain the purpose and relationship of domain users and groups and computer membership in a domain environment.
16.03	Join computers to a domain, add domain users to local groups and explain the impact on the operating system and user rights.
16.04	Given a user, business need, and security requirement show how GPOs impact the function of the operating system.
16.05	Given a scenario apply a GPO to users and computers that effectively meets the criteria of the scenario.
17.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. The student will be able to:
17.01	Describe the nature and types of business organizations.
17.02	Explain the effect of key organizational systems on performance and quality.
17.03	List and describe quality control systems and/or practices common to the workplace.
17.04	Explain the impact of the global economy on business organizations.
18.0	Describe the importance of professional ethics and legal responsibilities. The student will be able to:
18.01	Evaluate and justify decisions based on ethical reasoning.
18.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
18.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
18.04	Interpret and explain written organizational policies and procedures.

Course Number: CTS0003

Occupational Completion Point: B

Mobile-Security-Domain Environment Fundamentals – 150 Hours – SOC Code 15-1151

19.0	Explain and demonstrate the basic features of mobile operating systems. The student will be able to:
19.01	Compare and contrast the significant mobile operating systems as open source vs vendor specific, its impact on applications sources, its fundamental operations and interface.
19.02	Explain the various enterprise BYOD policies found in the local area, their impact on the user and security policies of company data.
19.03	Demonstrate the ability to navigate and locate administration functionality on different hardware platforms and different operating systems.
20.0	Establish mobile network connectivity and configure email, and applications and configure application synchronization. The student will be able to:
20.01	Configure fundamental settings for a user from a default state on a mobile operating system.
20.02	Add, configure and troubleshoot mobile applications.
20.03	Enable, configure and troubleshoot Bluetooth, NFC, wireless and cellular networks.
20.04	Configure synchronization with email systems and other critical business type applications and cloud-based providers.
20.05	Configure VPN for mobile devices.
21.0	Configure, compare and contrast methods for mobile security and hardware platforms. The student will be able to:
21.01	Compare and contrast security methods for different operating systems and hardware.
21.02	Compare and contrast security methods for Passcode locks.
21.03	Compare and contrast security methods for Log on security methods.
21.04	Compare and contrast security methods for Remote wipes.
21.05	Compare and contrast security methods for Locator applications.
21.06	Compare and contrast security methods for Patching/OS updates.
21.07	Configure various types of user and device security on mobile operating systems.
22.0	Identify and enterprise attack vectors, remove malware, viruses, and other security risk software from desktops, laptop, and mobile devices. The student will be able to:
22.01	Compare contrast common security threats.
22.02	Explain the use of malware, rootkits, phishing, shoulder surfing, spyware, app vulnerability.
22.03	Install and configure anti-virus and anti-malware software.

22.04	Implement security best practices.
22.05	Demonstrate setting strong passwords, changing default user names/passwords, disabling unused users, restricting user rights.
22.06	Demonstrate safe storage device sanitation: wipe, physical destruction, out-source for recycle and sanitation.
22.07	Establish and configure strong wireless security standards.
22.08	Using third party tools both installed and offline, detect malicious code and remove such code, using proper procedures for protecting user data.
23.0	Demonstrate proficiency identifying, and mitigating malicious threats using social and human elements in the workplace. The student will be able to:
23.01	Identify and implement physical security prevention methods.
23.02	Explain access control, physical document securing, tailgating, biometrics, badges, key fobs, privacy filters and retinal identification.
23.03	Explain the importance of “principle of least privilege” and “user education” in the overall company security policy.
23.04	Identify the “human” element within each company and the principles behind social engineered attacks.
23.05	Assess digital security.
23.06	Setup firewall, anti-virus, network access policies, user authentication, directory permissions.
23.07	Given a social engineered attack scenario, use proper procedures to identify the threat and mitigate the threat.
24.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The student will be able to:
24.01	Employ leadership skills to accomplish organizational goals and objectives.
24.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
24.03	Conduct and participate in meetings to accomplish work tasks.
24.04	Employ mentoring skills to inspire and teach others.
25.0	Identify and compare and contrast business type printers. The student will be able to:
25.01	Explain the principles of the xerographic process used by all laser and copy devices.
25.02	Compare and contrast the impact, thermal, and inkjet printer technologies.
25.03	Compare and contrast types of paper used by a variety of business type printers.
26.0	Install, configure and troubleshooting directly connected printers and share to the local network. The student will be able to:
26.01	Install, configure and troubleshoot typical MFP printers to a local host.

26.02	Demonstrate setup for printing, fax, copy and scan.
26.03	Install and configure a printer via, wireless, and connect mobile apps for control of printer/scanner functions.
26.04	Perform basic printer maintenance.
26.05	Share and secure hosted printers and troubleshoot printer and network connectivity issues.
27.0	Install, configure and troubleshooting server-based printers and validate the clients printing functionality. The student will be able to:
27.01	Install, configure and troubleshoot server-hosted printer.
27.02	Configure basic printer security and policies and user access.
27.03	Connect and configure and test client access and functionality to printer.

Course Number: CTS0005

Occupational Completion Point: C

Desktop Support Technician – 150 Hours – SOC Code 15-1151

28.0 Demonstrate command-line fundamentals, including hard drive navigation, network tools, basic scripts and the fundamentals of PowerShell. The student will be able to:

28.01 Demonstrate hard drive and directory navigation with command-line and PowerShell.

28.02 Demonstrate basic utilities for managing files, folders, operating system and network using command-line or PowerShell interfaces.

28.03 Setup logon and logoff scripts and basic use of various types of scripts to manage desktops.

29.0 Demonstrate proficiency in share permissions and file and folder security including fundamentals of domain users, local users, groups in an active directory environment. The student will be able to:

29.01 Demonstrate the fundamentals of shares and share permissions, file and folder security and the interaction between the two.

29.02 Demonstrate the fundamentals of users and groups in their role of share permissions and file and folder security.

29.03 Given a scenario, properly configure and set share, file and folder security for users and group combinations.

30.0 Demonstrate the fundamentals of network architectural structure of LANs, fundamentals and roles of the network switch, router and WAN. The student will be able to:

30.01 Explain the basic structure of extended star Ethernet LANs, identify the MDF and IDF roles.

30.02 Explain the ISP/WAN connectivity, devices and basic security structure.

30.03 State the role of the router.

30.04 State the role of switches, VLANs, PoE and switch interconnection in a basic LAN.

30.05 Explain the fundamentals network devices and their functions.

30.06 Define NAS, Bridge, Modem, router, firewall.

31.0 Demonstrate proficiency in tools and equipment for troubleshooting network connectivity. The student will be able to:

31.01 Use a variety of tools for network cables and connectors and punch downs.

31.02 Use cable tone and probe tools.

31.03 Use loopback adapters for troubleshooting and various network adapters for cable crossovers.

32.0 Demonstrate the use of network services including DNS, DHCP, cellular, cloud services and applications. The student will be able to:

32.01 Explain fundamental LAN network services: DNS, DHCP, and WINS.

32.02	Explain the fundamentals of cellular systems and their role in network and application connectivity.
32.03	Explain the fundamentals of cloud services and applications.
33.0	Demonstrate the fundamentals TCP/IP, OSI and Internet models of network layer addressing. The student will be able to:
33.01	Explain the fundamentals of the OSI and Internet models.
33.02	Explain and understand IPv4 classic addressing schemes and IPv6.
33.03	Explain the purpose of common TCP and UDP ports, protocols.
33.04	Explain the fundamentals of desktop-mobile use of TCP/IP configurations.
34.0	Setup and configure basic VoIP telephony functionality for business users. The student will be able to:
34.01	Explain the fundamentals of telephony and transition of that technology to VoIP.
34.02	List and describe the major components of user setup, basic configuration using VoIP.
34.03	Successfully configure a basic VoIP user, test the circuit for functionality.
35.0	Setup and configure VPN on desktop, tablet, and laptop platforms. The student will be able to:
35.01	Explain and compare the different technology and security used by VPN in the enterprise.
35.02	Configure and test a VPN client on a desktop, tablet or laptop.
35.03	Configure and test a public cloud-based VPN system.
36.0	Demonstrate proficiency installing, configuring, and troubleshooting management system agents, anti-virus, group policy objects, operating systems and applications updates. The student will be able to:
36.01	Explain the purpose enterprise management systems, both local and cloud-based.
36.02	Explain enterprise anti-malware systems and the agents critical to their success.
36.03	Explain the purpose of domain GPOs in the overall strategy for policy and security of the network.
36.04	Explain the control of application and operating system updates.
36.05	Demonstrate installing configuring and troubleshooting management agents, anti-malware, GPOs, and updates.
37.0	Demonstrate proficiency in installing, configuring and troubleshooting client-side virtualization. The student will be able to:
37.01	Identify hardware and software requirements for client-side virtualization.
37.02	Install type 1 and type 2 hypervisors on desktop operating systems.
37.03	Install, configure, and troubleshoot guest operating systems.

38.0	Demonstrate proficiency with different operating systems. The student will be able to:
38.01	Compare and contrast Windows, Linux and the MAC OS.
38.02	Explain the use and purpose of different operating systems within an enterprise.
38.03	Identify the certifications and skills needed to support different operating systems.
38.04	Compare the technical support challenges of different operating systems within a company.
39.0	Demonstrate proficiency of user data backup, configuration, and recovery. The student will be able to:
39.01	Explain the fundamentals of user profiles and user data redirection.
39.02	Properly migrate a user's data and settings from one platform to another.
39.03	Troubleshoot user profiles issues.
39.04	Demonstrate user data recovery and backup.
40.0	Demonstrate troubleshooting of PC and laptop hardware failures. The student will be able to:
40.01	Troubleshoot a variety of hardware failures.
40.02	Troubleshoot hard drive, RAID issues, cable connections, adapter, overheating, and power supply and motherboard and monitor.
41.0	Demonstrate troubleshooting of PC-laptop boot failures, BSOD, shutdown, devices failing to start, missing DLL message. The student will be able to:
41.01	Troubleshoot a variety of boot and shutdown failures.
41.02	Troubleshoot BSOD, operating system errors message, device and services failing to start, missing DLLs.

Course Number: CTS0020
Occupational Completion Point: D
Networking Fundamentals– 150 Hours – SOC Code 15-1152

42.0 Describe the operation of data networks. The student will be able to:

42.01 Explain the function of common networking protocols.

42.02 Identify commonly used TCP and UDP default ports.

42.03 Identify address formats- IPv4, IPv6, MAC address.

42.04 Explain the function of each layer of the OSI model.

42.05 Identify the proper use of addressing technologies and addressing schemes.

42.06 Identify common routing protocols.

42.07 Explain the purpose and properties of routing.

42.08 Compare the characteristics of wireless communication standards.

42.09 Interpret network diagrams.

43.0 Differentiate between various network media and topologies. The student will be able to:

43.01 Categorize standard cable types and their properties.

43.02 Identify common connector types.

43.03 Identify common physical network topologies.

43.04 Differentiate and implement appropriate wiring standards.

43.05 Select the appropriate media, cables, ports, and connectors to connect network devices.

43.06 Categorize WAN technology types and properties.

43.07 Categorize LAN technology types and properties.

43.08 Explain common logical network topologies and their characteristics.

43.09 Install components of wiring distribution.

43.10 Build appropriate cables.

43.11	Troubleshoot common network cabling issues.
44.0	Identify, install, and configure basic network devices. The student will be able to:
44.01	Install, configure and differentiate between common network devices.
44.02	Identify the functions of specialized network devices.
44.03	Explain the advanced features of a switch.
44.04	Implement a small switched network.
44.05	Verify network status and operation using basic utilities.
45.0	Implement an IP addressing scheme to meet network requirements. The student will be able to:
45.01	Assign and verify valid IP addresses in a LAN environment.
45.02	Describe Network Address Translation (NAT) and its importance in network communication.
45.03	Distinguish between public and private IP addresses.
45.04	Configure, verify, and troubleshoot DHCP and DNS operation.
45.05	Implement static and dynamic IP addressing.
45.06	Troubleshoot IP addressing issues.
46.0	Demonstrate use of network management tasks and methodologies. The student will be able to:
46.01	Explain network segmentation and traffic management concepts.
46.02	Conduct network monitoring to identify performance and connectivity issues.
46.03	Implement network troubleshooting methodologies.
46.04	Troubleshoot common connectivity issues and select an appropriate solution.
47.0	Demonstrate proficiency using basic network tools. The student will be able to:
47.01	Select the appropriate command line interface tool and interpret the output to verify functionality.
47.02	Explain the purpose of network scanners.
47.03	Utilize the appropriate hardware tools.

48.0 Demonstrate an understanding of network security threats and mitigation techniques. The student will be able to:

48.01 Explain the function of hardware and software security devices.

48.02 Explain common features of a firewall.

48.03 Explain the methods of network access security.

48.04 Explain methods of user authentication.

48.05 Explain issues that affect device security.

48.06 Implement password and physical security in a small routed network.

48.07 Identify common security threats and mitigation techniques.

Course Number: CTS0026
Occupational Completion Point: D
Network Technician – 150 Hours – SOC Code 15-1152

49.0	Configure, verify and troubleshoot a switch with VLANs and interswitch communications. The student will be able to:
49.01	Select the appropriate media, cables, ports, and connectors to connect switches to other network devices and hosts.
49.02	Explain the technology and media access control method for Ethernet networks.
49.03	Explain basic switching concepts and the operation of managed switches.
49.04	Perform and verify switch configuration tasks.
49.05	Verify network status and switch operation using basic utilities.
49.06	Describe enhanced switching technologies.
49.07	Describe how VLANs create logically separate networks and the need for routing between them.
49.08	Configure, verify and troubleshoot VLANs.
49.09	Implement basic switch security.
50.0	Implement an IP addressing scheme and IP Services to meet network requirements in a medium-size Enterprise branch office network. The student will be able to:
50.01	Describe the operation and benefits of using private and public IP addressing.
50.02	Explain the operation and benefits of using DHCP and DNS.
50.03	Implement static and dynamic addressing services for hosts in a LAN environment.
50.04	Calculate and apply an addressing scheme including subnetting IP networks.
50.05	Describe the technological requirements for running IPv6 in conjunction with IPv4 (e.g., protocols, dual stack, tunneling).
50.06	Describe IPv6 addressing.
50.07	Implement IPv6 in a network environment.
50.08	Identify and correct common problems associated with IP addressing and host configurations.
51.0	Understand basic router operation. The student will be able to:

51.01	Describe basic routing concepts (e.g., packet forwarding, router lookup process).
51.02	Describe the operation of routers.
51.03	Select the appropriate media, cables, ports and connectors to connect routers to other network devices and hosts.
51.04	Verify network connectivity (using ping, traceroute, telnet or SSH).
51.05	Explain the basics of routing concepts and protocols.
51.06	Explain the basics of Network Address Translation and Port Address Translation.
52.0	Demonstrate proficiency with configuring and Troubleshooting a WLAN. The student will be able to:
52.01	Describe the standards associated with wireless media.
52.02	Identify and describe the purpose of the components of a small WLAN.
52.03	Configure a small WLAN such that devices connect to the correct access point.
52.04	Describe the security features and capabilities of WI-FI Protected Access (WPA).
52.05	Describe common issues with implementing a WLAN and methods for addressing these issues.
52.06	Describe the wireless security standards.
52.07	Implement the appropriate wireless security standard.
52.08	Design and implement a wireless network using appropriate standards.
52.09	Identify common issues with implementing wireless networks.
52.10	Troubleshoot common wireless network issues.
53.0	Demonstrate proficiency with configuring and Troubleshooting a Server. The student will be able to:
53.01	Install Server OS and select appropriate roles.
53.02	Configure different server roles (DHCP, DNS, Print Server, File Server).
53.03	Configure network authorization and authentication on server.
53.04	Configure web content filtering and caching (Proxy).

53.05	Install and apply patches and updates.
53.06	Perform network backups and select appropriate mediums.
53.07	Perform software deployment over the network.
54.0	Demonstrate proficiency with configuring and troubleshooting a VPN. The student will be able to:
54.01	Describe the common protocols and ports associated with a VPN.
54.02	Setup and configure a VPN.
54.03	Troubleshoot common issues associated with VPN connectivity.
55.0	Demonstrate proficiency with configuring and troubleshooting a VOIP. The student will be able to:
55.01	Explain Quality of Service and how it applies to a VOIP system.
55.02	Describe common protocols associated with VOIP.
55.03	Explain the main features of a Call Management System.
56.0	Demonstrate proficiency with configuring and troubleshooting Virtualization. The student will be able to:
56.01	Setup and configure a networked virtual environment (e.g. Server Farm).
56.02	Explain the positives and negatives of virtualization.
56.03	Explain the different types of Storage Area Network devices.
56.04	Explain Cloud computing and cloud storage.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Digital Media Technology
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y500100
CIP Number	0509070200
Grade Level	30, 31
Standard Length	750 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1142 – Network and Computer Systems Administrators
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in technical digital media positions in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills.

The content includes but is not limited to practical experiences in the implementation, management, and maintenance of advanced telecommunication environments associated with the creation, packaging, and delivery of digital media.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	DIG0080	Digital Media Technician	BUS ED 1 @2 DIGI MEDIA 7G INFO TECH 7G	600 hours	15-1142

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Describe characteristics of digital media relative to format, standards, encoding schemes, and origin.
- 16.0 Compare and contrast various forms of digital media delivery systems.
- 17.0 Demonstrate an understanding of handling equipment, recording video and audio, exporting files and editing projects.
- 18.0 Demonstrate an understanding of the characteristics, development medium, and technical aspects of digital audio.
- 19.0 Create animation in digital media that enhances production.
- 20.0 Perform safety skills while performing or recording on set.
- 21.0 Apply appropriate lighting for location and/or set productions.
- 22.0 Operate a video camera.
- 23.0 Record, mix and edit audio resources.
- 24.0 Shoot Studio and /or location footage.
- 25.0 Design and generate graphic elements.
- 26.0 Demonstrate proficiency configuring and operating equipment and software applications used in the creation and delivery of digital video.
- 27.0 Demonstrate proficiency configuring and operating equipment and software applications used in the creation and delivery of digital audio.
- 28.0 Apply industry standard workflow management methods applicable to the integration and synchronization of audio and video into a single digital media product.
- 29.0 Apply industry standard asset management methods applicable to development of a digital media product.
- 30.0 Explain the importance of calibration in the production of digital media and the means by which it is accomplished.
- 31.0 Demonstrate proficiency in producing a digital media product for delivery for both televised and online streaming media.

- 32.0 Demonstrate proficiency in producing a digital media product for delivery using an Internet-based on-demand system (e.g., VOD, IPTV).
- 33.0 Demonstrate proficiency in producing a digital media product for delivery using an Internet-based streaming system.
- 34.0 Demonstrate proficiency in producing a digital media product for delivery using an Internet-based system featuring multi-point presence.
- 35.0 Demonstrate proficiency in producing a digital media product for delivery using satellite delivery systems.
- 36.0 Describe the evolution, role, and characteristics of a Content Distribution Network (CDN) for delivering digital media to Internet points.
- 37.0 Demonstrate an understanding of Internet Protocol Television (IPTV) systems, their types, applications, and implementation issues.
- 38.0 Successfully plan out and produce a professional portfolio showcasing mastery of multimedia production and self-marketing.
- 39.0 Utilize best practices involving advanced professional grade equipment.
- 40.0 Use innovative means and perceptual understanding to communicate through varied content, media and digital art techniques.
- 41.0 Develop competence and dexterity, through the use of processes, tools and techniques for various media.
- 42.0 Examine career opportunities in the Digital Media Field to determine requisite skills, qualifications, supply-and-demand, market location and potential earnings.
- 43.0 Demonstrate professional organizational skills to influence sequential process when producing multimedia.
- 44.0 Demonstrate professional interview skills.

Florida Department of Education
Student Performance Standards

Program Title: Digital Media Technology
Career Certificate Program Number: Y500100

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: DIG0080
Occupational Completion Point: B
Digital Media Technician – 600 Hours – SOC Code 15-1142

15.0	Describe characteristics of digital media relative to format, standards, encoding schemes, and origin. The student will be able to:
15.01	Determine the meaning of symbols, key terms, and other domain-specific words and phrases.
15.02	Identify and differentiate the appropriate use of digital media formats based on standard industry practices.
15.03	Identify and differentiate the appropriate use of encoding schemes based on project needs.
15.04	Identify the difference between digital media source files and digital media delivery systems.
16.0	Compare and contrast various forms of digital media delivery systems. The student will be able to:
16.01	Identify the differences between fixed digital media formats and digital media streaming.
16.02	Identify the various forms of digital media content distribution.
16.03	Describe the development of digital media technology as it pertains to digital signage.
16.04	Describe the impact of mobile and Wi-Fi technologies on the digital media development industry.
17.0	Demonstrate an understanding of handling equipment, recording video and audio, exporting files and editing projects. The student will be able to:
17.01	Identify digital image file types and their appropriate uses.
17.02	Compare and contrast the similarities and differences between Standard Definition and High Definition recordings.
17.03	Describe and apply the characteristics of digital video.
17.04	Identify and describe the various application platforms used in digital video development.
17.05	Create a video production that meets the industry standards of production.
18.0	Demonstrate an understanding of the characteristics, development medium, and technical aspects of digital audio. The student will be able to:
18.01	Identify and describe the fundamental aspects of sound theory.
18.02	Compare and contrast the similarities and differences between various audio recordings.
18.03	Describe the characteristics of digital audio.
18.04	Identify and describe the various application platforms used in digital audio recording and editing.
18.01	Enhance storytelling using sound effects.
18.02	Capture and edit original audio to be utilized with in class video production projects.

19.0	Create animation in digital media that enhances production. The student will be able to:
19.01	Describe the process of developing animations and identify the industry standard platforms used in their creation.
19.02	Describe the similarities and differences as well as industry standard platforms used in the development of 2D and 3D graphics.
19.03	Identify and describe the challenges in developing and deploying digital media content.
19.04	Identify the components and characteristics of motion that make up an animation.
19.05	Create animations within production.
19.06	Produce storyboarding, production plans (GANNT CHARTS) and playable rough cuts.
20.0	Perform safety skills while performing or recording on set. The student will be able to:
20.01	Perform proper care of equipment.
20.02	Demonstrate appropriate use of equipment in an efficient manner.
20.03	Demonstrate awareness of appropriate ergonomics.
20.04	Demonstrate safe ways to create action on set.
20.05	Apply ethical practices.
21.0	Apply appropriate lighting for location and/or set productions. The student will be able to:
21.01	Determine appropriate lighting needs for production settings.
21.02	Identify locations and studio lighting types, method of use and application.
21.03	Use lighting equipment according to industry safety standards.
22.0	Operate a video camera. The student will be able to:
22.01	Use current industry standard production video equipment.
22.02	Operate camera in studio and location (field) production environments.
22.03	Align camera for studio production.
22.04	Demonstrate appropriate framing for both SDTV and HDTV.
22.05	Operate (CCU) Camera Control Uni.
23.0	Record, mix and edit audio resources. The student will be able to:

23.01	Identify and select microphones for production needs.
23.02	Determine optimal microphone placement.
23.03	Establish appropriate recording conditions.
23.04	Set up audio recording equipment.
23.05	Perform appropriate pre-production check of production equipment.
23.06	Record location sound.
23.07	Record studio live sound.
23.08	Perform basic routine, preventative and repair maintenance on video equipment.
23.09	Define the various recording formats and media.
23.10	Define appropriate digital compression and signal (file) types.
23.11	Perform sound edits and enhancements.
24.0	Shoot studio and/or location footage. The student will be able to:
24.01	Plan a shot to obtain required action/footage.
24.02	Demonstrate appropriate shot sequences, transitions and post production (edit) effects.
24.03	Control camera movement to obtain required effects.
24.04	Control lens, focal length, aperture and exposure to obtain required effects.
24.05	Set up camera and recording equipment sequence.
25.0	Design and generate graphic elements. The student will be able to:
25.01	Determine the graphic requirements for a production.
25.02	Operate graphic production software.
25.03	Produce broadcast graphic elements for titling, credits and graphic transitions.
25.04	Determine the special effects need for a production.

25.05	Set up and operate character generator equipment and software.
25.06	Generate appropriate special effects and animated elements for a production.
25.07	Demonstrate an understanding of graphic image types, file formats, and technical requirements for a production.
25.08	Use image editing (bit mapped) software.
25.09	Edit graphics into the program or segment.
25.10	Demonstrate an ability to use type, color, composition and graphic elements for a specific production effect.
25.11	Demonstrate an ability to use different aspect ratios as needed for SDTV and HDTV.
25.12	Identify and describe the standard practices for retrieving digital media assets both on local and remote work stations / networks.
25.13	Describe the standard practices for establishing digital asset security.
25.14	Describe the purpose and function of metadata as it pertains to the management of digital assets.
26.0	Demonstrate proficiency configuring and operating equipment and software applications used in the creation and delivery of digital video. The student will be able to:
26.01	Produce video files according to industry standard specifications using digital media development hardware and software applications.
26.02	Identify and incorporate the appropriate use of digital video encoding based on industry standard practices.
26.03	Identify the various tools and procedures utilized in the conversion of digital media file types.
26.04	Demonstrate proficiency in the utilization of standard video production equipment.
26.05	Demonstrate proficiency in the connectivity and configuration of digital video equipment.
26.06	Identify and troubleshoot lighting issues as they pertain to the recording of digital video as well as describe common industry practices in the staging of light sources.
27.0	Demonstrate proficiency configuring and operating equipment and software applications used in the creation and delivery of digital audio. The student will be able to:
27.01	Produce audio files according to industry standard specifications using digital media development hardware and software applications.
27.02	Demonstrate proficiency in the utilization of standard audio production equipment.
27.03	Demonstrate proficiency in the connectivity and configuration of digital audio equipment.
28.0	Apply industry standard workflow management methods applicable to the integration and synchronization of audio and video into a single digital media product. The student will be able to:

28.01	Describe the various media integration systems and their appropriate uses in the development of digital media.
28.02	Identify and describe the importance of version control in digital asset management.
28.03	Identify and describe the various forms of digital audio / video synchronization and the tools and techniques used to sync digital audio and video.
28.04	Successfully operate digital audio/video devices simultaneously in order to produce HD quality media to synchronize assets for post-production.
29.0	Apply industry standard asset management methods applicable to development of a digital media product. The student will be able to:
29.01	Identify and describe the standard practices for storing and archiving digital media assets.
29.02	Successfully apply and enhance upon industry standard practices for storing and archiving digital media assets.
29.03	Identify and describe the standard practices for retrieving digital media assets both on local and remote work stations / networks.
29.04	Describe the standard practices for establishing digital asset security.
29.05	Describe the purpose and function of metadata as it pertains to the management of digital assets.
30.0	Explain the importance of calibration in the production of digital media and the means by which it is accomplished. The student will be able to:
30.01	Identify the necessity and effects of calibration on various digital media systems.
30.02	Identify standard practices in calibrating digital media production equipment.
12.01	Use lighting for effect to control mood and impact in production settings.
12.02	Use studio lighting master control equipment.
31.0	Demonstrate proficiency in producing a digital media product for delivery for both televised and online streaming media. The student will be able to:
31.01	Identify and describe the various physical and application formats for (DVD) media technology.
31.02	Identify and describe the various (DVD) physical outputs for media players.
31.03	Identify the features and specifications of (DVD) media and the (DVD) format.
31.04	Identify and describe the (DVD) media industry specification (red book standard).
31.05	Identify and describe the various coding mechanisms utilized in the creation of (DVD) media.
31.06	Identify and describe standard copy protection practices in (DVD) media creation.

31.07	Use standard (DVD) authoring / editing systems in the creation of (DVD) media.
31.08	Identify and describe the appropriate use of standard television formats (PAL & NTSC).
31.09	Demonstrate an awareness of the issues in quality when compressing digital media.
32.0	Demonstrate proficiency in producing a digital media product for delivery using an Internet-based on-demand system (e.g., VOD, IPTV). The student will be able to:
32.01	Develop digital media in the appropriate specified format for delivery on On-Demand Systems.
32.02	Develop digital media in the appropriate specified format for delivery on Video on demand (VOD) Systems.
32.03	Develop digital media in the appropriate specified format for delivery on IP Television (IPTV).
33.0	Demonstrate proficiency in producing a digital media product for delivery using an Internet-based streaming system. The student will be able to:
33.01	Develop digital media in the appropriate specified format for delivery on On-Demand Systems.
33.02	Develop digital media in the appropriate specified format for delivery on Video on demand (VOD) Systems.
33.03	Develop digital media in the appropriate specified format for delivery on IP Television (IPTV).
33.04	Develop digital media in the appropriate specified format for delivery on Grid Casting systems.
34.0	Demonstrate proficiency in producing a digital media product for delivery using an Internet-based system featuring multi-point presence. The student will be able to:
34.01	Demonstrate an awareness of the tools and practices used in establishing multiple points of presence.
34.02	Demonstrate an awareness of design constraints and attributes as they pertain to producing digital media for delivery on internet-based systems.
34.03	Demonstrate an awareness of communication channels and considerations as they pertain to producing digital media for delivery on internet-based systems.
35.0	Demonstrate proficiency in producing a digital media product for delivery using satellite delivery systems. The student will be able to:
35.01	Identify industry applications utilized in producing a digital media product for delivery using satellite delivery systems.
35.02	Identify current technologies and capabilities used in the production of a digital media product for delivery using satellite delivery systems.
35.03	Describe the current limitations (e.g. latency) of delivering digital media via satellite delivery systems.
35.04	Identify and describe common issues in delivering digital media via simulcast systems.
35.05	Identify and describe the process of delivering digital media via multicast systems.

36.0	Describe the evolution, role, and characteristics of a Content Distribution Network (CDN) for delivering digital media to Internet points. The student will be able to:
36.01	Describe content networking techniques as they pertain to the delivering of digital media to internet points.
37.0	Demonstrate an understanding of Internet Protocol Television (IPTV) systems, their types, applications, and implementation issues. The student will be able to:
37.01	Demonstrate an understanding of converged services and their application to Internet Protocol Television (IPTV).
37.02	Compare and contrast live versus stored media systems.
37.03	Demonstrate an understanding of Internet Protocol Television (IPTV) applications and delivery systems.
37.04	Demonstrate an understanding of common issues that pertain to the development of digital media for distribution over Internet Protocol Television (IPTV) systems.
38.0	Successfully plan out and produce a professional portfolio showcasing mastery of multimedia production and self-marketing. The student will be able to:
38.01	Showcase a high level of creative independence in producing multimedia content that focuses on the individual student's strengths and build upon any skills that may require additional practice throughout the Portfolio development.
38.02	Student will both document and demonstrate both successful and unsuccessful progress a throughout their portfolio development by use of a Production Schedule or GANTT CHART.
38.03	Write, direct and produce an amateur short film. This work will be continuously progressive until a Portfolio deadline is designated.
38.04	Write, direct and produce an amateur commercial advertisement. This work will be continuously progressive until Portfolio deadline is designated.
38.05	Write, direct and produce an amateur Visual Postcard. This work will be continuously progressive until Portfolio deadline is designated
38.06	Write, direct and produce an amateur Motion Graphics based tutorial. This work will be continuously progressive until Portfolio deadline is designated
39.0	Utilize best practices involving advanced professional grade equipment. The student will be able to:
39.01	Pack and transport equipment.
39.02	Identify and dismantle/assemble equipment.
39.03	Locate, scout and obtain appropriate on site permission.
39.04	Use model release form documents.
39.05	Scout locations for proper electrical outlets.
39.06	Plan, coordinate and manage a production GANTT Chart
39.07	Define specific dates for multiple video production projects.
39.08	Determine post-production requirements.

39.09	Coordinate post-production values.
39.10	Identify and attempt to resolve production issues during post-production.
39.11	Practice leadership skills.
39.12	Manage crew and staff during pre-planning and production.
39.13	Present project proposals including script, storyboards and shot lists.
39.14	Delegate and assign tasks to members during all phases of production.
39.15	Examine career opportunities in the Digital Media field to determine requisite skills, qualifications, supply-and-demand, market location, and potential earning.
39.16	Apply advanced color correction techniques to film.
39.17	Demonstrate and apply primary practice of marketing sales techniques.
40.0	Use innovative means and perceptual understanding to communicate through varied content, media and digital art techniques. The student will be able to:
40.01	Showcase a high level of creative independence in producing multimedia content that focuses on the individual student's strengths and build upon any skills that may require additional practice throughout Portfolio development.
40.02	Students will both document and demonstrate both successful and unsuccessful progress throughout their portfolio development by use of a Production Schedule or GANNT CHART.
40.03	Write, direct and produce an amateur short film. This work will be continuously progressive until a Portfolio deadline is designated.
40.04	Write, direct and produce an amateur commercial advertisement. This work will be continuously progressive until Portfolio deadline is designated.
40.05	Write, direct and produce an amateur Visual Postcard. This work will be continuously progressive until Portfolio deadline is designated.
40.06	Write, direct and produce an amateur Motion Graphics based tutorial. This work will be continuously progressive until Portfolio deadline is designated.
40.07	Demonstrate strong use of graphical design programs (Photoshop, Illustrator) to edit, enhance and properly choose formats for placement and use in Premiere, Final Cut, Motion or After Effects.
41.0	Develop competence and dexterity, through practice, in the use of processes, tools and techniques for various media. The student will be able to:
41.01	Utilize best practices involving advanced professional grade equipment.
41.02	Pack and transport equipment.
41.03	Identify and dismantle/assemble equipment.
41.04	Use model release form documents.
41.05	Locate, scout and obtain appropriate on site permission as needed.

41.06	Define specific dates for multiple video production projects.
41.07	Coordinate post-production values.
41.08	Identify and attempt to resolve production issues during post-production.
41.09	Present project proposals including script, storyboards and shot lists.
41.10	Delegate and assign tasks to members during all phases of production.
41.11	Manage crew and staff during pre-planning and production.
42.0	Examine career opportunities in the Digital Media field to determine requisite skills, qualifications, supply-and-demand, market location, and potential earning. The student will be able to:
42.01	Demonstrate and apply primary practice of marketing sales techniques.
42.02	Identify, demonstrate and practice modern day online and televised marketing techniques.
42.03	Research average salary range for various Digital Media careers.
42.04	Research existing Digital Media careers and determine specified skills and qualifications.
43.0	Demonstrate professional organizational skills to influence sequential process when producing multimedia. The student will be able to:
43.01	Properly save and export multiple formats of video, audio and images from specified editing programs for use in cross platform devices and software.
43.02	Use PC/MAC operating system to create multiple directories specified to the types of media being imported or used for their projects.
43.03	Identify known software issues and determine solutions.
43.04	Understand updated software and its system requirements.
44.0	Demonstrate professional interview skills. The student will be able to:
44.01	Showcase the value of their own skills during mock interviews.
44.02	Be able to present works to others and openly discuss the purpose of its value.
44.03	Initiate and participate in group discussions related to others progress and offer intuitive solutions as well as accepting constructive criticism and conforming to new processes.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations

benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as

instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Modeling Simulation Production
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y500200
CIP Number	0511080402
Grade Level	30, 31
Standard Length	1500 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other 15-1132 – Software Developers, Applications 15-1131– Computer Programmer
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

The Modeling and Simulation program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster and the expansive employment opportunities in the field of Modeling and Simulation. This course provides technical skill proficiency and includes competency-based applied learning through the use of hands-on labs and the development of a multi-year portfolio. Students will build academic knowledge, enhance higher-order reasoning and problem-solving skills, develop leadership and collaboration abilities and refine general employability and occupation-specific skills.

The content includes but is not limited to practical experiences in modeling and simulation conceptualization, design, storyboarding, development methodologies, essential programming techniques, prototype development, production processes and implementation challenges. Science, Computer Programming and Math are embedded throughout the program to emphasize the relationship between these areas and the field of Modeling and Simulation. To further enrich this course sequence it is recommended students take a sequence of electives in either visual arts, computer arts, or digital arts including but not limited to Computer Programming, Web Design, Gaming and Animation, Robotics and/or Geospatial/Geographic Information Systems Technology.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of six occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0770	Modeling & Simulation Technician	COMPU SCI 6	150 hours	15-1199
B	CTS0776	Modeling & Simulation Programmer I	ENG&TEC ED1@2	300 hours	15-1131
C	CTS0777	Modeling & Simulation Programmer II	TEC ED 1 @2	300 hours	15-1131
D	CTS0778	Modeling & Simulation Advanced Programmer	ENG 7G	300 hours	15-1131
E	CTS0774	Modeling & Simulation Developer	ENG TECH 7G INFO TECH 7G COMP PROG 7G ROBOTICS 7G BUS ED 1 @2 TV PRO TEC @7 7G COMM ART @ 7 7G	450 hours	15-1132

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate an understanding of essential modeling and simulation terms by using them as they relate to specific careers requiring modeling and simulation skills and knowledge.
- 02.0 Demonstrate information fluency using emerging research techniques and technology.
- 03.0 Demonstrate a knowledge of the information technology industry, the history of computers including their components and functionality, as they relate to Modeling and Simulation.
- 04.0 Explain intelligent systems as they relate to modeling, simulation and data analysis.
- 05.0 Demonstrate knowledge of different operating systems
- 06.0 Explore software evolution and lifecycle as it relates to modeling and simulation.
- 07.0 Understand the production process of modeling, simulation and entertainment.
- 08.0 Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets.
- 09.0 Demonstrate production use of high-end Game Engines.
- 10.0 Categorize the different gaming genres.
- 11.0 Describe the game development life cycle.
- 12.0 Develop a game design document.
- 13.0 Identify gameplay elements and their characteristics.
- 14.0 Explore the methods used to create and sustain player immersion.
- 15.0 Describe the general principles of storytelling.
- 16.0 Develop an understanding of programming languages as they relate to modeling and simulation.
- 17.0 Incorporate audio assets into modeling and simulation engine.
- 18.0 Implement multimedia programming as it relates to modeling simulation using a gaming engine.
- 19.0 Create and maintain documentation.
- 20.0 Compile, build and publish finished games and simulation.
- 21.0 Analyze, identify and use game engine physics.
- 22.0 Develop effective user interfaces (UI).
- 23.0 Use real time technology to model and simulate environments.
- 24.0 Demonstrate an understanding of underlying principles of numerical analysis and how it relates to modeling and simulation.
- 25.0 Plan program design using object oriented programming (OOP) for modeling and simulation.
- 26.0 Use programming to develop modeling and simulation applications.
- 27.0 Test programs related to modeling and simulation.
- 28.0 Explain visual simulation.
- 29.0 Analyze model fidelity as related to modeling and simulation techniques.
- 30.0 Demonstrate knowledge of rigging.
- 31.0 Demonstrate knowledge of basic character setup.
- 32.0 Demonstrate knowledge of motion capture systems.
- 33.0 Understand systems engineering for simulators.
- 34.0 Analyze numerical characteristics of univariate data sets to describe patterns and departure from patterns, using statistics for various distributions.

- 35.0 Perform program maintenance to troubleshoot and optimize code.
- 36.0 Use innovative technologies to create prototypes of models.
- 37.0 Develop and program complex artificial intelligence systems (AI).
- 38.0 Identify functions of advance memory and information processing.
- 39.0 Demonstrate proficiency using various software applications while understanding the hardware requirements needed for modeling and simulations including processors, input/output (I/O) devices.
- 40.0 Build a simple scenario for experimentation or training.
- 41.0 Demonstrate an understanding of underlying principles of experimental simulation and how it relates to modeling and simulation.
- 42.0 Use probabilities (relative frequency and theoretical), to plan and conduct an experiment that will address control, randomization and measurement of experimental error.
- 43.0 Use innovative technologies to create prototypes of models.
- 44.0 Apply the principles of entrepreneurship to Modeling and Simulation and demonstrate an understanding of the design and production of prototypes from conception to mass production.
- 45.0 Demonstrate information fluency using emerging research techniques and technology.

Florida Department of Education
Student Performance Standards

Program Title: Modeling Simulation Production
Career Certificate Program Number: Y500200

Course Number: CTS0770	
Occupational Completion Point: OCP A	
Modeling & Simulation Technician – 150 Hours – SOC Code 15-1199	
01.0	Demonstrate an understanding of essential modeling and simulation terms by using them as they relate to specific careers requiring modeling and simulation skills and knowledge. The student will be able to:
01.01	Define and explain essential modeling and simulation terms and concepts.
01.02	Identify disciplines which use modeling and simulation tools and discuss their real world applications.
01.03	Identify modeling and simulation related careers and the educational and professional requirements for various fields.
01.04	Compare and contrast the central modeling and simulation concepts and careers.
01.05	Explain the past, present, and future importance of modeling and simulation.
02.0	Demonstrate information fluency using emerging research techniques and technology. The student will be able to:
02.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer.).
02.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.
02.03	Use technology tools to collaborate and generate a deliverable product.
02.04	Develop and display an electronic portfolio.
02.05	Demonstrate research skills using browsers, search engines, directories, and databases.
02.06	Create and evaluate a list of materials found online for relevance, appropriateness and bias.
02.07	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.
02.08	Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, Bing).
02.09	Identify effective Boolean search strategies.

02.10	Correlate the use of social media in the field of modeling and simulation for a variety of purposes.
02.11	Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf).
03.0	Demonstrate a knowledge of the information technology industry, the history of computers including their components and functionality, as they relate to Modeling and Simulation. The student will be able to:
03.01	Explain how information technology and modeling and simulation impact the operation and management of business and society.
03.02	Explain the emergence of e-commerce and e-government and the potential impact on business and society.
03.03	Trace the evolution of the Internet from its inception to the present and into the future.
03.04	Analyze physical models and organize them conceptually based on their development and historical relevance.
03.05	Use graphic technology to create a visualization of a historic simulator or synthetic environment that has evolved over time.
03.06	Describe the evolution of the digital computer as it relates to modeling and simulation.
03.07	Explain the need for and use of input devices and displays to design and create models and simulations.
03.08	Demonstrate an understanding of storage management (e.g., hard drive, floppy disk) as it relates to creating and storing digital models and simulations.
03.09	Identify the advantages and limitations of computer-generated models and simulation.
04.0	Explain intelligent systems as they relate to modeling, simulation and data analysis. The student will be able to:
04.01	Define intelligent system.
04.02	Explain and examine structured logic and semantics.
04.03	Explain the use of intelligent systems.
04.04	Examine programs using the elements of an intelligent system.
05.0	Demonstrate knowledge of different operating systems. The student will be able to:
05.01	Explain the history and purpose of various operating systems (e.g., DOS, Windows, Mac, and Unix/Linux).
05.02	Discuss the impact of RAM and ROM technology on the development of the modern computer operating systems and microcomputers.
05.03	Demonstrate proficiency with file management and structure (e.g., folder creation, file creation, backup, copy, delete, open, save).
05.04	Identify the internal components of a computer (e.g., power supply, hard drive, motherboard, input/output (I/O) cards/ports, cabling).
05.05	Identify the different control systems for simulation.
05.06	Explain the factors that can limit the simulation capabilities of personal computers.

06.0	Explore software evolution and lifecycle as it relates to modeling and simulation. The student will be able to:
06.01	Explain software and hardware lifecycles and their steps.
06.02	Demonstrate an understanding of the basic concepts of computer maintenance, upgrades and life cycles.
07.0	Understand the production process of modeling, simulation and entertainment. The student will be able to:
07.01	Explain software and hardware lifecycles and their steps.
07.02	Demonstrate an understanding of the basic concepts of computer maintenance, upgrades and life cycles.
07.03	Demonstrate speed and efficiency concepts.
07.04	Demonstrate use of a production pipeline.
07.05	Identify the departments of an animation studio
07.06	Describe the interrelationships among departments.
07.07	Demonstrate basic communication concepts (verbal, memos, paperwork).
07.08	Identify the stages of production.
07.09	Correctly use studio terms and jargon.
07.10	Create and organize production paperwork into design/production documentation.
07.11	Identify target audiences, markets, and demographics.
07.12	Demonstrate ability to write a professionally formatted script.
07.13	Demonstrate ability to breakdown a script into production elements (cast, props).
07.14	Demonstrate understanding of visual storytelling and how storyboards are used during production.
08.0	Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets. The student will be able to:
08.01	Practice ethical behaviors regarding copyright, citation, and plagiarism.
08.02	Understand the process of patent application filing, product trials, and communication techniques to describe their product.
08.03	Explain the purposes of copyrights, trademarks, and patents and understand the limitations and expectations.
08.04	Explore and examine components of intellectual property such as patents, copyrights, trademarks, and trade secrets.

08.05	Understand “Fair Use and Fair Dealing” practices.
08.06	Understand the transfer and licensing of creative works.
08.07	Understand the use of “exclusive rights” to intellectual creations.
08.08	Utilize digital watermarking.
09.0	Demonstrate production use of high-end Game Engines. The student will be able to:
09.01	Demonstrate working knowledge of interface and workspace.
09.02	Setup projects properly.
09.03	Create and transform game objects and edit their properties.
09.04	Create and use collision models and triggers.
09.05	Setup and modify camera.
09.06	Apply input data into game systems.
09.07	Implement animation setup.
09.08	Create and modify particle systems and their properties.
09.09	Design and implement visual effects using compositing techniques.
09.10	Develop, test and implement game scripts.
10.0	Categorize the different gaming genres. The student will be able to:
10.01	Research, compare and categorize different game genres.
10.02	Analyze examples of different gaming genres.
10.03	Define and use the necessary vocabulary related to gaming and the different game genres.
11.0	Describe the game development life cycle. The student will be able to:
11.01	Identify steps in the pre-production process including the proof of concept and market research.
11.02	Describe the iterative prototyping process (e.g., Alpha, Beta).
11.03	Determine platform, technology and scripting requirements.

11.04	Implement techniques of scenario development, levels, and missions.
11.05	Discuss game testing requirements and methods.
12.0	Develop a game design document. The student will be able to:
12.01	Evaluate and discuss the choice of delivery system.
12.02	Evaluate and discuss choices of genre, game design software, art, digital media, and animation software.
12.03	Create a game strategy overview, character overview, and storyboard overview.
12.04	Define the rules of play and multi-player options.
12.05	Create the layout and interfaces overview and digital media overview.
12.06	Determine the gameplay interaction requirements and create the progression levels overview.
12.07	Define strategic positioning of game immersion dynamics and psychological effect.
12.08	Identify hardware and software constraints.
13.0	Identify gameplay elements and their characteristics. The student will be able to:
13.01	Analyze and deconstruct game environments and interactions.
13.02	Compare and contrast popular games and simulations in terms of player interaction, plot complexity, and rewards.
13.03	Categorize gameplay elements by player types and target audience.
14.0	Explore the methods used to create and sustain player immersion. The student will be able to:
14.01	Research and define the term "immersion".
14.02	Explore and explain factors that create player immersion in a game or simulation.
14.03	Examine games and simulations and explain the methods each one uses to increase player immersion.
15.0	Describe the general principles of storytelling. The student will be able to:
15.01	Identify the essential elements of a story.
15.02	Describe how creative writing is used as a game design tool.
15.03	Compare and contrast methods of delivering a story in a game.

Course Number: CTS0776
Occupational Completion Point: OCP B
Modeling & Simulation Programmer I – 300 Hours – SOC Code 15-1131

16.0 Develop an understanding of programming languages as they relate to modeling and simulation. The student will be able to:

16.01 Explain the history of programming languages.

16.02 Explain how compilers work.

16.03 Identify the three types of programming design approaches (e.g., top-down, structured and object-oriented).

17.0 Incorporate audio assets into modeling and simulation engine. The student will be able to:

17.01 Describe the audio effects workflow.

17.02 Explain audio codecs and formats used in game/simulation engines.

17.03 Import audio into the game/simulation engine.

17.04 Use appropriate naming conventions for audio assets.

18.0 Implement multimedia programming as it relates to modeling simulation using a gaming engine. The student will be able to:

18.01 Demonstrate proficiency in creating multiple composite objects.

18.02 Demonstrate proficiency in moving composite graphics objects.

18.03 Demonstrate proficiency in rotating composite graphics objects manually.

18.04 Distinguish between flock and flee artificial intelligence algorithms.

18.05 Write programs that use blitting.

18.06 Identify the basic constructs used in bounding box collision algorithms.

18.07 Identify the basic constructs used in truer bounding box collisions.

18.08 Demonstrate proficiency in creating a bouncing simulation.

18.09 Simulate pattern-based movement.

18.10 Simulate multiple sprites movement.

18.11 Identify the basic constructs used in keyboard input.

18.12 Identify the basic constructs used in mouse input.

18.13 Identify the basic constructs used in double buffering.

19.0	Create and maintain documentation. The student will be able to:
19.01	Write documentation to assist operators and end-users.
19.02	Follow established documentation standards.
19.03	Update existing documentation to reflect program changes.
20.0	Compile, build and publish finished games and simulation. The student will be able to:
20.01	Apply proper settings depending on the intended publishing platforms.
20.02	Refine project to increase performance.
20.03	Successfully build a game and simulation.
20.04	Publish product to intended platform.
21.0	Analyze, identify and use game engine physics. The student will be able to:
21.01	Identify the different components used by the engine's physics system.
21.02	Apply "ray casting" to solve different physics and collision problems.
21.03	Change physics settings depending on simulation needs.
22.0	Develop effective user interfaces (UI). The student will be able to:
22.01	Utilize various design techniques for UI development.
22.02	Create clear, concise, responsive UI.
22.03	Provide efficient feedback while interacting with the UI.

Course Number: CTS0777
Occupational Completion Point: OCP C
Modeling & Simulation Programmer II – 300 Hours – SOC Code 15-1131

23.0 Use real time technology to model and simulate environments. The student will be able to:

23.01 Identify simulator applications.

23.02 Identify where team simulators would be appropriate.

23.03 Identify where individual simulators would be appropriate.

23.04 Understand where and why networked simulators are used.

24.0 Demonstrate an understanding of underlying principles of numerical analysis and how it relates to modeling and simulation. The student will be able to:

24.01 Apply logical reasoning skills to solve real-world problems through the development of mathematical models.

24.02 Design a step-by-step plan (algorithm) to solve a given problem.

24.03 Write program specifications that define the constraints of a given problem.

24.04 Use a programmable calculator.

24.05 Write an algorithm to solve mathematical problems using formulas, equations, and functions.

25.0 Plan program design using object oriented programming (OOP) for modeling and simulation. The student will be able to:

25.01 Formulate a plan to determine program specifications individually or in groups.

25.02 Use a graphical representation or pseudo code to represent the structure in a program or subroutine.

25.03 Design programs to solve problems using problem-solving strategies.

26.0 Use programming to develop modeling and simulation applications. The student will be able to:

26.01 Utilize reference manuals.

26.02 Write programs according to recognized programming standards.

26.03 Write internal documentation statements as needed in the program source code.

26.04 Code programs in high-level languages for game/simulation applications.

26.05 Write code that accesses sequential, random, and direct files.

26.06	Code programs using logical statements (e.g., If-Then-Else, Do...While).
26.07	Enter and modify source code using a program language editor.
26.08	Code routines within programs that validate input data.
26.09	Use the rounding function in calculations within programs.
26.10	Write programs as part of a development team.
26.11	Write event-driven programs.
26.12	Write programs using timed-event strategies and methodologies.
26.13	Write programs that include score keeping.
26.14	Write programs that display text.
26.15	Write programs that use composite graphic objects.
26.16	Write programs that load a bitmap for background.
26.17	Write programs that utilize a sprite handler.
26.18	Write programs that use animation.
26.19	Write programs that use scrolling.
26.20	Write programs that use transparency.
26.21	Write documentation to assist operators and end-users.
26.22	Follow established documentation standards.
26.23	Update existing documentation to reflect program changes.
27.0	Test programs related to modeling and simulation. The student will be able to:
27.01	Perform debugging activities.
27.02	Evaluate program test results.
27.03	Use trace routines of compilers to assist in program debugging.

27.04 Compile and run programs.

27.05 Create a stable code base.

27.06 Develop data for use in program testing.

27.07 Distinguish among the different types of program and design errors.

Course Number: CTS0779
Occupational Completion Point: OCP D
Modeling & Simulation Advanced Programmer – 300 Hours – SOC Code 15-1131

28.0 Explain visual simulation. The student will be able to:

28.01 Define and explain uses of visual simulation.

28.02 Explain the use of visual simulation in distributed simulation.

28.03 Explain the functions of the image generators, display and databases to support visual subsystem of simulators.

29.0 Explain distributed simulation. The student will be able to:

29.01 Explain networking concepts.

29.02 Explain distributed simulation protocols.

29.03 Explain the major components in a networked simulation or model.

30.0 Explain object models. The student will be able to:

30.01 Describe objects using object oriented design (OOD).

30.02 Distinguish between abstract and real objects.

30.03 Explain why object oriented design is an effective programming paradigm.

30.04 Implement classes and methods.

30.05 Describe the benefits of object oriented concepts.

30.06 Describe object oriented design (OOD) using pseudo-code or Unified Modeling Language (UML).

31.0 Demonstrate an understanding of mathematical modeling in relation to the production process. The student will be able to:

31.01 Explain mathematical modeling as processes.

31.02 Explain the role of modeler in mathematical modeling.

31.03 Identify job titles associated with mathematical modeling.

31.04 Explain the modeling production pipeline as it relates to mathematical modeling.

32.0 Demonstrate an understanding of 3D modeling and simulation software engines. The student will be able to:

32.01 Understand concepts of the transfer of training.

32.02 Understand mathematics of physics based real-time simulators.

32.03	Describe components of visual systems (image generation, databases and displays).
32.04	Describe theory of motion/control loading simulation and cue synchronization.
32.05	Describe trainee station design, sensor simulation and instructor/operator station design.
32.06	Understand and utilize collision detection.
33.0	Understand systems engineering for simulators. The student will be able to:
33.01	Understand the systems engineering life cycle process and terminology.
33.02	Identify the major milestones in the system life cycle.
33.03	Understand the Systems Engineering life cycle process and terminology including the following: system requirements analysis, system design, hardware design and development, software design and development, system integration, configuration management, acceptance testing and contractor logistics support.
33.04	Identify major milestones in the system life cycle such as preliminary/critical design reviews, establish function baseline, allocated baseline, product baseline and ready for training (RFT).
34.0	Analyze numerical characteristics of univariate data sets to describe patterns and departure from patterns, using statistics for various distributions. The student will be able to:
34.01	Define terminology associated with data collection, statistics and graphing.
34.02	Differentiate between the various methods of data collection.
34.03	Explain the uses of random number generators.
34.04	Recognize various sources of bias in data collection.
34.05	Prepare a sample data collection.
34.06	Determine the numerical characteristics of a data set and analyze data.
34.07	Interpret tables of statistics.
34.08	Create bar charts and pie graphs with appropriate software.
34.09	Analyze the data to solve a presented problem.
34.10	Apply problem analysis using flowcharts or the Unified Modeling Language (UML).
35.0	Perform program maintenance to troubleshoot and optimize code. The student will be able to:
35.01	Review requested modification of programs and establish a plan of action.
35.02	Design needed modifications in compliance with established standards.

35.03	Code, test, and debug modifications prior to updating production code.
35.04	Update production programs and documentation with changes.
35.05	Analyze output to identify and annotate errors or enhancements.
36.0	Use innovative technologies to create prototypes of models. The student will be able to:
36.01	Identify emerging technologies to develop prototypes.
36.02	Compare and contrast the benefits and limitations of using various prototyping methods and costs.
36.03	Use emerging technologies to create a prototype (i.e. 3D printing software, 3D printers or other applicable devices).
37.0	Develop and program complex artificial intelligence systems (AI). The student will be able to:
37.01	Design intelligent interactions between players and AI.
37.02	Implement different complex AI algorithms.
37.03	Develop pathfinding systems for AI.
38.0	Identify functions of advance memory and information processing. The student will be able to:
38.01	Manipulate data between numbering systems. (binary, decimal, hexadecimal).
38.02	Identify how numeric and non-numeric data are represented in memory.
38.03	Identify the characteristics and properties of reference variables and pointers.
38.04	Apply efficient memory management techniques to prevent memory leaking.

Course Number: CTS0774
Occupational Completion Point: E
Modeling & Simulation Developer –450 Hours – SOC Code 15-1131

39.0	Demonstrate proficiency using various software applications while understanding the hardware requirements needed for modeling and simulations including processors, input/output (I/O) devices. The student will be able to:
39.01	Compare and contrast the appropriate use of various software and visualization applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music).
39.02	Demonstrate proficiency in the use of various software and visualization applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music).
40.0	Build a simple scenario for experimentation or training. The student will be able to:
40.01	Explain the importance of scenario building in simulations.
40.02	Identify the building blocks of scenarios.
40.03	Design a storyboard for a simulation.
40.04	Build a simple simulation with a finite number of variables.
40.05	Identify the various components of a simulation.
40.06	Run a simulation application given specific parameters.
40.07	Explain verification and validation of a simulation.
40.08	Review the importance of scenario building in simulations.
40.09	Explore/develop building blocks of scenarios.
40.10	Design a detailed storyboard for a simulation.
40.11	Build a simulation with a level of fidelity.
40.12	Describe the history of gaming and evolution of video games.
40.13	Design games using programming techniques.
40.14	Implement a simple game using appropriate software.
41.0	Demonstrate an understanding of underlying principles of experimental simulation and how it relates to modeling and simulation. The student will be able to:
41.01	Use proper attributes to develop a flowchart.
41.02	Compare various types of studies (i.e. survey, observation, experiment).

41.03	Identify and explain an experimental design process.
41.04	Set realistic objectives for the experiment.
41.05	Determine the appropriate response or output.
41.06	Select process variables or design parameters (control factors), noise factors and the interactions among the process variables of interest.
41.07	Perform experimental design execution.
41.08	Check that the data are consistent with the experimental assumptions.
41.09	Interpret and present results.
42.0	Use probabilities (relative frequency and theoretical), to plan and conduct an experiment that will address control, randomization and measurement of experimental error. The student will be able to:
42.01	Define and explain probability rules and event terminology.
42.02	Identify events as complementary, dependent, independent, mutually exclusive or not mutually exclusive.
42.03	Analyze categorical data using two-way tables to describe patterns and departure from patterns and to find marginal frequency and relative frequencies.
42.04	Distinguish between empirical and theoretical probability.
42.05	Calculate probabilities.
42.06	Explain the law of large numbers.
42.07	Calculate probabilities using addition rules.
42.08	Calculate probabilities using the multiplications rules.
42.09	Define the Fundamental Counting Rule, Permutation, and Combination.
42.10	Perform calculations using the Fundamental Counting Rule, Permutation and Combination.
42.11	Distinguish when one would use a permutation and when one would use a combination.
42.12	Define experimental terminology.
42.13	Explain potential reasons for experimental error.
42.14	Demonstrate an understanding of the principles of probability by performing a probability experiment within the classroom.

43.0	Use innovative technologies to create prototypes of models. The student will be able to:
43.01	Identify emerging technologies to develop prototypes.
43.02	Compare and contrast the benefits and drawbacks of using various prototyping methods and costs.
43.03	Use emerging technologies to create a prototype (i.e. 3D printing software, 3D printers or other applicable devices).
44.0	Apply the principles of entrepreneurship to Modeling and Simulation and demonstrate an understanding of the design and production of prototypes from conception to mass production. The student will be able to:
44.01	Identify the usefulness of technology applications.
44.02	Determine the design architecture.
44.03	Formulate and test a proof of concept.
44.04	Understand the value of partnerships and sub-contracting of production and distribution of product.
44.05	Develop an understanding of the production process.
44.06	Understand return on investment (ROI) concepts.
44.07	Examine market analysis of product.
44.08	Develop a comprehensive business model and present a clear and professional proposal to investors.
45.0	Demonstrate information fluency using emerging research techniques and technology. The student will be able to:
45.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
45.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.
45.03	Use technology tools to collaborate and generate a deliverable product.
45.04	Develop and display an electronic portfolio.
45.05	Demonstrate research skills using browsers, search engines, directories, and databases.
45.06	Create and evaluate a list of materials found online for relevance, appropriateness and bias.
45.07	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.
45.08	Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, Bing).
45.09	Identify effective Boolean search strategies.

45.10 Correlate the use of social media in the field of modeling and simulation for a variety of purposes.

45.11 Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf).

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Modeling Simulation Design
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y500300
CIP Number	0511080403
Grade Level	30, 31
Standard Length	1500 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other 15-1132 – Software Developers, Applications 27-1014 - Multimedia Artists and Animators
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

Purpose

The Modeling Simulation Design program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster and the expansive employment opportunities in the field of Modeling and Simulation. This course provides technical skill proficiency and includes competency-based applied learning through the use of hands-on labs and the development of a multi-year portfolio. Students will build academic knowledge, enhance higher-order reasoning and problem-solving skills, develop leadership and collaboration abilities and refine general employability and occupation-specific skills.

The content includes but is not limited to practical experiences in modeling and simulation conceptualization, design, storyboarding, development methodologies, essential programming techniques, prototype development, production processes and implementation challenges. Science, Computer Programming, Math, 2D and 3D Art are embedded throughout the program to emphasize the relationship between these areas and the field of Modeling and Simulation. To further enrich this course sequence it is recommended students take a sequence of electives in either visual

arts, computer arts, or digital arts including but not limited to Computer Programming, Web Design, 2D and 3D Art, Gaming and Animation, Robotics and/or Geospatial/Geographic Information Systems Technology.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of five occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0770	Modeling & Simulation Technician	COMPU SCI 6	150 hours	15-1199
B	CTS0771	Modeling & Simulation 2D Artist	ENG&TEC ED1@2	300 hours	27-1014
C	CTS0772	Modeling & Simulation 3D Artist	TEC ED 1 @2	300 hours	27-1014
D	CTS0773	Modeling & Simulation Technical Artist	ENG 7G	300 hours	27-1014
E	CTS0774	Modeling & Simulation Developer	ENG TECH 7G INFO TECH 7G COMP PROG 7G ROBOTICS 7G BUS ED 1 @2 TV PRO TEC @7 7G COMM ART @7 7G	450 hours	15-1132

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate an understanding of essential modeling and simulation terms by using them as they relate to specific careers requiring modeling and simulation skills and knowledge.
- 02.0 Demonstrate information fluency using emerging research techniques and technology.
- 03.0 Demonstrate a knowledge of the information technology industry, the history of computers including their components and functionality, as they relate to Modeling and Simulation.
- 04.0 Explain intelligent systems as they relate to modeling, simulation and data analysis.
- 05.0 Demonstrate knowledge of different operating systems
- 06.0 Explore software evolution and lifecycle as it relates to modeling and simulation
- 07.0 Understand the production process of modeling, simulation and entertainment.
- 08.0 Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets.
- 09.0 Demonstrate production use of high-end Game Engines.
- 10.0 Categorize the different gaming genres.
- 11.0 Describe the game development life cycle.
- 12.0 Develop a game design document.
- 13.0 Identify gameplay elements and their characteristics.
- 14.0 Explore the methods used to create and sustain player immersion.
- 15.0 Describe the general principles of storytelling.
- 16.0 Demonstrate an understanding of visual modeling in relation to the production process.
- 17.0 Understand the role of texture artists in relation to the production process.
- 18.0 Demonstrate knowledge of basic lighting.
- 19.0 Demonstrate knowledge of basic animation.
- 20.0 Demonstrate knowledge of photo editing software.
- 21.0 Demonstrate knowledge of video editing software.
- 22.0 Utilize basic audio production techniques, sound construction, and editing techniques as related to modeling and simulation.
- 23.0 Create and design a vector or bitmap art reference to develop a texture map to build a 3D model for simulation.
- 24.0 Demonstrate the use of experimental and engineering design techniques to produce real world or industry simulations.
- 25.0 Identify gameplay elements and their characteristics.
- 26.0 Explore the methods used to create and sustain player immersion.
- 27.0 Describe the general principles of storytelling.
- 28.0 Develop effective user interfaces (UI).
- 29.0 Explore the foundations of Digital Painting and Art.
- 30.0 Explore 2D texture painting techniques using painting software.
- 31.0 Demonstrate knowledge of basic materials and textures.
- 32.0 Apply industry standards for 3D animation software and user interface to create 3D simple and complex models.
- 33.0 Demonstrate basic understanding of modeling principles.
- 34.0 Explain environmental models.
- 35.0 Use visual modeling techniques and software to create an environmental model.

- 36.0 Demonstrate knowledge of basic 3D rendering.
- 37.0 Demonstrate knowledge of polygon modeling.
- 38.0 Demonstrate knowledge of non-uniform rational b-splines (NURBS) modeling.
- 39.0 Demonstrate knowledge of animation principles as it relates to the underlying physics of modeling.
- 40.0 Analyze model fidelity as related to modeling and simulation techniques.
- 41.0 Demonstrate knowledge of rigging.
- 42.0 Demonstrate knowledge of basic character setup.
- 43.0 Demonstrate knowledge of motion capture systems.
- 44.0 Explore 3D sculpting and texturing techniques using high polygon sculpting software.
- 45.0 Demonstrate proficiency using various software applications while understanding the hardware requirements needed for modeling and simulations including processors, input/output (I/O) devices.
- 46.0 Build a simple scenario for experimentation or training.
- 47.0 Demonstrate an understanding of underlying principles of experimental simulation and how it relates to modeling and simulation.
- 48.0 Use probabilities (relative frequency and theoretical), to plan and conduct an experiment that will address control, randomization and measurement of experimental error.
- 49.0 Use innovative technologies to create prototypes of models.
- 50.0 Apply the principles of entrepreneurship to Modeling and Simulation and demonstrate an understanding of the design and production of prototypes from conception to mass production.
- 51.0 Demonstrate information fluency using emerging research techniques and technology.

Florida Department of Education
Student Performance Standards

Program Title: Modeling Simulation Production
Career Certificate Program Number: Y500300

Course Number: CTS0770	
Occupational Completion Point: OCP A	
Modeling & Simulation Technician – 150 Hours – SOC Code 15-1199	
01.0	Demonstrate an understanding of essential modeling and simulation terms by using them as they relate to specific careers requiring modeling and simulation skills and knowledge. The student will be able to:
01.01	Define and explain essential modeling and simulation terms and concepts.
01.02	Identify disciplines which use modeling and simulation tools and discuss their real world applications.
01.03	Identify modeling and simulation related careers and the educational and professional requirements for various fields.
01.04	Compare and contrast the central modeling and simulation concepts and careers.
01.05	Explain the past, present, and future importance of modeling and simulation.
02.0	Demonstrate information fluency using emerging research techniques and technology. The student will be able to:
02.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
02.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.
02.03	Use technology tools to collaborate and generate a deliverable product.
02.04	Develop and display an electronic portfolio.
02.05	Demonstrate research skills using browsers, search engines, directories, and databases.
02.06	Create and evaluate a list of materials found online for relevance, appropriateness and bias.
02.07	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.
02.08	Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, Bing).
02.09	Identify effective Boolean search strategies.

02.10	Correlate the use of social media in the field of modeling and simulation for a variety of purposes.
02.11	Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf).
03.0	Demonstrate a knowledge of the information technology industry, the history of computers including their components and functionality, as they relate to Modeling and Simulation. The student will be able to:
03.01	Explain how information technology and modeling and simulation impact the operation and management of business and society.
03.02	Explain the emergence of e-commerce and e-government and the potential impact on business and society.
03.03	Trace the evolution of the Internet from its inception to the present and into the future.
03.04	Analyze physical models and organize them conceptually based on their development and historical relevance.
03.05	Use graphic technology to create a visualization of a historic simulator or synthetic environment that has evolved over time.
03.06	Describe the evolution of the digital computer as it relates to modeling and simulation.
03.07	Explain the need for and use of input devices and displays to design and create models and simulations.
03.08	Demonstrate an understanding of storage management (e.g., hard drive, floppy disk) as it relates to creating and storing digital models and simulations.
03.09	Identify the advantages and limitations of computer-generated models and simulation.
04.0	Explain intelligent systems as they relate to modeling, simulation and data analysis. The student will be able to:
04.01	Define intelligent system.
04.02	Explain and examine structured logic and semantics.
04.03	Explain the use of intelligent systems.
04.04	Examine programs using the elements of an intelligent system.
05.0	Demonstrate knowledge of different operating systems. The student will be able to:
05.01	Explain the history and purpose of various operating systems (e.g., DOS, Windows, Mac, and Unix/Linux).
05.02	Discuss the impact of RAM and ROM technology on the development of the modern computer operating systems and microcomputers.
05.03	Demonstrate proficiency with file management and structure (e.g., folder creation, file creation, backup, copy, delete, open, save).
05.04	Identify the internal components of a computer (e.g., power supply, hard drive, motherboard, input/output (I/O) cards/ports, cabling).
05.05	Identify the different control systems for simulation.
05.06	Explain the factors that can limit the simulation capabilities of personal computers.

06.0	Explore software evolution and lifecycle as it relates to modeling and simulation. The student will be able to:
06.01	Explain software and hardware lifecycles and their steps.
06.02	Demonstrate an understanding of the basic concepts of computer maintenance, upgrades and life cycles.
07.0	Understand the production process of modeling, simulation and entertainment. The student will be able to:
07.01	Explain software and hardware lifecycles and their steps.
07.02	Demonstrate an understanding of the basic concepts of computer maintenance, upgrades and life cycles.
07.03	Demonstrate speed and efficiency concepts.
07.04	Demonstrate use of a production pipeline.
07.05	Identify the departments of an animation studio
07.06	Describe the interrelationships among departments.
07.07	Demonstrate basic communication concepts (verbal, memos, paperwork).
07.08	Identify the stages of production.
07.09	Correctly use studio terms and jargon.
07.10	Create and organize production paperwork into design/production documentation.
07.11	Identify target audiences, markets, and demographics.
07.12	Demonstrate ability to write a professionally formatted script.
07.13	Demonstrate ability to breakdown a script into production elements (cast, props).
07.14	Demonstrate understanding of visual storytelling and how storyboards are used during production.
08.0	Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets. The student will be able to:
08.01	Practice ethical behaviors regarding copyright, citation, and plagiarism.
08.02	Understand the process of patent application filing, product trials, and communication techniques to describe their product.
08.03	Explain the purposes of copyrights, trademarks, and patents and understand the limitations and expectations.
08.04	Explore and examine components of intellectual property such as patents, copyrights, trademarks, and trade secrets.

08.05	Understand “Fair Use and Fair Dealing” practices.
08.06	Understand the transfer and licensing of creative works.
08.07	Understand the use of “exclusive rights” to intellectual creations.
08.08	Utilize digital watermarking.
09.0	Demonstrate production use of high-end Game Engines. The student will be able to:
09.01	Demonstrate working knowledge of interface and workspace.
09.02	Setup projects properly.
09.03	Create and transform game objects and edit their properties.
09.04	Create and use collision models and triggers.
09.05	Setup and modify camera.
09.06	Apply input data into game systems.
09.07	Implement animation setup.
09.08	Create and modify particle systems and their properties.
09.09	Design and implement visual effects using compositing techniques.
09.10	Develop, test and implement game scripts.
10.0	Categorize the different gaming genres. The student will be able to:
10.01	Research, compare and categorize different game genres.
10.02	Analyze examples of different gaming genres.
10.03	Define and use the necessary vocabulary related to gaming and the different game genres.
11.0	Describe the game development life cycle. The student will be able to:
11.01	Identify steps in the pre-production process including the proof of concept and market research.
11.02	Describe the iterative prototyping process (e.g., Alpha, Beta).
11.03	Determine platform, technology and scripting requirements.

11.04	Implement techniques of scenario development, levels, and missions.
11.05	Discuss game testing requirements and methods.
12.0	Develop a game design document. The student will be able to:
12.01	Evaluate and discuss the choice of delivery system.
12.02	Evaluate and discuss choices of genre, game design software, art, digital media, and animation software.
12.03	Create a game strategy overview, character overview, and storyboard overview.
12.04	Define the rules of play and multi-player options.
12.05	Create the layout and interfaces overview and digital media overview.
12.06	Determine the gameplay interaction requirements and create the progression levels overview.
12.07	Define strategic positioning of game immersion dynamics and psychological effect.
12.08	Identify hardware and software constraints.
13.0	Identify gameplay elements and their characteristics. The student will be able to:
13.01	Analyze and deconstruct game environments and interactions.
13.02	Compare and contrast popular games and simulations in terms of player interaction, plot complexity, and rewards.
13.03	Categorize gameplay elements by player types and target audience.
14.0	Explore the methods used to create and sustain player immersion. The student will be able to:
14.01	Research and define the term "immersion".
14.02	Explore and explain factors that create player immersion in a game or simulation.
14.03	Examine games and simulations and explain the methods each one uses to increase player immersion.
15.0	Describe the general principles of storytelling. The student will be able to:
15.01	Identify the essential elements of a story.
15.02	Describe how creative writing is used as a game design tool.
15.03	Compare and contrast methods of delivering a story in a game.

Course Number: CTS0771
Occupational Completion Point: OCP B
Modeling & Simulation 2D Artist – 300 Hours – SOC Code 27-1014

16.0 Demonstrate an understanding of visual modeling in relation to the production process. The student will be able to:

16.01 Explain visual modeling as a process.

16.02 Explain the role of a modeler in visual modeling.

16.03 Identify job titles associated with visual modeling.

16.04 Explain the modeling production pipeline as it relates to visual modeling.

17.0 Understand the role of texture artists in relation to the production process. The student will be able to:

17.01 Define texturing as a process.

17.02 Define the role of texture artist.

17.03 Identify job titles associated with texture artist.

17.04 Identify texture creation in the production pipeline.

17.05 Demonstrate knowledge of the difference between textures and shades.

18.0 Demonstrate knowledge of basic lighting. The student will be able to:

18.01 Compare and contrast real lighting with 3D lighting.

18.02 Demonstrate an understanding of 3 point lighting (key, fill, back).

18.03 Demonstrate an understanding of low-key and high-key lighting.

18.04 Use include/exclude commands to target light on objects.

18.05 Demonstrate use of negative intensity.

19.0 Demonstrate knowledge of basic animation. The student will be able to:

19.01 Apply animation principles to object animation.

19.02 Demonstrate an understanding of animation timelines.

19.03 Demonstrate an understanding of key framing.

19.04	Record and edit keyframes.
19.05	Demonstrate an understanding in the use of controllers.
19.06	Render basic reference animation.
20.0	Demonstrate knowledge of photo editing software. The student will be able to:
20.01	Demonstrate understanding file formats and storage options.
20.02	Identify parts of the software interface (menus/palettes).
20.03	Demonstrate ability to use each of the basic tool sets.
20.04	Demonstrate ability to import, export and save images.
20.05	Demonstrate understanding of layers and channels.
20.06	Demonstrate understanding of filters, effects and plug-ins.
20.07	Demonstrate understanding of file presets.
20.08	Demonstrate ability to select portions of an image for manipulation.
20.09	Demonstrate ability to transform selections and images (crop, scale).
20.10	Demonstrate ability to color correct images (brightness, hue, contrast).
20.11	Demonstrate ability to use brushes for image creation and correction.
20.12	Understand non-destructive and destructive operations.
20.13	Demonstrate the ability to import, paint and export 3D objects.
21.0	Demonstrate knowledge of video editing software. The student will be able to:
21.01	Demonstrate understanding file formats and storage options.
21.02	Identify parts of the software interface (menus/palettes).
21.03	Demonstrate ability to use each of the basic tool sets.
21.04	Demonstrate ability to import, export and save video.
21.05	Demonstrate understanding of layers and compositing.
21.06	Demonstrate understanding of filters, effects and plug-ins.

21.07	Demonstrate understanding of file presets.
21.08	Demonstrate understanding of rendering process.
21.09	Demonstrate ability to transform video (crop, scale).
21.10	Demonstrate ability to color correct images (brightness, hue, contrast).
21.11	Demonstrate ability to use brushes for image creation and correction.
21.12	Understand non-destructive and destructive operations.
21.13	Demonstrate the compositing integration of rendered 3D animation with video.
22.0	Utilize basic audio production techniques, sound construction, and editing techniques as related to modeling and simulation. The student will be able to:
22.01	Describe the use of digital recording decks and other digital storage devices.
22.02	Describe the function and operation of digital audio workstations.
22.03	Edit, cut, erase, and insert sound utilizing various digital production techniques.
22.04	Perform digital noise reduction and noise extraction via spectral display.
22.05	Survey and discuss the use of naming conventions and temp sounds.
22.06	Demonstrate an understanding of various audio construction software.
22.07	Analyze and discuss methods of matching sound effects to art assets.
22.08	Identify and categorize commonly used technology sound engine integration equipment.
22.09	Identify and discuss resources such as sound effects libraries.
22.10	Examine methods of sound implementation and associated software.
22.11	Explain how and why digital video may be integrated into a model or simulation design.
22.12	Explain the roles and responsibilities of the sound design team.
22.13	Describe the use of 3D and surround sound.
22.14	Apply knowledge of distance/spatial effects, including surround sound, in a game/simulation.
22.15	Analyze the relationship of the audio environment to the visual environment.

23.0	Create and design a vector or bitmap art reference to develop a texture map to build a 3D model for simulation. The student will be able to:
23.01	Know the difference between vectors and bitmaps.
23.02	Demonstrate an understanding of various 2D art programs.
23.03	Utilize the programs tools and brushes.
23.04	Know the importance of layers.
23.05	Identify file formats.
23.06	Use digital media software to create a vector or bitmap reference object.
23.07	Import a reference object into 3D modeling software.
23.08	Convert a reference object to 3D.
24.0	Demonstrate the use of experimental and engineering design techniques to produce real world or industry simulations. The student will be able to:
24.01	Understand the design requirements and limitations of a 2D modeling and simulation engine.
24.02	Demonstrate the use of various mediums and mixed media (traditional or digital) in a 2D modeling and simulation.
24.03	Demonstrate the ability to create character and object views for animation.
24.04	Break down animation into a series of pictures to import animation to a modeling and simulation engine.
24.05	Demonstrate the effective use of animation loops and cycles in a modeling and simulation engine.
24.06	Demonstrate an understanding of the value of timing to convey character motion.
24.07	Demonstrate the effective use of animation arcs for the articulation of body elements.
24.08	Demonstrate the use of principles of animation such as anticipation, squash, stretch, weight, exaggeration and overlapping secondary motion.
24.09	Demonstrate the use of phonemes to display speech in animation.
25.0	Identify gameplay elements and their characteristics. The student will be able to:
25.01	Analyze and deconstruct game environments and interactions.
25.02	Compare and contrast popular games and simulations in terms of player interaction, plot complexity, and rewards.
25.03	Categorize gameplay elements by player types and target audience.

26.0	Explore the methods used to create and sustain player immersion. The student will be able to:
26.01	Research and define the term “immersion”.
26.02	Explore and explain factors that create player immersion in a game or simulation.
26.03	Examine games and simulations and explain the methods each one uses to increase player immersion.
27.0	Describe the general principles of storytelling. The student will be able to:
27.01	Identify the essential elements of a story.
27.02	Describe how creative writing is used as a game design tool.
27.03	Compare and contrast methods of delivering a story in a game.
28.0	Develop effective user interfaces (UI). The student will be able to:
28.01	Utilize various design techniques for UI development.
28.02	Create clear, concise, responsive UI.
28.03	Provide efficient feedback while interacting with the UI.
29.0	Explore the foundations of Digital Painting and Art. The student will be able to:
29.01	Demonstrate knowledge of lines, shapes and values.
29.02	Explain the importance of Value in digital painting and composition.
29.03	Explain what Color Theory is and why it is important to design and composition.
29.04	Demonstrate skill in drawing construction, thumbnails and clean lines.
29.05	Demonstrate skill of blend and brush tools.
29.06	Sketch base objects in perspective.
29.07	Explain what makes a compelling composition and why it is important.
29.08	Explain the importance of art studies and history.
29.09	Create a landscape digital painting for use in game engine.

30.0 Explore 2D texture painting techniques using painting software. The student will be able to:

30.01 Explain the differences between hard and soft surfaces

30.02 Demonstrate skill in painting organic materials, texture, cloth, wood and metal.

30.03 Demonstrate proper technique in applying painted materials to scenes and objects.

Course Number: CTS0772
Occupational Completion Point: OCP B
Modeling & Simulation 3D Artist – 300 Hours – SOC Code 27-1014

31.0	Demonstrate knowledge of basic materials and textures. The student will be able to:
31.01	Demonstrate an understanding of material and texture storage.
31.02	Apply textures to an object.
31.03	Demonstrate an understanding of procedural shaders.
31.04	Demonstrate an understanding of channels.
31.05	Adjust the transparency, luminance, and reflection of a material.
31.06	Demonstrate an understanding of displacement maps.
31.07	Demonstrate an understanding of bump maps.
31.08	Demonstrate knowledge of material projections.
31.09	Demonstrate an understanding of UV mapping.
31.10	Demonstrate an understanding of 3D painting.
31.11	Understand how light affects the look of materials.
31.12	Understand how camera angles can affect the look of materials.
32.0	Apply industry standards for 3D animation software and user interface to create 3D simple and complex models. The student will be able to:
32.01	Identify the computer requirements for 3D animation software.
32.02	Compare and contrast available 3D animation software.
32.03	Identify available file formats and protocols.
32.04	Explain the cinematic stage paradigm in 3D software.
32.05	Demonstrate an understanding of naming conventions.
32.06	Develop software and file backup plan.

32.07	Identify common icons within the software.
32.08	Demonstrate use of keyboard shortcuts.
32.09	Understand the use of a three-button mouse.
32.10	Identify the main windows of a 3D program.
32.11	Identify common window layouts.
32.12	Identify tool icons within the software.
32.13	Understand the significance of keyboard shortcut use and efficiency.
32.14	Demonstrate an understanding of the Euclidean Geometry Model (x-y-z coordinate system).
32.15	Demonstrate an understanding of attribute managers.
32.16	Demonstrate an understanding of layers.
32.17	Navigate the modeling window using pan, rotate, and zoom controls.
32.18	Demonstrate knowledge of selection tools (lasso, loop).
32.19	View objects in wireframe, gourard shading, lines, boxes and modes.
32.20	Demonstrate use of selection sets.
32.21	Undo and redo an action within the program.
32.22	Locate the help menu system.
33.0	Demonstrate basic understanding of modeling principles. The student will be able to:
33.01	Understand 3D construction theory.
33.02	Demonstrate an understanding of primitives and parametric modeling.
33.03	Demonstrate an understanding of non-uniform rational basis spline (NURBS), splines, and polygonal modeling.
33.04	Demonstrate the ability to use reference images and files while modeling.

34.0	Explain environmental models. The student will be able to:
34.01	Explain the use of environmental modeling.
34.02	Discuss how to model environmental effects.
34.03	Discuss the effects of environmental simulations on related simulations.
34.04	Examine environmental models available on the internet.
35.0	Use visual modeling techniques and software to create an environmental model. The student will be able to:
35.01	Demonstrate information fluency by conducting research need to create an environmental model.
35.02	Use modeling techniques and software to create a basic environmental model.
35.03	Communicate the relevance of the model and its impact on the real world.
36.0	Demonstrate knowledge of basic 3D rendering. The student will be able to:
36.01	Demonstrate an understanding of processor, hardware and software rendering techniques.
36.02	Determine the final render format (size, codec, quality).
36.03	Demonstrate an understanding of basic render settings.
36.04	Select the range of frames to be rendered.
37.0	Demonstrate knowledge of polygon modeling. The student will be able to:
37.01	Demonstrate an understanding of N-gons.
37.02	Demonstrate an understanding of subdivision.
37.03	Demonstrate basic polygon editing and manipulation.
37.04	Demonstrate knowledge of point management (location).
37.05	Demonstrate the ability to create polygonal models from points.
37.06	Demonstrate an understanding of cutting/division tools.
37.07	Demonstrate an understanding of extrudes.

37.08	Demonstrate an understanding of symmetry.
37.09	Demonstrate an understanding of hyper NURBS.
37.10	Demonstrate an understanding of basic deformers (bend, twist, melt).
38.0	Demonstrate knowledge of non-uniform rational b-splines (NURBS) modeling. The student will be able to:
38.01	Demonstrate an understanding of points, vertices, edges, and polygons.
38.02	Demonstrate an understanding of poly-count.
38.03	Demonstrate an understanding of primitives.
38.04	Define parametric primitives.
38.05	Locate an object's properties, attributes, and coordinates.
38.06	Demonstrate understanding of Non uniform rational b-splines (NURBS).
38.07	Demonstrate understanding of splines and generators (extrude, lathe, sweep).
38.08	Understand the use of hierarchy.
38.09	Demonstrate an understanding of Boolean objects.
38.10	Demonstrate an understanding of Null objects.
38.11	Demonstrate an understanding of scene management (hiding-unhiding).
38.12	Demonstrate an understanding of arrays.
39.0	Demonstrate knowledge of animation principles as it relates to the underlying physics of modeling. The student will be able to:
39.01	Demonstrate an understanding of the principle of squash and stretch.
39.02	Demonstrate an understanding of the principle of anticipation.
39.03	Demonstrate an understanding of the principle of staging.
39.04	Demonstrate an understanding of the principle of straight ahead action and pose to pose.
39.05	Demonstrate an understanding of the principle of follow through and overlapping action.

39.06 Demonstrate an understanding of the principle of slow in and slow out.

39.07 Demonstrate an understanding of the principle of arcs.

39.08 Demonstrate an understanding of the principle of secondary action.

39.09 Demonstrate an understanding of the principle of timing.

39.10 Demonstrate an understanding of the principle of exaggeration.

39.11 Demonstrate an understanding of the principle of solid drawing.

39.12 Demonstrate an understanding of the principle of appeal.

Course Number: CTS0773
Occupational Completion Point: OCP D
Modeling & Simulation Technical Artist – 300 Hours – SOC Code 27-1014

40.0 Analyze model fidelity as related to modeling and simulation techniques. The student will be able to:

40.01 Define fidelity.

40.02 Discuss the ramifications of model fidelity parameters and their variations.

40.03 Select the proper level of fidelity to solve a given problem.

40.04 Identify the rationale for selecting fidelity level.

40.05 Adjust model fidelity parameters to meet output requirements.

41.0 Demonstrate knowledge of rigging. The student will be able to:

41.01 Define rigging as a process.

41.02 Define the role of rigger.

41.03 Identify job titles associated with a rigger.

41.04 Identify rigging creation in the production pipeline.

42.0 Demonstrate knowledge of basic character setup. The student will be able to:

42.01 Compare and contrast rigging approaches and styles.

42.02 Demonstrate an understanding of the rig as it relates to the model.

42.03 Demonstrate an understanding of skeletal systems.

43.0 Demonstrate knowledge of motion capture systems. The student will be able to:

43.01 Understand knowledge of the history of motion capture.

43.02 Understand the awareness of emerging technologies in the industry.

43.03 Understand motion capture for 3D production.

44.0 Explore 3D sculpting and texturing techniques using high polygon sculpting software. The student will be able to:

44.01 Navigate 3D sculpting interface and workspace.

44.02 Create and Transform base object for sculpting.

44.03 Create subdivisions of objects for high poly sculpting.

44.04 Demonstrate working knowledge of sculpt and paint tools including creating sculpt layers and paint layers.

44.05 Create high detail models using sculpt and paint tools.

44.06 Demonstrate proficiency in Retopology.

44.07 Display sculpts through model viewport filters.

Course Number: CTS0774

Occupational Completion Point: E

Modeling & Simulation Developer – 450 Hours – SOC Code 15-1131

45.0 Demonstrate proficiency using various software applications while understanding the hardware requirements needed for modeling and simulations including processors, input/output (I/O) devices. The student will be able to:

45.01 Compare and contrast the appropriate use of various software and visualization applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music).

45.02 Demonstrate proficiency in the use of various software and visualization applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music).

46.0 Build a simple scenario for experimentation or training. The student will be able to:

46.01 Explain the importance of scenario building in simulations.

46.02 Identify the building blocks of scenarios.

46.03 Design a storyboard for a simulation.

46.04 Build a simple simulation with a finite number of variables.

46.05 Identify the various components of a simulation.

46.06 Run a simulation application given specific parameters.

46.07 Explain verification and validation of a simulation.

46.08 Review the importance of scenario building in simulations.

46.09 Explore/develop building blocks of scenarios.

46.10 Design a detailed storyboard for a simulation.

46.11 Build a simulation with a level of fidelity.

46.12 Describe the history of gaming and evolution of video games.

46.13 Design games using programming techniques.

46.14 Implement a simple game using appropriate software.

47.0 Demonstrate an understanding of underlying principles of experimental simulation and how it relates to modeling and simulation. The student will be able to:

47.01 Use proper attributes to develop a flowchart.

47.02 Compare various types of studies (i.e. survey, observation, experiment).

47.03	Identify and explain an experimental design process.
47.04	Set realistic objectives for the experiment.
47.05	Determine the appropriate response or output.
47.06	Select process variables or design parameters (control factors), noise factors and the interactions among the process variables of interest.
47.07	Perform experimental design execution.
47.08	Check that the data are consistent with the experimental assumptions.
47.09	Interpret and present results.
48.0	Use probabilities (relative frequency and theoretical), to plan and conduct an experiment that will address control, randomization and measurement of experimental error. The student will be able to:
48.01	Define and explain probability rules and event terminology.
48.02	Identify events as complementary, dependent, independent, mutually exclusive or not mutually exclusive.
48.03	Analyze categorical data using two-way tables to describe patterns and departure from patterns and to find marginal frequency and relative frequencies.
48.04	Distinguish between empirical and theoretical probability.
48.05	Calculate probabilities.
48.06	Explain the law of large numbers.
48.07	Calculate probabilities using addition rules.
48.08	Calculate probabilities using the multiplications rules.
48.09	Define the Fundamental Counting Rule, Permutation, and Combination.
48.10	Perform calculations using the Fundamental Counting Rule, Permutation and Combination.
48.11	Distinguish when one would use a permutation and when one would use a combination.
48.12	Define experimental terminology.
48.13	Explain potential reasons for experimental error.
48.14	Demonstrate an understanding of the principles of probability by performing a probability experiment within the classroom.

49.0	Use innovative technologies to create prototypes of models. The student will be able to:
49.01	Identify emerging technologies to develop prototypes.
49.02	Compare and contrast the benefits and drawbacks of using various prototyping methods and costs.
49.03	Use emerging technologies to create a prototype (i.e. 3D printing software, 3D printers or other applicable devices).
50.0	Apply the principles of entrepreneurship to Modeling and Simulation and demonstrate an understanding of the design and production of prototypes from conception to mass production. The student will be able to:
50.01	Identify the usefulness of technology applications.
50.02	Determine the design architecture.
50.03	Formulate and test a proof of concept.
50.04	Understand the value of partnerships and sub-contracting of production and distribution of product.
50.05	Develop an understanding of the production process.
50.06	Understand return on investment (ROI) concepts.
50.07	Examine market analysis of product.
50.08	Develop a comprehensive business model and present a clear and professional proposal to investors.
51.0	Demonstrate information fluency using emerging research techniques and technology. The student will be able to:
51.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
51.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.
51.03	Use technology tools to collaborate and generate a deliverable product.
51.04	Develop and display an electronic portfolio.
51.05	Demonstrate research skills using browsers, search engines, directories, and databases.
51.06	Create and evaluate a list of materials found online for relevance, appropriateness and bias.
51.07	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.
51.08	Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, Bing).
51.09	Identify effective Boolean search strategies.

51.10 Correlate the use of social media in the field of modeling and simulation for a variety of purposes.

51.11 Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf).

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Web Development
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y700100
CIP Number	0511080100
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1199 – Computer Occupations, All Other
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as an Assistant Web Designer, a Web Designer, and Senior Web Designer in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to operating system commands and web document development, design, promotion and scripting.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0070	Web Design Foundations	BUS ED 1 @2	150 hours	15-1199
	CTS0071	Web Interface Design	VOE @7	150 hours	15-1199
C	CTS0049	Web Scripting	TC COOP ED @7	150 hours	15-1199
	CTS0015	Web Media Integration	BUS DP @7 %G	150 hours	15-1199
D	CTS0016	Web E-commerce	ELECT DP @7 %G	150 hours	15-1199
	CTS0017	Web Interactivity	CLERICAL @7 7G	150 hours	15-1199
			SECRETAR 7G		
TEC ELEC \$7 G					
			COMP SCI 6		
			COMM ART @7 7G		
			WEB DEV 7 G		

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Demonstrate proficiency setting website project requirements during the design phase and project planning phase of web development.
- 16.0 Demonstrate proficiency creating a logical website file structure.
- 17.0 Create basic webpages that meet the industry standards as set forth by the W3C (World Wide Web Consortium).
- 18.0 Incorporate images and graphical formatting on a webpage.
- 19.0 Create a basic table structure.
- 20.0 Incorporate form structures in a webpage.
- 21.0 Discuss appropriate use of frame structures and their outdated usage.
- 22.0 Understand the basic principles of Cascading Style Sheets-CSS.
- 23.0 Use CSS to create basic webpages based on industry standards.
- 24.0 Develop website page layout using AP (Absolute Positioning) elements.
- 25.0 Understand basic web design technology.
- 26.0 Describe the process for publishing a website.
- 27.0 Describe how website performance is monitored and analyzed.
- 28.0 Create an informational website that conforms to industry standards as set forth by the W3C.
- 29.0 Demonstrate efficient, consistent website development practice (use of templates, snippets).
- 30.0 Demonstrate language arts knowledge and skills.
- 31.0 Demonstrate mathematics knowledge and skills.
- 32.0 Incorporate Human Computer Interface (HCI) principles of design.

- 33.0 Research and obtain information for use in designing the user interface.
- 34.0 Create a user friendly interface using Cascading Style Sheets (CSS).
- 35.0 Create a CSS formatted informational website.
- 36.0 Demonstrate proficiency publishing, testing, monitoring, and maintaining a website.
- 37.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 38.0 Solve problems using critical thinking skills, creativity and innovation.
- 39.0 Describe the roles within teams, work units, departments, larger environment as it relates to website project management.
- 40.0 Describe the importance of professional ethics and legal responsibilities as it relates to website development.
- 41.0 Discuss the differences between server-side and client-side scripting.
- 42.0 Demonstrate understanding of the Document Object Model (DOM).
- 43.0 Design, write, debug, and incorporate a JavaScript client-side script into a webpage.
- 44.0 Incorporate basic JavaScript form validation and form handling (using pre-built validation scripts or online libraries).
- 45.0 Use advanced JavaScript techniques.
- 46.0 Demonstrate understanding of JavaScript accessibility issues.
- 47.0 Select and modify appropriate library and pre-built JavaScript to incorporate into webpage.
- 48.0 Demonstrate understanding of XML vocabularies and documents.
- 49.0 Create and debug an XML Document.
- 50.0 Demonstrate an understanding of Asynchronous JavaScript and XML (AJAX) and its implications for web developers.
- 51.0 Plan and implement a multi-page website that features graphics, pictures, and video galleries using AJAX techniques.
- 52.0 Incorporate Canvas API methods into a webpage.
- 53.0 Demonstrate an understanding of PHP scripting.
- 54.0 Design, write, debug, and incorporate a PHP client-side script into a webpage.
- 55.0 Demonstrate an understanding of databases.
- 56.0 Incorporate a database into a webpage.
- 57.0 Demonstrate knowledge and skills necessary to setup a secure E-commerce site.
- 58.0 Identify security issues associated with E-commerce and discuss methods to mitigate risks.
- 59.0 Apply skills necessary to setup an E-commerce storefront.
- 60.0 Employ techniques to enhance the value and profitability of an E-commerce website.
- 61.0 Develop an evaluation and performance monitoring framework featuring established metrics and target goals for an E-commerce website.
- 62.0 Demonstrate an understanding of Content Management Systems (CMS) and their implications for web development.
- 63.0 Use CMS features, functions, and extensions/modules to create/enhance a website.
- 64.0 Evaluate the suitability for and system requirements for a content management system.
- 65.0 Demonstrate an understanding of multimedia applications and their implications for web designers.
- 66.0 Create and incorporate interactive website components.
- 67.0 PDF document usage considerations.
- 68.0 Create, format, and manipulate PDF documents.
- 69.0 Display, distribution, and print considerations for PDF documents.
- 70.0 Create and manage PDF forms.
- 71.0 Incorporate PDF security in a PDF document.
- 72.0 Demonstrate proficiency using HTML5 features and functions.

**Florida Department of Education
Student Performance Standards**

**Program Title: Web Development
Career Certificate Program Number: Y700100**

**Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151**

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: CTS0070

Occupational Completion Point: B

Web Design Foundations (Assistant Web Designer) – 150 Hours – SOC Code 15-1199

15.0	Demonstrate proficiency setting website project requirements during the design phase and project planning phase of Web development. The student will be able to:
15.01	Define information architecture.
15.02	Discuss the importance of information architecture to web design and development.
15.03	Conduct a client interview to determine the business purpose and needs.
15.04	Conduct a competitive analysis.
15.05	Describe the activities performed during the design phase and project planning phase of website development.
15.06	Demonstrate basic design principles (e.g., use of colors, proximity, rule of thirds, white space in the design of a website).
15.07	Define the site structure by creating a content map, site map, storyboard, associated wireframes, and web design comp for client approval.
15.08	Analyze and evaluate global site maps.
15.09	Discuss the legal and ethical issues (e.g., copyright laws, obtaining permission, public domain, proper citations) related to web design.
15.10	Describe accessibility and its implications on web design.
15.11	Identify the client and target audience needs, as well as the purpose of a website.
15.12	Describe project management responsibilities.
15.13	Define website project scope and scope creep.
15.14	Determine deadlines and deliverables for a website project.
15.15	Discuss Americans with Disabilities Act (ADA) standards for accessibility.
16.0	Demonstrate proficiency creating a logical website file structure. The student will be able to:
16.01	Create an efficient, maintainable directory structure for a website, including the site root and subfolders for assets (e.g., images, templates, CSS).
16.02	Demonstrate and use correct file paths for relative, site root relative, and absolute links.
16.03	Apply acceptable and logical website file naming conventions (e.g., index.html, comments.htm, about_us.htm).
16.04	Examine emerging and new markup languages.
16.05	Determine browser or platform compatibility as it relates to webpage design.

16.06	Identify common DOCTYPEs (e.g., Strict, Transitional and Frameset, and HTML5) and describe their appropriate use.
17.0	Create basic webpages that meet the industry standards as set forth by the W3C (World Wide Web Consortium). The student will be able to:
17.01	Create basic webpage structures using common markup elements and attributes.
17.02	Incorporate list structures in a webpage (e.g., ordered, unordered, definition).
17.03	Incorporate hyperlinks in a webpage (e.g., external, internal, email, named anchors).
17.04	Describe the influence of the W3C in the web development industry.
17.05	Write proper webpage syntax using tags and attributes that meet the standards set forth by the W3C.
17.06	Incorporate common webpage elements and attributes in a webpage (e.g., title, comment tags, id).
17.07	Differentiate between absolute and relative links used in a webpage.
17.08	Define and incorporate the target attribute for hyperlinks suitable for its purpose.
17.09	Use the HTML AUDIO and VIDEO tags to display a media file on the webpages.
18.0	Incorporate images and graphical formatting on a webpage. The student will be able to:
18.01	Describe usage guidelines (e.g., format types, size, relevance) for integrating images and graphics onto a webpage.
18.02	Compare and contrast standard image formats used in webpage design.
18.03	Incorporate graphics into a webpage design.
18.04	Create and incorporate image maps in a webpage.
18.05	Optimize images and graphics for use in a webpage.
19.0	Create a basic table structure. The student will be able to:
19.01	Describe how tables are used in web design.
19.02	Discuss the advantages and disadvantages of incorporating tables in a webpage design.
19.03	Define and modify table structures for the presentation of tabular information.
19.04	Create accessible tables using standard table elements and attributes.
20.0	Incorporate form structures in a webpage. The student will be able to:
20.01	Create an accessible form using common elements, including form, fieldset, legend, textarea, select, option, button, labels, and input (radio, checkbox, submit, reset, image, password, hidden).

20.02	Describe and diagram the relationship between HTML forms and server-side technologies.
20.03	Compare and contrast the GET and POST methods for forms handling.
20.04	Define form validation and describe how it is accomplished.
20.05	List popular server-side technologies often used to process content sent from HTML forms.
20.06	Connect a HTML form to a server-side script for processing.
21.0	Discuss appropriate use of frame structures and their outdated usage. The student will be able to:
21.01	Discuss using frames and iframe structures and the related security vulnerabilities
21.02	Describe appropriate uses of iframes.
22.0	Understand the basic principles of Cascading Style Sheets-CSS. The student will be able to:
22.01	Define the purpose of CSS and describe its importance in web design.
22.02	Discuss existing and emerging CSS versions.
22.03	Explain how inheritance and specificity affect CSS rule conflicts.
22.04	Discuss the different placement of CSS (e.g., inline, external, embedded).
23.0	Use CSS to create basic webpages based on industry standards. The student will be able to:
23.01	Recognize and use element selectors, ID selectors, class selectors, pseudo-class selectors, and descendant selectors.
23.02	Use inline, internal and external style sheets.
23.03	Use the link and import methods to connect to an external style sheet.
23.04	Apply basic CSS properties (background, border, color, float, font, height, line-height, list-style, margin, overflow, padding, position, text-align, text-indent, width, padding).
23.05	Use CSS to style tables (e.g., borders, width, spacing, alignment, background).
23.06	Use CSS to enhance the appearance and usability of an HTML form.
24.0	Develop website page layout using AP (Absolute Positioning) elements. The student will be able to:
24.01	Compare and contrast positioning types on a webpage.
24.02	Describe the usage of AP elements in a webpage.

24.03	Incorporate AP elements in a webpage layout using appropriate Div tags.
24.04	Discuss the benefits and drawbacks of using AP elements for webpage layouts.
24.05	Determine how the stacking order and z-index impact webpages created with AP elements.
25.0	Understand basic web design technology. The student will be able to:
25.01	Discuss client-side and server-side technologies.
25.02	Define e-commerce types and usage.
25.03	Describe database connectivity relative to websites.
26.0	Describe the process for publishing a website. The student will be able to:
26.01	Explore domain name selection process.
26.02	Identify process to registering a domain name.
26.03	Compare and contrast hosting providers, features, and selection criteria.
26.04	Describe the various means for uploading website files (e.g., FTP, web-based tools).
27.0	Describe how website performance is monitored and analyzed. The student will be able to:
27.01	Identify issues related to website maintenance.
27.02	Use webpage validation tools.
27.03	Describe website performance metrics (e.g., visits, time-on-page, time-on-site) and discuss their design implications.
27.04	Demonstrate knowledge of accessibility problems and solutions.
27.05	Discuss current basic Search Engine Optimization techniques.
27.06	Explore common website analytic tools.
28.0	Create an informational website that conforms to industry standards as set forth by the W3C. The student will be able to:
28.01	Use GUI (Graphical User Interface) web authoring software to create a multi-page informational website.
28.02	Use image-editing software to enhance website designs with simple graphics.
28.03	Enhance the website using client-side technologies (navigation bars, rollover images or text, check plug-ins).

29.0	Demonstrate efficient, consistent website development practice (use of templates, snippets). The student will be able to:
29.01	Produce website designs that would work equally well on various operating systems and platforms, browser versions/configurations, and devices.
29.02	Describe various file formats that can be imported onto a website (tabular data, word processing, presentation, PDFs).
30.0	Demonstrate language arts knowledge and skills. The student will be able to:
30.01	Locate, comprehend and evaluate key elements of oral and written information.
30.02	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
30.03	Present information formally and informally for specific purposes and audiences.
31.0	Demonstrate mathematics knowledge and skills. The student will be able to:
31.01	Demonstrate knowledge of arithmetic operations.
31.02	Analyze and apply data and measurements to solve problems and interpret documents.
31.03	Construct charts/tables/graphs using functions and data.

Course Number: CTS0071
Occupational Completion Point: B
Web Interface Design (Assistant Web Designer) – 150 Hours – SOC Code 15-1199

32.0	Incorporate Human Computer Interface (HCI) principles of design. The student will be able to:
32.01	Describe the fundamental design principles of human computer interface.
32.02	Differentiate between computer and human factors in screen/page design.
32.03	Describe what is meant by an “intuitive” interface.
32.04	Describe how typography, color scheme, and graphic usage are used to set website feel/tone for various types of websites (e.g., educational, entertainment, ecommerce). Identify and use the following design concepts: contrast, repetition, alignment, proximity, writing style.
32.05	Identify and use the following design concepts: contrast, repetition, alignment, proximity, writing style.
32.06	Define and establish logo, identity, and branding needed for an effective website.
32.07	Evaluate the HCI features included on a webpage storyboard.
32.08	Create a series of webpage storyboards that incorporate HCI design principles.
33.0	Research and obtain information for use in designing the user interface. The student will be able to:
33.01	Identify common user information needs, information gathering models, and methods for gathering user research.
33.02	Define the primary audience and customer expectations.
33.03	Describe target audience preferences based on demographics (e.g., gender, age, economic status, culture).
33.04	Identify and use web analytic tools to shape an information architecture strategy (determine keywords).
33.05	Apply the results of research and analytics to the design of a user interface.
34.0	Create a user friendly interface using Cascading Style Sheets (CSS). The student will be able to:
34.01	Create CSS styles suitable for use on a user friendly webpage interface.
34.02	Use element selectors, ID selectors, class selectors, pseudo-class selectors, and descendant selectors to create a table-less webpage design.
34.03	Create a series of templates formatted exclusively using CSS.
34.04	Use CSS syntax to configure and apply style sheets for multiple media displays (e.g., screen display and print).
34.05	Use CSS syntax to implement custom web fonts on a webpage.

34.06	Use CSS syntax to implement transitions and transformations to create animations on a webpage.
34.07	Use CSS media queries to develop a responsive user interface.
34.08	Explore various web authoring software (e.g. text editor or GUI editors).
34.09	Create documented CSS style sheets for layout and appearance purposes.
35.0	Create a CSS formatted informational website. The student will be able to:
35.01	Use GUI (Graphical User Interface) web authoring software to create a multi-page informational website.
35.02	Create documented CSS style sheets for layout and appearance purposes.
35.03	Incorporate methods used to drive traffic to the website, then engage and retain visitors.
35.04	Apply standard search engine optimization (SEO) practices (e.g., keyword proximity; density; relevance; appropriate page titles, URLs, and headings, alt tags) to enhance search engine performance.
35.05	Use standard design techniques to create websites and correct display issues using multiple browsers and platforms.
35.06	Discuss the pros and cons of using existing and emerging animation software.
35.07	Use client-side technologies such as rollovers, check plug-ins, and pop-up windows to enhance the user interface.
36.0	Demonstrate proficiency publishing, testing, monitoring, and maintaining a website. The student will be able to:
36.01	Recognize the relationship between local and remote site structure.
36.02	Identify methods of acquiring a domain name, appropriate hosting, and search engine registry.
36.03	Understand and implement strategies to measure website traffic and improve search engine analytics reports.
36.04	Describe the use of standard web marketing techniques.
36.05	Describe how social media and social networking sites can be used for marketing purposes.
36.06	Test websites using common resolutions, browsers, accessibility, and validation techniques.
36.07	Use popular Internet browsers and tools as defined by W3C Browser Statistics (e.g., Mozilla Firefox (Web Developer Toolbar, ColorZilla, MeasureIt, Firebug), Internet Explorer 7/8) to display and troubleshoot websites.
36.08	Explore standard practices for feedback and usability testing.
36.09	Identify and incorporate standard security measures in a website.
36.10	Identify and use online validation tools.
36.11	Change invalid markup to comply with standards.

36.12	Build a webpage that successfully passes the W3C validation test at http://validator.w3.org .
36.13	Write markup that facilitates accessibility.
36.14	Understand how to publish sites to remote server.
36.15	Differentiate between local, testing, and remote website files and storage.
37.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
37.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
37.02	Locate, organize and reference written information from various sources.
37.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
37.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
37.05	Apply active listening skills to obtain and clarify information.
37.06	Develop and interpret tables and charts to support written and oral communications.
37.07	Exhibit public relations skills that aid in achieving customer satisfaction.
38.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
38.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
38.02	Employ critical thinking and interpersonal skills to resolve conflicts.
38.03	Identify and document workplace performance goals and monitor progress toward those goals.
38.04	Conduct technical research to gather information necessary for decision-making.
39.0	Describe the roles within teams, work units, larger environment as it relates to website project management. The student will be able to:
39.01	Describe the types of websites and the major processes that make them successful.
39.02	Explain project management and team member key roles.
39.03	List and describe project management control systems (i.e., scope, timeframe, deliverables).
39.04	Explain the impact of the global economy and cultures on website planning and production.
40.0	Describe the importance of professional ethics and legal responsibilities as it relates to website development. The student will be able to:
40.01	Evaluate and justify decisions based on ethical reasoning.

40.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.

40.03 Identify and explain personal and corporate consequences of unethical or illegal practices in website development.

40.04 Interpret and explain written organizational policies and procedures.

Course Number: CTS0049

Occupational Completion Point: C

Web Scripting (Web Designer) – 150 Hours – SOC Code 15-1199

41.0 Discuss the differences between server-side and client-side scripting. The student will be able to:

41.01 Describe the role scripting languages play in the creation of websites.

41.02	Identify and describe the advantages, disadvantages, and primary uses of popular scripting languages (e.g., JavaScript, VBScript, Perl, PHP, JScript).
42.0	Demonstrate understanding of the Document Object Model (DOM). The student will be able to:
42.01	Describe the purpose of the Document Object Model (layout, objects, properties, methods).
42.02	Describe how JavaScript uses the DOM to detect and manipulate elements on a webpage.
43.0	Design, write, debug, and incorporate a JavaScript client-side script into a webpage. The student will be able to:
43.01	Write, analyze and explain JavaScript syntax.
43.02	Describe usage of various data types.
43.03	Describe how the use of decision-making logic (AND, OR) is employed in a JavaScript program.
43.04	Create and use variables, operators, and expressions.
43.05	Use common JavaScript events and event handlers (e.g., click, load, onClick, onLoad) to control program flow, appearance, or functionality.
43.06	Understand and incorporate JavaScript arrays (e.g., array basics, types, usage, methods, sorting).
43.07	Understand and incorporate JavaScript functions (e.g., using the DOM, pass a value, return value, create objects, work with classes, objects).
43.08	Understand and incorporate JavaScript loops and conditions (e.g., loop basics, types, usage).
43.09	Recognize, isolate, and correct common JavaScript errors (e.g., syntax, function errors, reserved word usage, unsupported DOM).
43.10	Apply JavaScript best coding practices (i.e., properly documenting scripts, field naming conventions, writing understandable code).
43.11	Use different methods to incorporate JavaScript onto a webpage (e.g., <script> element, JavaScript statement block, external scripts).
43.12	Troubleshoot and test incorporated script (i.e., functionality, browser usage, resolve known bugs).
44.0	Incorporate basic JavaScript form validation and form handling (using pre-built validation scripts or online libraries). The student will be able to:
44.01	Identify and use form elements to solicit user input.
44.02	Use JavaScript with HTML form controls.
44.03	Validate web forms prior to submission.
44.04	Use output commands to display processed data in an appropriately formatted form.
45.0	Use advanced JavaScript techniques. The student will be able to:
45.01	Write JavaScript suitable for plug-in detection, image manipulation, and the creation of custom JavaScript objects.

45.02	Use JavaScript to incorporate, create, update, and delete cookies.
45.03	Describe the common security issues relevant to JavaScript.
46.0	Demonstrate understanding of JavaScript accessibility issues. The student will be able to:
46.01	Describe the purpose of the Browser Object Model (BOM) and how it relates to JavaScript.
46.02	Make webpages accessible and functional when JavaScript is disabled or unsupported.
47.0	Select and modify appropriate library and pre-built JavaScript to incorporate into webpage. The student will be able to:
47.01	Explore common JavaScript libraries and describe the advantages and disadvantages of using libraries.
47.02	Analyze pre-built library items to determine functionality.
47.03	Explain how a library item achieves desired processing.
47.04	Determine if pre-built script provides functionality required in an effective manner.
47.05	Incorporate pre-built library items into webpages.
47.06	Identify the restrictions related to using pre-built scripts (i.e.; copyright, processing, and length of script).
47.07	Modify pre-built scripts to suit functionality requirements.
47.08	Test and troubleshoot pre-built scripts and widgets incorporated into webpages.

Course Number: CTS0015
Occupational Completion Point: C
Web Media Integration (Senior Web Designer) – 150 Hours – SOC Code 15-1199

48.0	Demonstrate understanding of XML vocabularies and documents. The student will be able to:
48.01	Understand XML vocabularies.
48.02	Define well-formed and valid XML documents.
48.03	Describe the basic structure of an XML document.

49.0	Create and debug an XML Document. The student will be able to:
49.01	Create an XML declaration.
49.02	Work with XML comments.
49.03	Create XML elements and attributes.
49.04	Work with character and entity references.
49.05	Describe how XML handles character data, parsed character data, and white space.
49.06	Work with XML parsers.
49.07	Understand how web browsers work with XML documents.
49.08	Apply a style sheet to an XML document.
50.0	Demonstrate an understanding of Asynchronous JavaScript and XML (AJAX) and its implications for web developers. The student will be able to:
50.01	Identify the technologies that comprise AJAX and explain how they interact.
50.02	Describe the purpose, advantages, disadvantages, and functions of AJAX.
50.03	Describe how AJAX works and how it is used in the creation of websites.
50.04	Define appropriate use of AJAX in a web project.
50.05	Identify AJAX Usability and Accessibility issues and their workarounds.
50.06	Describe AJAX related browser compatibility issues and their workarounds.
50.07	Explore popular AJAX applications currently on the Internet (auto-complete (Google), updating user content (Twitter), voting and rating (social bookmarking)).
50.08	Describe common security issues associated to AJAX.
50.09	Analyze the server-side implications of AJAX applications.
50.10	Explore methods for testing and maintaining an AJAX application.
50.11	Explore the future of AJAX and its implementation.
51.0	Plan and implement a multi-page website using AJAX techniques. The student will be able to:
51.01	Research AJAX design principles and patterns (e.g., Observer, Command and MVC).
51.02	Research and compare popular AJAX frameworks, libraries, and toolkits (e.g., JQuery, DOJO, Prototype).

51.03	Identify and implement strategies for progressive enhancement of a webpage.
51.04	Update specific areas of a page with data from the server (e.g., server-login updated) without reloading the webpage.
51.05	Demonstrate the ability to transmit data in different formats (e.g., XML, JSON, alternatives to JavaScript).
51.06	Use AJAX to create form submission and validation (e.g. password strength check, email/URL validation).
51.07	Integrate a third party image gallery component.
52.0	Incorporate Canvas API methods into a webpage. The student will be able to:
52.01	Use the HTML CANVAS tag to create a drawing area on a webpage.
52.02	Use JavaScript to write text on a canvas.
52.03	Use JavaScript to draw basic shapes (e.g., lines, circles, squares) on a canvas.
52.04	Use JavaScript and AJAX to draw charts and graphs on a canvas.
53.0	Demonstrate an understanding of PHP scripting. The student will be able to:
53.01	Define the purpose of PHP and describe its importance in web design.
53.02	Discuss existing and emerging PHP versions.
53.03	Discuss various configuration options for installing PHP on a server.
54.0	Design, write, debug, and incorporate a PHP client-side script into a webpage. The student will be able to:
54.01	Write, analyze and explain PHP syntax.
54.02	Describe usage of various data types.
54.03	Describe how the use of decision-making logic (e.g. and, or) is employed in a PHP program.
54.04	Create and use variables, operators and expressions.
54.05	Understand and incorporate PHP arrays (e.g., array basics, types, usage, methods, sorting).
54.06	Understand and incorporate PHP objects (e.g., creation, access).
54.07	Understand and incorporate PHP functions (e.g., pass a value, return value).
54.08	Understand and incorporate PHP loops and conditions (e.g., loop basics, types, usage).
54.09	Recognize, isolate, and correct common PHP errors (e.g., syntax, function errors, reserved word usage).

54.10	Apply PHP best coding practices (i.e., properly documenting scripts, field naming conventions, writing understandable code).
54.11	Troubleshoot and test incorporated script (i.e., functionality, browser usage, resolve known bugs).
55.0	Demonstrate an understanding of databases. The student will be able to:
55.01	Define the purpose of a database and describe its importance in web design.
55.02	Define the purpose of SQL.
55.03	Discuss existing database management systems (e.g., MySQL, Oracle, SQL Server).
56.0	Incorporate a database into a webpage. The student will be able to:
56.01	Create a database to store information for a website.
56.02	Understand how to use basic SQL commands (e.g., select, insert, update, delete) to manipulate the information in a database.
56.03	Execute SQL commands to manipulate the information in a database using a database management system.
56.04	Execute SQL commands to manipulate the information in a database using PHP.

Course Number: CTS0016
Occupational Completion Point: D
Web E-commerce (Senior Web Designer) – 150 Hours – SOC Code 15-1199

57.0 Demonstrate knowledge and skills necessary to setup a secure E-commerce site. The student will be able to:

57.01 Compare and contrast popular pre-built shopping cart software (e.g., PrestaShop, Zend Cart).

57.02 Compare and contrast hosting options available for use with shopping cart software (i.e., shared hosting or dedicated server).

57.03 Discuss shopping cart vulnerabilities and best-practice preventative measures.

57.04 Identify hardware and software necessary to install and setup pre-built shopping cart software.

57.05 Install and configure necessary software (database, server) to run pre-built shopping cart software.

57.06 Install and configure pre-built shopping cart software.

57.07 Verify database and server connectivity.

57.08 Test and troubleshoot setup/configuration issues.

58.0 Identify security issues associated with E-commerce and discuss methods to mitigate risks. The student will be able to:

58.01 Describe the differences between Transaction Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL).

58.02 Explain transaction security.

58.03 Identify security and payment processing issues involved in developing a site (e.g., SSL, Digital Certificates, SET Protocol, Cyber Cash).

58.04 Demonstrate understanding of https and htaccess and their usage.

58.05 Explore methods to obtain an SSL certificate and secure transactions.

58.06 Compare and contrast the appropriateness of employing a merchant account or a payment gateway to handle online transactions.

58.07 Discuss the process, advantages, disadvantages, and costs associated with opening a merchant account.

58.08 Describe the process, advantages, disadvantages, and costs associated with using a payment gateway.

59.0 Apply skills necessary to setup an E-commerce storefront. The student will be able to:

59.01 Setup and use an FTP (File Transfer Protocol) program to transfer files to a web server.

59.02 Add business specific information to site storefront (e.g., logos, product images, descriptions).

59.03 Setup back-end site administration functions and navigation.

59.04	Setup a schema for incorporating shipping, handling, and processing fees based on carrier, geographical zones, and weight/price range.
59.05	Experiment with various add-ons, themes, and modules available for customization.
59.06	Make simple modifications to a shopping cart to suit client needs (e.g., modify fields, add buttons).
59.07	Customize forms to accommodate client products and/or services.
59.08	Setup Search preferences and functionality for products and/or services.
59.09	Setup customer contact preferences and email notification functionality.
59.10	Apply Search Engine Optimization (SEO) techniques to shopping cart pages.
59.11	Test operation of shopping cart pages in multiple browsers.
59.12	Troubleshoot issues and errors related to browser display and functionality.
60.0	Employ techniques to enhance the value and profitability of an E-commerce website. The student will be able to:
60.01	Determine business goals for the E-commerce site.
60.02	Identify the various types of advertising options in E-commerce (e.g., links, banner ads, affiliate programs, pop-up windows, viral marketing, newsgroup postings).
60.03	Describe affiliate marketing and its implications for E-commerce websites.
60.04	Analyze popular affiliate programs/networks and available payment schemes.
60.05	Explain the differences, advantages, and disadvantages of CPM, PPC, and Pay per Sale/Lead.
60.06	Determine appropriate affiliate program for target audience.
60.07	Identify the method to join an affiliate program/network.
60.08	Identify considerations/requirements of selecting an affiliate program.
60.09	Determine appropriate number of affiliate programs necessary to suit client site.
60.10	Determine the terms and conditions of sale, including warranties, after-sales service, and privacy assurances.
60.11	Determine customer service options (e.g., e-mail, phone, fax).
60.12	Create a site map.
60.13	Create a Frequently Asked Questions (FAQ) page.
60.14	Create a product/version comparison chart, where appropriate.

60.15	Create feedback, review, survey, and recommendation pages.
61.0	Develop evaluation and performance monitoring metrics and target goals for an E-commerce website. The student will be able to:
61.01	Research existing and emerging analytical, usability, SEO tools to improve customer satisfaction and site conversion rates.
61.02	Describe web analytics tools and their features/functions.
61.03	Use web analytics tools to determine optimum site keywords.
61.04	Experiment with using advanced segments to view subsets of data (relating to purchasing habits, website usage, searches).
61.05	Customize analytic reports using appropriate metrics (e.g., average per-visit value, bounce rates, time spent on page).
61.06	Create more concise reports using advanced filters in web analytics tools.
61.07	Use intelligence features of web analytics tools to discover patterns of usage and setup corresponding alerts.
61.08	Research popular mobile analytics tools (e.g., Motally) and their features.
61.09	Interpret analytic report data and optimize website accordingly, if appropriate.

Course Number: CTS0017
Occupational Completion Point: D
Web Interactivity (Senior Web Designer) – 150 Hours – SOC Code 15-1199

62.0 Demonstrate an understanding of Content Management Systems (CMS) and their implications for web development. The student will be able to:

62.01 Describe the fundamental operation of a CMS.

62.02 Describe the typical features of a content management system.

62.03 Compare and contrast popular CMS applications (e.g., WordPress, Joomla).

62.04 Describe how a content management system can be used to enhance website interactivity.

62.05 Demonstrate proficiency installing and configuring content management systems and extensions/modules.

63.0 Use CMS features, functions, and extensions/modules to create/enhance a website. The student will be able to:

63.01 Create a basic multipage website using a content management system.

63.02 Enhance a webpage by using a content management system to incorporate images, animations, or video segments.

63.03 Incorporate a blog feature into a website using a content management system.

63.04 Demonstrate proficiency using CMS built-in security for website, password and database backup.

63.05 Demonstrate proficiency using add-on modules, or plug-ins.

64.0 Evaluate the suitability for and system requirements for a content management system. The student will be able to:

64.01 Identify business goals and evaluate their suitability for a content management system.

64.02 Determine web hosting system requirements.

64.03 Create a schema for creating, deleting, and managing users and their permissions.

64.04 Discuss the value represented by templates in a content management system development environment.

65.0 Demonstrate an understanding of multimedia applications and their implications for web designers. The student will be able to:

65.01 Compare and contrast the leading multimedia development applications for website development (e.g., Adobe Flash, Microsoft Silverlight).

65.02 Describe those circumstances whereby multimedia may be used to add interactivity to a website.

65.03 Describe the limitations of multimedia development applications relative to website development viewed on various platforms (e.g.,

PCs, tablets, mobile devices).

66.0 Create and incorporate interactive website components. The student will be able to:

66.01 Create buttons, menus, and other components that feature a static, hover, and rollover effect.

66.02 Convert original artwork into an interactive component with associated script behavior.

66.03 Adjust the component properties including opacity, filter, rotation, and action.

66.04 Resize a multi-layer component to ensure uniform resizing of each layer.

66.05 Create scrolling images, panels, and lists for incorporating into a web design.

66.06 Create and incorporate animated banners, headers, and website introduction pages (e.g., Adobe Flash, Microsoft Silverlight).

67.0 PDF document usage considerations. The student will be able to:

67.01 Discuss the advantages and disadvantages of using PDF documents in a website.

67.02 Research and discuss PDF document usage best practices.

67.03 Determine when it is appropriate to use PDF documents (e.g., brochure downloads, large reports, catalogs, interactive forms).

67.04 Compare and contrast the functionality of software applications used to create and process PDFs.

67.05 Research and describe search engine optimization considerations related to the use of PDF documents.

67.06 Research and discuss security issues related to PDF document usage in a website (viruses, auto-open).

67.07 Identify accessibility issues related to using PDF documents in a website.

68.0 Create, format, and manipulate PDF documents. The student will be able to:

68.01 List & describe the methods available for creating PDF documents.

68.02 Create a PDF using a variety of software applications, multiple files, and webpages.

68.03 Demonstrate ability to format, modify and enhance a PDF document.

68.04 Describe the differences in PDF standards for document prepress data interchange and long-term archiving.

68.05 Embed images, text, audio, video, and Flash content into a PDF document.

68.06	Create and modify automatically generated and manual bookmarks in a PDF document.
68.07	Add clickable links to a PDF document.
68.08	Incorporate Find and Search methods to locate specific text in a PDF document.
68.09	Describe the method used to search scanned documents (optical character recognition).
68.10	Understand and correct color separation issues.
68.11	Create and modify PDF documents using available tools to meet accessibility requirements (e.g., tags, reading order, forms, supplemental content for multimedia, text-to-speech).
68.12	Export a PDF document in a different format.
69.0	Display, distribution, and print considerations for PDF documents. The student will be able to:
69.01	Define file specifications use to generate smaller files for electronic distribution and on-screen display.
69.02	Specify image downsampling and compression settings to generate a PDF file with a smaller file size.
69.03	Identify and correct potential printing issues in a PDF document.
69.04	Ensure a PDF document meets appropriate criteria for print or electronic distribution.
69.05	Demonstrate ability to control flattening of a transparent PDF document and misregistration.
69.06	Demonstrate color management techniques that affect on-screen display and printing.
69.07	Discuss methods and tools used to review a PDF document (email, shared, tracking).
70.0	Create and manage PDF forms. The student will be able to:
70.01	Create an interactive form using fields, form objects, and distribution methods.
70.02	Distribute a form electronically and manage distributed forms.
70.03	Demonstrate ability to redact content in a form to protect sensitive information.
70.04	Preview, test, and modify an interactive form.
71.0	Incorporate PDF security in a PDF document. The student will be able to:
71.01	Secure a PDF document using passwords, encryption, digital IDs and signatures.
71.02	Creating Security Policies and Certificates for a PDF document.

71.03	Enable usage rights for Adobe Readers.
72.0	Demonstrate proficiency using HTML5 features and functions. The student will be able to:
72.01	Apply HTML5 APIs in webpages for interactivity (e.g., audio/video, drag & drop, drawing canvas).
72.02	Apply HTML5 interactivity elements into webpages (i.e., <canvas>, <embed>, <audio>, <video>, <details> <input>).
72.03	Utilize HTML5 fallback strategies to address browser support issues.
72.04	Utilize HTML5 to define dynamic behaviors using JavaScript.
72.05	Use HTML5 specification to manipulate text and images.
72.06	Use HTML5 to create persistent data and single session storage (HTML 5 Local Offline Storage & Session Storage).
72.07	Use HTML5 for media event handling (audio, video, embed, image).
72.08	Use HTML5 event handling for window, mouse, and form events.
72.09	Use CSS3 to style HTML5 (e.g., transitions, typography enhancements).

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Java Development & Programming
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y700200
CIP Number	0511020313
Grade Level	30, 31
Standard Length	1200 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA SkillsUSA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of programming and software development; procedural and object-oriented programming; creating regular and specialized applications using the Java programming language, including testing, monitoring, debugging, documenting, and maintaining Java computer applications.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0041	Computer Programmer Assistant	BUS ED 1 @2	300 hours	15-1131
C	CTS0044	Computer Programmer	COMPU SCI 6	150 hours	15-1131
D	CTS0031	Java Developer	COMP PROG 7G	600 hours	15-1131

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 16.0 Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development.
- 17.0 Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types.
- 18.0 Distinguish between iterative and non-iterative program control structures.
- 19.0 Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages.
- 20.0 Describe the processes, methods, and conventions for software development and maintenance.
- 21.0 Explain the types, uses, and limitations of testing for ensuring quality control.
- 22.0 Create a program design document using Unified Modeling Language (UML) or other common design tool.
- 23.0 Solve problems using critical thinking skills, creativity and innovation.
- 24.0 Use information technology tools.
- 25.0 Describe the importance of security and privacy information sharing, ownership, licensure and copyright.
- 26.0 Design a computer program to meet specific physical, operational, and interaction criteria.
- 27.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
- 28.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
- 29.0 Effectively communicate and collaborate.
- 30.0 Demonstrate responsible use of technology and information.
- 31.0 Explain key concepts that distinguish object-oriented programming from procedural programming.

- 32.0 Create a project plan that defines requirements, structural design, time estimates, and testing elements.
- 33.0 Design, document, and create object-oriented computer programs.
- 34.0 Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results.
- 35.0 Understand human interactions in intelligence.
- 36.0 Construct statements that declare, initialize, and modify different types of variables used in Java programs.
- 37.0 Describe the types and characteristics of lexical units in the Java programming language.
- 38.0 Describe the data types employed in Java programs.
- 39.0 Construct Java statements that employ the use of various operators.
- 40.0 Write executable statements using Java.
- 41.0 Describe variable scope and its implications in Java programming.
- 42.0 Apply common Java programming style guidelines and conventions.
- 43.0 Demonstrate use of the compiler and interpreter through command line interface.
- 44.0 Construct conditional control statements in Java.
- 45.0 Construct iterative control statements in Java.
- 46.0 Use nested loop iterative control statements in Java.
- 47.0 Produce input and output for Java programs.
- 48.0 Use packages and import statements in a Java program.
- 49.0 Create a Java program that uses methods.
- 50.0 Create a Java program that uses parameters in methods.
- 51.0 Describe and use recursion in a Java program.
- 52.0 Construct Java statements that use the String class to manipulate String data.
- 53.0 Construct Java statements that use Classes.
- 54.0 Manage class relationships.
- 55.0 Construct Java statements that illustrate the use of multiplicities in class relationships.
- 56.0 Use object references.
- 57.0 Describe the types of arrays and construct Java statements that illustrate the use and manipulation of multi-dimensional and jagged arrays.
- 58.0 Construct Java statements that illustrate different ways of using inheritance.
- 59.0 Construct Java statements that use collections.
- 60.0 Write Java code that uses the Iterator and List interfaces.
- 61.0 Create Java code that includes exception handling code.
- 62.0 Create Java code that uses the Object class.
- 63.0 Use standard library classes that comprise the Java API.
- 64.0 Create Java code that uses exceptions to improve program quality.
- 65.0 Describe Java 2 Micro Edition (J2ME) uses, characteristics, and constraints.
- 66.0 Create and convert classes using Unified Modeling Language (UML).
- 67.0 Create programs that use of Remote Method Invocation (RMI) and other server technologies associated with Relational Database Management Systems (RDMS) and Structured Query Language (SQL).
- 68.0 Demonstrate an understanding of Java Integration APIs, including Java Message Service (JMS), Enterprise JavaBeans (EJB), and Java Naming and Directory Interface (JNDI).
- 69.0 Demonstrate an understanding of Java Client APIs, including the Abstract Window Toolkit (AWT), Swing, and Java applet.
- 70.0 Understand and apply Java 2 Enterprise Edition (J2EE) Server Solutions.
- 71.0 Create a database application using the Java programming language.

- 72.0 Create a graphical user interface application using the Java programming language.
- 73.0 Create a web-based application using the Java programming language.
- 74.0 Write code to perform common and union database queries using SQL and Java.
- 75.0 Implement Java program statements using objects.
- 76.0 Utilize debugging tools and write error handlers.
- 77.0 Demonstrate file I/O.
- 78.0 Utilize API functions.
- 79.0 Test and debug databases.
- 80.0 Successfully work as a member of a software development team.
- 81.0 Manage time according to a plan.
- 82.0 Keep acceptable records of progress, problems and solutions.
- 83.0 Plan, organize and carry out a project plan.
- 84.0 Manage resources.
- 85.0 Use tools, materials, and processes in an appropriate and safe manner.
- 86.0 Demonstrate an understanding of the software development process.
- 87.0 Research content related to the project and document the results.
- 88.0 Use presentation skills, and appropriate media to describe the progress, results and outcome of the experience.
- 89.0 Demonstrate competency in the area of expertise related to developing computer software using the Java programming language.

Florida Department of Education
Student Performance Standards

Program Title: Java Development and Programming
Career Certificate Program Number: Y700200

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: CTS0041
Occupational Completion Point: B
Computer Programmer Assistant – 300 Hours – SOC Code 15-1131

15.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
15.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
15.02	Locate, organize and reference written information from various sources.
15.03	Construct writings and/or communications using developmentally appropriate terminology.
15.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
15.05	Analyze the positive and negative impacts of technology on popular culture and personal life.
15.06	Discuss how technology has changed the way people build and manage organizations and how technology impacts personal life.
15.07	Evaluate ways in which adaptive technologies may assist users with special needs.
15.08	Explain how societal and economic factors are affected by access to critical information.
15.09	Discuss the challenges (e.g., political, social, and economic) in providing equal access and distribution of technology in a global society.
16.0	Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development. The student will be able to:
16.01	Explore a variety of careers to which computing is central.
16.02	Compare and contrast appropriate and inappropriate social networking behaviors.
16.03	Discuss the impact of computing on business and commerce (e.g., automated inventory processing, financial transactions, e-commerce, virtualization, cloud computing).
16.04	Evaluate the impacts of irresponsible use of information (e.g., plagiarism, falsification of data) on collaborative projects.
16.05	Identify tasks performed by programmers.
16.06	Describe how businesses use computer programming to solve business problems.
16.07	Investigate job opportunities in the programming field.
16.08	Explain different specializations and the related training in the computer programming field.
16.09	Explain the need for continuing education and training of computer programmers.
16.10	Understand and identify ways to use technology to support lifelong learning.
16.11	Explain enterprise software systems and how they impact business.

16.12	Describe ethical responsibilities of computer programmers.
16.13	Describe the role of customer support to software program quality.
16.14	Identify credentials and certifications that may improve employability for a computer programmer.
16.15	Identify devices, tools, and other environments for which programmers may develop software.
17.0	Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types. The student will be able to:
17.01	Identify the characteristics (e.g., size, limits) and uses of different numerical and non-numerical data types.
17.02	Explain the types and uses of variables in programs.
17.03	Determine the best data type to use for given programming problems.
17.04	Compare and contrast simple data structures and their uses.
17.05	Identify the types of operations that can be performed on different data types.
17.06	Evaluate arithmetic and logical expressions using appropriate operator precedence.
17.07	Explain how computers store different data types in memory.
17.08	Demonstrate the difference between "data" and "information".
17.09	Use different number systems to represent data.
17.10	Explain how national and international standards (i.e., ASCII, UNICODE) are used to represent non-numerical data.
17.11	Use Boolean logic to perform logical operations.
18.0	Distinguish between iterative and non-iterative program control structures. The student will be able to:
18.01	Create non-iterative programming structures and explain their uses.
18.02	Create iterative programming structures and explain their uses.
18.03	Explain how sequence, selection, and iteration are building blocks of algorithms.
19.0	Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages. The student will be able to:
19.01	Differentiate between multiple levels of an operating system, translation, and interpretation that support program execution.
19.02	Explain the program execution process (by an interpreter and in CPU hardware).
19.03	Describe object-oriented concepts.

19.04	Explain the characteristics of procedural and object-oriented programming languages.
19.05	Compare and contrast programming languages that are compiled, interpreted, and translated.
19.06	Classify programming languages by paradigm and application domain (e.g., imperative, functional, logic languages and how well suited they are for certain application domains such as web programming, symbolic processing, data/numerical processing).
20.0	Describe the processes, methods, and conventions for software development and maintenance. The student will be able to:
20.01	Describe a software development process that is used to solve problems at different software development stages.
20.02	Describe and demonstrate ethical and responsible use of modern communication media and devices.
20.03	Define alternative methods of program development (e.g., rapid prototyping, waterfall, spiral model, peer coding).
20.04	List and explain the steps in the program development cycle.
20.05	Describe different types of documentation used in the program development cycle (e.g., requirements document, program design documents, test plans).
20.06	Describe different methods used to facilitate version control.
21.0	Explain the types, uses, and limitations of testing for ensuring quality control. The student will be able to:
21.01	Explain the uses and limits of testing in ensuring program quality.
21.02	Explain testing performed at different stages of the program development cycle (e.g., unit testing, system testing, user acceptance testing).
21.03	Describe and identify types of programming errors.
21.04	Analyze and manipulate data collected by a variety of data collection techniques.
21.05	Explain what tools are applied to provide automated testing environments.
22.0	Create a program design document using common design tool. The student will be able to:
22.01	Describe different design methodologies and their uses (e.g., object-oriented design, structured design, rapid application development).
22.02	Describe tools for developing a program design (e.g., Unified Modeling Language, flowcharts, design documents, pseudocode).
22.03	Explain the role of existing libraries and packages in facilitating programmer productivity.
22.04	Participate and contribute to a design review of a program design developed using a common program design tool (e.g., UML, flowcharts, design documents, pseudocode).
22.05	Write a program design document using standard design methodology.
22.06	Define input and output for a program module using standard design methodology.

23.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
23.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
23.02	Employ critical thinking and interpersonal skills to resolve conflicts.
23.03	Identify and document workplace performance goals and monitor progress toward those goals.
23.04	Conduct technical research to gather information necessary for decision-making.
23.05	Discuss digital tools or resources to use for a real-world task based on their efficiency and effectiveness, individually and collaboratively.
24.0	Use information technology tools. The student will be able to:
24.01	Use personal information management (PIM) applications to increase workplace efficiency.
24.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
24.03	Employ computer applications to access, create, manage, integrate, and store information.
24.04	Employ collaborative/groupware applications to facilitate group work.
24.05	Use a development process in creating a computational artifact, individually and collaboratively, followed by reflection, analysis, and iteration (e.g., data-set analysis program for science and engineering fair, capstone project that includes a program, term research project based on program data).
25.0	Describe the importance of security and privacy information sharing, ownership, licensure and copyright. The student will be able to:
25.01	Describe security and privacy issues that relate to computer networks including the permanency of data on the Internet, online identity, and privacy.
25.02	Discuss the impact of government regulation on privacy and security.
25.03	Describe how different types of software licenses (e.g., open source, proprietary licenses) can be used to share and protect intellectual property.
25.04	Explain how access to information may not include the right to distribute the information.
25.05	Describe differences between open source, freeware, and proprietary software licenses, and how they apply to different types of software.
25.06	Discuss security and privacy issues that relate to computer networks.
25.07	Identify computer-related laws and analyze their impact on digital privacy, security, intellectual property, network access, contracts, and harassment.
26.0	Design a computer program to meet specific physical, operational, and interaction criteria. The student will be able to:

26.01	Choose appropriate data types depending on the needs of the program.
26.02	Define appropriate user prompts for clarity and usability (e.g., user guidance for data ranges, data types).
26.03	Design and develop program for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
26.04	Compare techniques for analyzing massive data collections.
26.05	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
26.06	Create mobile computing applications and/or dynamic webpages through the use of a variety of design and development tools, programming languages and mobile devices/emulators.
26.07	Explain the role of an application programming interface (API) in the development of applications and the distinction between a programming language's syntax and the API.
26.08	Identify the tools required to develop a program (e.g., editors, compilers, linkers, integrated development environments, APIs, libraries).
26.09	Use an industrial-strength integrated development environment to implement a program.
27.0	Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types. The student will be able to:
27.01	Use appropriate naming conventions to define program variables and methods.
27.02	Use a program editor to write the source code for a program.
27.03	Write programs that use selection structures.
27.04	Write programs that use repetition structures.
27.05	Write programs that use nested structures.
27.06	Use internal documentation (e.g., single-line and multi-line comments, program headers, module descriptions, meaningful variable and function/module names) to document a program according to accepted standards.
27.07	Compile, run, test and debug programs.
27.08	Write programs that use standard arithmetic operators with different numerical data types.
27.09	Write programs that use standard logic operators.
27.10	Write programs that use a variety of common data types.
27.11	Write programs that perform data conversion between standard data types.
27.12	Write programs that define, use, search, and sort arrays.
27.13	Write programs that use user-defined data types.

27.14	Demonstrate understanding and use of appropriate variable scope.
27.15	Explain recursive programming structure.
27.16	Use global and local scope appropriately in program implementation.
28.0	Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input. The student will be able to:
28.01	Critically examine classical algorithms and implement an original algorithm.
28.02	Write programs that perform user input and output.
28.03	Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
28.04	Write program modules such as functions, subroutines, or methods.
28.05	Write program modules that accept arguments.
28.06	Write program modules that return values.
28.07	Write program modules that validate arguments and return error codes.
28.08	Design and implement a simple simulation algorithm to analyze, represent and understand natural phenomena.
28.09	Use APIs and libraries to facilitate programming solutions.
28.10	Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common programming standards.
29.0	Effectively communicate and collaborate. The student will be able to:
29.01	Evaluate modes of communication and collaboration.
29.02	Select appropriate tools within a project environment to communicate with project team members.
29.03	Utilize project collaboration tools (such as version control systems and integrated development environments) while working on a collaborative software project.
29.04	Generate, evaluate, and prioritize questions that can be researched through digital resources and online tool.
29.05	Perform advanced searches to locate information and/or design a data-collection approach to gather original data.
29.06	Communicate and publish key ideas and details to a variety of audiences using digital tools and media-rich resources.
30.0	Demonstrate responsible use of technology and information. The student will be able to:
30.01	Explain the principles of cryptography by examining encryption, digital signatures, and authentication methods (e.g. explain why and how certificates are used with https for authentication and encryption).
30.02	Implement an encryption, digital signature, or authentication method.

30.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

Course Number: CTS0044
Occupational Completion Point: C
Computer Programmer – 150 Hours – SOC Code 15-1131

31.0	Explain key concepts that distinguish object-oriented programming from procedural programming. The student will be able to:
31.01	Demonstrate the understanding and use of classes, objects, attributes, and behaviors.
31.02	Demonstrate the understanding and use of inheritance.
31.03	Demonstrate the understanding and use of data encapsulation.
31.04	Demonstrate the understanding and use of polymorphism.
31.05	Use predefined functions and parameters, classes, and methods to divide a complex problem into simpler parts by using the principle of abstraction to manage complexity (e.g., by using searching and sorting as abstractions).
32.0	Create a project plan for an object-oriented programming project that defines requirements, structural design, time estimates, and testing elements. The student will be able to:
32.01	Write a project plan for completion of a project that includes gathering program requirements, developing the program, and testing it.
32.02	Write a program requirements document that identifies business purpose, functional requirements, system requirements, and other common components of a requirements document.
32.03	Design an object-oriented program using standard design methodology.
32.04	Work with other team members to develop a project plan for a program.
32.05	Work with other team members to write a design document for a program with multiple functions and shared data.
32.06	Participate in design meetings that review program design documents for conformance to program requirements.
32.07	Estimate the time to develop a program or module.
32.08	Evaluate algorithms by their efficiency, correctness, and clarity (e.g., by analyzing and comparing execution times, testing with multiple inputs or data sets, and by debugging).
33.0	Design, document, and create object-oriented computer programs. The student will be able to:
33.01	Compare and contrast recursive functions to iterative methods.
33.02	Understand the implementation of character strings in the programming language.
33.03	Write programs that perform string processing (e.g., manipulating, comparing strings, concatenation).
33.04	Write programs that implements user-defined data types.
33.05	Decompose a problem by defining new functions and classes.

33.06	Write object-oriented programs that implement inheritance.
33.07	Write object-oriented programs that implement polymorphism.
33.08	Develop class constructors.
33.09	Write programs that define and use program constants.
33.10	Write programs that perform error handling.
33.11	Participate in program code review meetings to evaluate program code for validity, quality, performance, data integrity, and conformance to program design documents.
33.12	Describe the concept of parallel processing as a strategy to solve large problems.
33.13	Demonstrate concurrency by separating processes into threads of execution and dividing data into parallel streams.
33.14	Update a program module to implement enhancements or corrections and demonstrate appropriate documentation (internal and external) related to version control.
33.15	Write programs that use complex data structures (e.g., stacks, queues, trees, linked list).
33.16	Write programs that are event-driven.
33.17	Write programs that perform file input and output (i.e., sequential and random access file input/output).
33.18	Explain intractable problems and understand that problems exist that are computationally unsolvable (undecidable) (e.g., classic intractable problems include Towers of Hanoi, TSP).
33.19	Explain the value of heuristic algorithms to approximate solutions for intractable problems (e.g., a heuristic solution to TSP).
34.0	Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results. The student will be able to:
34.01	Develop a test plan for an object-oriented program.
34.02	Write test plans for event-driven programs.
34.03	Write test plans for programs that perform file input and output.
34.04	Perform test and debug activities on object-oriented programs, including those written by someone else.
34.05	Perform test and debug activities on an event-driven program.
34.06	Perform test and debug activities on programs that perform file input and output and verify the correctness of output files.
34.07	Document the findings of testing in a test report.
35.0	Understand human interactions in intelligence. The student will be able to:
35.01	Describe the unique features of computers embedded in mobile devices and vehicles.

35.02	Describe the common physical and cognitive challenges faced by users when learning to use software and hardware.
35.03	Describe the process of designing software to support specialized forms of human-computer interaction.
35.04	Explain the notion of intelligent behavior through computer modeling and robotics.
35.05	Describe common measurements of machine intelligence (e.g., Turing test).
35.06	Describe a few of the major branches of artificial intelligence (e.g., expert systems, natural language processing, machine perception, machine learning).
35.07	Describe major applications of artificial intelligence and robotics, including, but not limited to, the medical, space, and automotive fields.

Course Number: CTS0031
Occupational Completion Point: D
Java Developer – 600 Hours – SOC Code 15-1131

36.0 Construct statements that declare, initialize, and modify different types of variables used in Java programs. The student will be able to:

36.01 Describe how variables are used in programs.

36.02 Identify the eight Java primitive data types.

36.03 Identify the minimum and maximum ranges of primitive data types.

36.04 Identify which data type should be used for a given situation.

36.05 Identify the syntax for using variables.

36.06 Declare and initialize variables.

36.07 Assign new values to variables.

36.08 Create and use constant variables.

37.0 Describe the types and characteristics of lexical units in the Java programming language. The student will be able to:

37.01 Describe the types of lexical units.

37.02 Describe identifiers and identify valid and invalid identifiers.

37.03 Describe and identify reserved words, delimiters, literals, and comments.

38.0 Describe the data types employed in Java programs. The student will be able to:

38.01 Describe the data type categories.

38.02 Give examples of primitives, reference data types.

38.03 Identify and use enumerations.

38.04 Understand the use of Wrapper Classes in programs.

38.05 Describe the difference between real and integer data types.

39.0 Construct Java statements that employ the use of various operators. The student will be able to:

39.01 Construct statements using arithmetic operators.

39.02 Construct statements using relational operators.

39.03 Construct and use statements using logical operators.

39.04	Construct and use statements using assignment operators.
39.05	Construct and execute statements using operator precedence.
40.0	Write executable statements using Java. The student will be able to:
40.01	Construct variable assignment statements.
40.02	Construct statements using built-in math functions.
40.03	Differentiate between implicit and explicit data type conversions.
40.04	Describe when implicit data type conversions take place.
40.05	List the drawbacks of implicit data type conversions.
40.06	Describe the process of autoboxing and promotion.
40.07	Construct statements using functions to explicitly convert data types.
41.0	Describe variable scope and its implications in Java programming. The student will be able to:
41.01	Understand the scope and visibility of variables.
41.02	Write programs using local variables.
41.03	Describe the scope of a variable.
41.04	Describe the default value of local, instance, and static scope of variables.
41.05	Describe how compiler uses scope to identify variables with the same name.
42.0	Apply common Java programming style guidelines and conventions. The student will be able to:
42.01	List examples of good programming practices.
42.02	Insert comments into code.
42.03	Follow formatting guidelines when writing code.
42.04	Understand the different types of errors produced by programs.
43.0	Demonstrate use of the compiler and interpreter through command line interface. The student will be able to:
43.01	Describe the use of the Java compiler (javac) and Java interpreter (Java VM).
43.02	Demonstrate the use of the -classpath flag and -d flag to the compiler.
43.03	Identify the environmental variables of PATH and CLASSPATH.
43.04	Describe the process of command line arguments to the program.

43.05	Create programs that take in multiple command line arguments.
44.0	Construct conditional control statements in Java. The student will be able to:
44.01	Construct and use an if statement.
44.02	Construct and use a switch statement.
44.03	Construct and use a while, do while, and for loop.
44.04	Construct and use a conditional operator.
45.0	Construct iterative control statements in Java. The student will be able to:
45.01	Describe the types of loop statements and their uses.
45.02	Construct and use the while and do while loop.
45.03	Construct and use the for loop.
45.04	Construct and use the enhanced for loop.
45.05	Describe when a while loop is used.
45.06	Describe when a for loop is used.
46.0	Use nested loop iterative control statements in Java. The student will be able to:
46.01	Construct and execute a program using nested loops.
46.02	Construct and execute a loop using break and continue.
46.03	Evaluate a nested loop construct and sentinel value.
47.0	Produce input and output for Java programs. The student will be able to:
47.01	Describe and use classes (e.g., Scanner, System) to input data into programs.
47.02	Demonstrate the use of different ways to input data into programs using Scanner or System class.
47.03	Describe and demonstrate the use of the System class to produce output to the console.
47.04	Explain the difference between print and println functions in the System class.
47.05	Create and use escape sequences.
48.0	Use packages and import statements in a Java program. The student will be able to:
48.01	Describe the use of import statements.
48.02	Describe the use of packages.

48.03	Create code that uses package statements to avoid class conflict.
48.04	Create packages that abide by standard Java naming convention.
48.05	Demonstrate the use of Java-API to search for classes and packages.
49.0	Create a Java program that uses methods. The student will be able to:
49.01	Differentiate between anonymous blocks and methods.
49.02	Identify the benefits of using methods.
49.03	Describe a method signature.
49.04	Create a method.
49.05	Describe how a method is invoked.
49.06	Describe the purpose of overloading methods.
49.07	Create overloaded methods in programs.
50.0	Create a Java program that uses parameters in methods. The student will be able to:
50.01	Describe how parameters are passed into functions.
50.02	Define a parameter.
50.03	Create a method using a parameter.
50.04	Invoke a method that has parameters.
50.05	Distinguish between formal and actual parameters.
50.06	Demonstrate the use of reference parameters in methods.
51.0	Describe and use recursion in a Java program. The student will be able to:
51.01	Describe the use of recursion in solving problems.
51.02	Describe the difference of iterative and recursive methods.
51.03	Demonstrate the use of direct recursion.
51.04	Demonstrate the use of indirect recursion.
52.0	Construct Java statements that use the String class to manipulate String data. The student will be able to:
52.01	Explain the use of the String class.

52.02	Create code to concatenate strings using the concatenation operator.
52.03	Demonstrate how to search a string using indexOf method of the String class.
52.04	Explain the effect of immutability of Strings.
52.05	Create Strings using string literals, and through new keyword.
52.06	Demonstrate the use of the following string manipulation methods of the String class: charAt,length, trim, substring, replace, startsWidth and endsWith.
53.0	Construct Java statements that use Classes. The student will be able to:
53.01	Describe and identify abstract data types.
53.02	Describe the difference between an object and a class.
53.03	Identify class attributes.
53.04	Create instance variables for a class.
53.05	Use visibility modifiers for attributes.
53.06	Identify constructors and describe their use.
53.07	Describe encapsulation.
53.08	Write class using encapsulation.
53.09	Apply data abstraction through the use of accessor or and mutator methods.
53.10	Describe the equals method.
53.11	Demonstrate the use of classes in methods as both parameters and return types.
53.12	Describe the garbage collection process.
53.13	Demonstrate reusability and extensibility in class creation.
53.14	Demonstrate the use of Comparable interface to compare objects.
54.0	Manage class relationships. The student will be able to:
54.01	Explain the association relationship among classes.
54.02	Explain the direct association relationship among classes.
54.03	Explain the composition and aggregation relationship among classes.
54.04	Explain the direct association relationship among classes.

54.05	Write programs that use composition, association.
54.06	Write programs that use direct association.
55.0	Construct Java statements that illustrate the use of multiplicities in class relationships. The student will be able to:
55.01	Describe how multiplicities affect class relationships.
55.02	Describe one-to one, one-to-many, and many-to-many relationships.
55.03	Write programs that use multiplicities in class relationships.
56.0	Use object references. The student will be able to:
56.01	Identify reference aliases.
56.02	Understand and use null reference.
56.03	Explain the this reference and its use in class creation.
57.0	Describe the types of arrays and construct Java statements that illustrate the use and manipulation of multi-dimensional and jagged arrays. The student will be able to:
57.01	Declare and initialize an array.
57.02	Demonstrate the use of initializer lists.
57.03	Demonstrate the use of arrays in methods.
57.04	Demonstrate the updating, populating and destroying arrays.
57.05	Explain linear and binary searching.
57.06	Sort arrays using selection sort, insertion sort, and bubble sort.
57.07	Demonstrate the use of multidimensional arrays.
57.08	Demonstrate the use of jagged arrays.
57.09	Demonstrate basic hashing using arrays.
58.0	Construct Java statements that illustrate different ways of using inheritance. The student will be able to:
58.01	Explain the purpose and use of inheritance in object oriented programming.
58.02	Explain the difference between single and multiple inheritance.
58.03	Create parent and child classes.
58.04	Create overloaded methods.

58.05	Describe the has-a and is-a relationship.
58.06	Create class hierarchies.
58.07	Explain the process of generalization to specification.
58.08	Demonstrate the use of abstract classes.
58.09	Explain polymorphism.
58.10	Create a program that uses polymorphism.
58.11	Demonstrate the use of the instanceof method.
59.0	Construct Java statements that use collections. The student will be able to:
59.01	Describe data structure of linked lists.
59.02	Create a linked list manually.
59.03	Use the ArrayList class.
59.04	Create a stack and Queue manually.
59.05	Use the Stack and Queue standard class.
59.06	Identify which data structure is best fitted for a situation.
59.07	Use iterators with collections.
59.08	Identify how to insert, delete, update, and traverse data structures.
60.0	Write Java code that uses the Iterator and List interfaces. The student will be able to:
60.01	Describe the purpose of interfaces.
60.02	Create and use interfaces in programs.
60.03	Use the Comparable interface.
60.04	Use the Iterator interface and List Interface in programs.
60.05	Understand the program to the interface principle.
61.0	Create Java code that includes exception handling code. The student will be able to:
61.01	Describe the advantages of including exception handling code.

61.02	Describe the purpose of an EXCEPTION section in a program block.
61.03	Create code to include an EXCEPTION section.
61.04	List the guidelines for exception handling.
62.0	Create Java code that uses the Object class. The student will be able to:
62.01	Understand the Object class relationship to other classes.
62.02	Demonstrate the use of toString method.
62.03	Demonstrate the use of clone and finalize methods.
62.04	Write program to use Object class functionality.
63.0	Use standard library classes that comprise the Java API. The student will be able to:
63.01	Describe the classes and methods in the basic input/output package.
63.02	Describe the classes and methods in the utilities package.
63.03	Describe the classes and methods in the utilities package.
63.04	Describe the classes and methods in the networking package.
63.05	Describe the classes and methods in the AWT and swing package.
63.06	Describe the classes and methods in the SQL and SQLX package.
64.0	Create Java code that uses exceptions to improve program quality. The student will be able to:
64.01	Explain how exception handling works in Java.
64.02	Trap exceptions using try and catch.
64.03	Explain when to use the finally clause.
64.04	Demonstrate handling exceptions through throwing and catching.
64.05	Create and Exception and manage the exception.
64.06	Explain the use of inheritance and exceptions.
65.0	Describe Java 2 Micro Edition (J2ME) uses, characteristics, and constraints. The student will be able to:

65.01	Understand midlets.
65.02	Explain CLDC and profiles.
65.03	Explain the constraints specific to J2ME programming when compared to J2SE.
65.04	Understand the high architectural goal of J2ME.
65.05	Create user-defined functions.
66.0	Create and convert classes using Unified Modeling Language (UML). The student will be able to:
66.01	Identify UML elements Classes, abstract Classes, Interfaces.
66.02	Identify UML attributes, operators, visibility modifiers and UML associations.
66.03	Given a set of classes be able to convert the classes to a UML diagram.
66.04	Given a UML diagram be able to create classes.
67.0	Create programs that use of Remote Method Invocation (RMI) and other server technologies associated with Relational Database Management Systems (RDMS) and Structured Query Language (SQL). The student will be able to:
67.01	Understand and describe RMI.
67.02	Write a program to use RMI.
67.03	Understand RDMS and SQL technologies.
67.04	Use the Java Database Connectivity API to connect and execute SQL statements to RDMS.
68.0	Demonstrate an understanding of Java Integration APIs, including Java Message Service (JMS), Enterprise JavaBeans (EJB), and Java Naming and Directory Interface (JNDI). The student will be able to:
68.01	Understand and describe JMS.
68.02	Understand and describe EJB technology.
68.03	Understand and describe JNDI technology.
69.0	Demonstrate an understanding of Java Client APIs, including the Abstract Window Toolkit (AWT), Swing, and Java applet. The student will be able to:
69.01	Understand and describe AWT and GUI interface.
69.02	Understand and describe the use of Swing components and GUI.
69.03	Understand and describe the use of applet technology.

70.0	Understand and apply Java 2 Enterprise Edition (J2EE) Server Solutions. The student will be able to:
70.01	Understand java Web Services.
70.02	Underrated and use SMTP and Java Mail technologies.
70.03	Understand how to use JSP and Servlets.
71.0	Create a database application using the Java programming language. The student will be able to:
71.01	Utilize loop statements.
71.02	Given a scenario, use arithmetic, comparison, and pattern-matching operators.
71.03	Create user-defined functions.
71.04	Utilize common built-in functions.
71.05	Declare variables in modules and procedures.
71.06	Declare arrays, and initialize elements of arrays.
71.07	Declare and use object variables and collections, and use their associated properties and methods.
71.08	Declare symbolic constants, and make them available locally or publicly.
71.09	Respond to events.
72.0	Create a graphical user interface application using the Java programming language. The student will be able to:
72.01	Utilize loop statements.
72.02	Given a scenario, use arithmetic, comparison, and pattern-matching operators.
72.03	Create user-defined functions.
72.04	Utilize common built-in functions.
72.05	Declare variables in modules and procedures.
72.06	Declare arrays, and initialize elements of arrays.
72.07	Declare and use object variables and collections, and use their associated properties and methods.
72.08	Declare symbolic constants, and make them available locally or publicly.
72.09	Use the Java Event model to handle user inputs from events.

72.10	Use JComponents and layout managers to create the GUI.
73.0	Create a web-based application using the Java programming language. The student will be able to:
73.01	Utilize loop statements.
73.02	Given a scenario, use arithmetic, comparison, and pattern-matching operators.
73.03	Create user-defined functions.
73.04	Utilize common built-in functions.
73.05	Declare variables in modules and procedures.
73.06	Declare arrays, and initialize elements of arrays.
73.07	Declare and use object variables and collections, and use their associated properties and methods.
73.08	Declare symbolic constants, and make them available locally or publicly.
73.09	Write JSP pages to process user input.
73.10	Write Servlets to provide input and output processing for the web solution.
74.0	Write code to perform common and union database queries using SQL and Java. The student will be able to:
74.01	Utilize SQL to write common queries.
74.02	Refer to objects by using SQL.
74.03	Utilize union queries.
75.0	Implement Java program statements using objects. The student will be able to:
75.01	Determine when to use data access objects.
75.02	Differentiate between objects and collections.
75.03	Write statements that access and modify database objects, EJB objects.
75.04	Select appropriate methods and property settings for use with specified objects.
76.0	Utilize debugging tools and write error handlers. The student will be able to:
76.01	Trap errors.
76.02	Utilize debugging tools to suspend program execution, and to examine, step through, and reset execution of code.

76.03	Debug code samples.
76.04	Utilize the Debugger to monitor variable values.
76.05	Write an error handler.
77.0	Demonstrate file input/output (I/O). The student will be able to:
77.01	Read from sequential and random access files.
77.02	Write to sequential and random access files.
77.03	Use file serialization.
78.0	Utilize API functions. The student will be able to:
78.01	Properly declare functions.
78.02	Use the by value and by reference parameters.
79.0	Test and debug databases. The student will be able to:
79.01	Implement error handling.
79.02	Test and debug library databases.
80.0	Successfully work as a member of a software development team. The student will be able to:
80.01	Accept responsibility for specific tasks in a given situation.
80.02	Document progress, and provide feedback on work accomplished in a timely manner.
80.03	Complete assigned tasks in a timely and professional manner.
80.04	Reassign responsibilities when the need arises.
80.05	Complete daily tasks as assigned on one's own initiative.
81.0	Manage time according to a plan. The student will be able to:
81.01	Set realistic time frames and schedules.
81.02	Keep a written time sheet of work accomplished on a daily basis.
81.03	Meet goals and objectives set by the team.
81.04	Identify individual priorities.
81.05	Complete a weekly evaluation of accomplishments, and reevaluate goals, objectives and priorities as needed.

82.0	Keep acceptable records of progress problems and solutions. The student will be able to:
82.01	Develop a record keeping system in the form of a log book to record daily progress.
82.02	Use a project journal to identify problem statement.
82.03	Develop a portfolio of work accomplished to include design drawings, flowcharts, drawings and plans, and prototypes.
83.0	Plan, organize, and carry out a project plan. The student will be able to:
83.01	Determine the scope of a project.
83.02	Organize the team according to individual strengths.
83.03	Assign specific tasks within a team.
83.04	Determine project priorities.
83.05	Identify required resources.
83.06	Plan research, design, development, and evaluation activities as required.
83.07	Carry out the project plan to successful completion.
84.0	Manage resources. The student will be able to:
84.01	Identify required resources for each stage of the project plan.
84.02	Determine the methods needed to acquire needed resources.
84.03	Demonstrate good judgment in the use of resources.
84.04	Recycle and reuse resources where appropriate.
84.05	Demonstrate an understanding of proper legal and ethical treatment of copyrighted material.
85.0	Use tools, materials, and processes in an appropriate and safe manner. The student will be able to:
85.01	Identify the proper tool for a given job.
85.02	Use tools and machines in a safe manner.
85.03	Adhere to laboratory or job site safety rules and procedures.
85.04	Identify the application of processes appropriate to the task at hand.
85.05	Identify materials appropriate to their application.

86.0	Demonstrate an understanding of the software development process. The student will be able to:
86.01	State the goals of the software application clearly.
86.02	Identify and write a plan to achieve each goal.
86.03	Develop a list of materials and content required for each goal.
86.04	Develop a step by step procedure for developing the application.
86.05	Follow a written procedure.
86.06	Record data from evaluation activities.
86.07	Document conclusions and solutions based on evaluation results, observations and data.
86.08	Document progress using a project log.
86.09	Write an abstract describing the project plan.
87.0	Research content related to the project and document the results following industry conventions. The student will be able to:
87.01	Identify the basic research needed to develop the project plan.
87.02	Identify available resources for completing background research required in the project plan.
87.03	Demonstrate the ability to locate resource materials in a library, data base, internet and other research resources.
87.04	Demonstrate the ability to organize information retrieval.
87.05	Demonstrate the ability to prepare a topic outline.
87.06	Write a draft of the research report.
87.07	Edit and proof the research report. Use proper form for a bibliography, footnotes, quotations, and references.
87.08	Prepare an electronically composed research paper in proper form.
87.09	Conduct an alpha and beta evaluation of the project's product.
87.10	Write a report on the evaluations, documenting results, data, observations, and design changes based on the results.
88.0	Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience. The student will be able to:
88.01	Prepare a multi-media presentation on the completed project.
88.02	Make an oral presentation, using multi-media materials.

88.03	Review the presentation, and make changes in the delivery method(s) to improve presentation skills.
89.0	Demonstrate competency in the area of expertise related to developing computer software using the Java programming language. The student will be able to:
89.01	Demonstrate a mastery of the content of the selected subject area.
89.02	Demonstrate the ability to use related technological tools, materials and processes related to the specific program area.
89.03	Demonstrate the ability to apply the knowledge, experience and skill developed in the previous program completion to the successful completion of this demonstration.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Database Application Development & Programming
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y700300
CIP Number	0511020315
Grade Level	30, 31
Standard Length	1200 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA SkillsUSA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of programming and software development; procedural and object-oriented programming; creating regular and specialized applications using standard and extended Structured Query Language (SQL), including testing, monitoring, debugging, documenting, and maintaining database applications.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0041	Computer Programmer Assistant	BUS ED 1 @2 COMPU SCI 6 COMP PROG 7G	300 hours	15-1131
C	CTS0044	Computer Programmer		150 hours	15-1131
D	CTS0062	Database Programmer		600 hours	15-1131

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 16.0 Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development.
- 17.0 Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types.
- 18.0 Distinguish between iterative and non-iterative program control structures.
- 19.0 Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages.
- 20.0 Describe the processes, methods, and conventions for software development and maintenance.
- 21.0 Explain the types, uses, and limitations of testing for ensuring quality control.
- 22.0 Create a program design document using Unified Modeling Language (UML) or other common design tool.
- 23.0 Solve problems using critical thinking skills, creativity and innovation.
- 24.0 Use information technology tools.
- 25.0 Describe the importance of security and privacy information sharing, ownership, licensure and copyright.
- 26.0 Design a computer program to meet specific physical, operational, and interaction criteria.
- 27.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
- 28.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
- 29.0 Effectively communicate and collaborate.
- 30.0 Demonstrate responsible use of technology and information.
- 31.0 Explain key concepts that distinguish object-oriented programming from procedural programming.

- 32.0 Create a project plan that defines requirements, structural design, time estimates, and testing elements.
- 33.0 Design, document, and create object-oriented computer programs.
- 34.0 Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results.
- 35.0 Understand human interactions in intelligence.
- 36.0 Develop an awareness of the changes taking place in the information age and how they fit into an evolving society.
- 37.0 Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs.
- 38.0 Develop the process of creating an entity by identifying relationships.
- 39.0 Formulate and assemble initial entity relationship by expanding on modeling concepts.
- 40.0 Consider the degree and optionality of relationships of entities.
- 41.0 Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams.
- 42.0 Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships.
- 43.0 Demonstrate proficiency in designing and adding complexity to an entity-relationship model (ERM).
- 44.0 Apply complex ERM information by fine-tuning entities and the process for relating them.
- 45.0 Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved.
- 46.0 Demonstrate proficiency in the technique of normalization by labeling and organizing all items in a database in such a way as to prevent any confusion or mistakes.
- 47.0 Demonstrate proficiency in table normalization by combining the techniques of an entity relationship model or a top-down, business approach to data with normalization or a bottom-up mathematical approach to data.
- 48.0 Apply blueprint principles to begin designing a tool for creating a web-based interface access to a database.
- 49.0 Extend the logical model presentation model by normalizing the data and mapping the management system.
- 50.0 Apply techniques for building a storage management system by creating a website using templates and wizards.
- 51.0 Demonstrate design and functionality by constructing a group business presentation.
- 52.0 Demonstrate comprehension of database modeling competency through group presentation.
- 53.0 Demonstrate comprehension that the database management software is a system for organizing the storage unit (or database) according to business needs and rules, through data integrity constraints.
- 54.0 Demonstrate comprehension of aspects of SQL language interface by writing basic SQL statements.
- 55.0 Demonstrate proficiency working with columns, characters, and rows in SQL.
- 56.0 Demonstrate proficiency in using SQL comparison operators.
- 57.0 Demonstrate proficiency in using logical comparisons and precedence rules.
- 58.0 Demonstrate proficiency using SQL single row functions.
- 59.0 Demonstrate proficiency displaying data from multiple tables.
- 60.0 Demonstrate proficiency aggregating data using group functions.
- 61.0 Demonstrate proficiency utilizing subqueries.
- 62.0 Demonstrate proficiency producing readable output with SQL language interface, reporting tool, and data manipulation language.
- 63.0 Demonstrate proficiency creating and managing database objects.
- 64.0 Demonstrate proficiency altering tables and constraints implementing views.
- 65.0 Demonstrate mastery of creating and implementing views, synonyms, indexes and other database objects.
- 66.0 Demonstrate ability to control user access and SQL language interface and reporting tool.
- 67.0 Demonstrate comprehension of bundling features of SQL.
- 68.0 Demonstrate comprehension working with composite data types by writing executable script files.
- 69.0 Describe the differences between SQL and SQL extension languages.

- 70.0 Create program blocks.
- 71.0 Use variables in program blocks.
- 72.0 Recognize lexical units.
- 73.0 Recognize data types.
- 74.0 Use scalar data types.
- 75.0 Use various types of joins.
- 76.0 Use SQL group functions and subqueries.
- 77.0 Write executable statements.
- 78.0 Use nested blocks and variable scope.
- 79.0 Use good programming practices.
- 80.0 Write DML statements to manipulate data.
- 81.0 Retrieve data.
- 82.0 Manipulate data.
- 83.0 Use transaction control statements
- 84.0 Use IF conditional control statements.
- 85.0 Use CASE conditional control statements.
- 86.0 Use basic LOOP iterative control statements.
- 87.0 Use WHILE and FOR loop iterative control statements.
- 88.0 Use nested loop iterative control statements.
- 89.0 Use explicit cursors.
- 90.0 Use explicit cursor attributes.
- 91.0 Use cursor FOR loops.
- 92.0 Use cursors with parameters.
- 93.0 Use cursors for update transactions.
- 94.0 Use multiple cursors.
- 95.0 Handle exceptions.
- 96.0 Trap server exceptions.
- 97.0 Trap user-defined exceptions.
- 98.0 Create procedures.
- 99.0 Use parameters in procedures.
- 100.0 Pass parameters.
- 101.0 Create stored functions.
- 102.0 Use functions in SQL statements.
- 103.0 Manage procedures and functions.
- 104.0 Manage object privileges.
- 105.0 Use invoker's rights.
- 106.0 Create packages.
- 107.0 Manage package constructs.
- 108.0 Use advanced package concepts.
- 109.0 Manage persistent state of package variables.
- 110.0 Use vendor-supplied packages.
- 111.0 Understand dynamic SQL.

- 112.0 Understand triggers.
- 113.0 Create DML triggers.
- 114.0 Create DDL and database event triggers.
- 115.0 Manage triggers.
- 116.0 Use large object data types.
- 117.0 Manage binary types.
- 118.0 Manage indexes.
- 119.0 Manage dependencies.
- 120.0 Demonstrate an understanding of Agile Development.
- 121.0 Program a database application.
- 122.0 Utilize the basic concepts of database design.
- 123.0 Utilize SQL and union queries.
- 124.0 Implement program statements using objects.
- 125.0 Utilize debugging tools and write error handlers.
- 126.0 Demonstrate file I/O.
- 127.0 Create forms and identify all the properties of a form.
- 128.0 Manipulate data using object models.
- 129.0 Develop custom controls.
- 130.0 Utilize API functions.
- 131.0 Demonstrate and implement database replication using programming tools.
- 132.0 Analyze and implement security options.
- 133.0 Implement client/server applications.
- 134.0 Optimize the performance of a database.
- 135.0 Perform application distribution.
- 136.0 Test and debug databases.
- 137.0 Describe the difference between relational and NoSQL databases.
- 138.0 Demonstrate an understanding of Data Science and the concept of Data mining.

Florida Department of Education
Student Performance Standards

Program Title: Database Application Development & Programming
Career Certificate Program Number: Y700300

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: CTS0041
Occupational Completion Point: B
Computer Programmer Assistant – 300 Hours – SOC Code 15-1131

15.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
15.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
15.02	Locate, organize and reference written information from various sources.
15.03	Construct writings and/or communications using developmentally appropriate terminology.
15.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
15.05	Analyze the positive and negative impacts of technology on popular culture and personal life.
15.06	Discuss how technology has changed the way people build and manage organizations and how technology impacts personal life.
15.07	Evaluate ways in which adaptive technologies may assist users with special needs.
15.08	Explain how societal and economic factors are affected by access to critical information.
15.09	Discuss the challenges (e.g., political, social, and economic) in providing equal access and distribution of technology in a global society.
16.0	Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development. The student will be able to:
16.01	Explore a variety of careers to which computing is central.
16.02	Compare and contrast appropriate and inappropriate social networking behaviors.
16.03	Discuss the impact of computing on business and commerce (e.g., automated inventory processing, financial transactions, e-commerce, virtualization, cloud computing).
16.04	Evaluate the impacts of irresponsible use of information (e.g., plagiarism, falsification of data) on collaborative projects.
16.05	Identify tasks performed by programmers.
16.06	Describe how businesses use computer programming to solve business problems.
16.07	Investigate job opportunities in the programming field.
16.08	Explain different specializations and the related training in the computer programming field.
16.09	Explain the need for continuing education and training of computer programmers.
16.10	Understand and identify ways to use technology to support lifelong learning.
16.11	Explain enterprise software systems and how they impact business.

16.12	Describe ethical responsibilities of computer programmers.
16.13	Describe the role of customer support to software program quality.
16.14	Identify credentials and certifications that may improve employability for a computer programmer.
16.15	Identify devices, tools, and other environments for which programmers may develop software.
17.0	Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types. The student will be able to:
17.01	Identify the characteristics (e.g., size, limits) and uses of different numerical and non-numerical data types.
17.02	Explain the types and uses of variables in programs.
17.03	Determine the best data type to use for given programming problems.
17.04	Compare and contrast simple data structures and their uses.
17.05	Identify the types of operations that can be performed on different data types.
17.06	Evaluate arithmetic and logical expressions using appropriate operator precedence.
17.07	Explain how computers store different data types in memory.
17.08	Demonstrate the difference between "data" and "information".
17.09	Use different number systems to represent data.
17.10	Explain how national and international standards (i.e., ASCII, UNICODE) are used to represent non-numerical data.
17.11	Use Boolean logic to perform logical operations.
18.0	Distinguish between iterative and non-iterative program control structures. The student will be able to:
18.01	Create non-iterative programming structures and explain their uses.
18.02	Create iterative programming structures and explain their uses.
18.03	Explain how sequence, selection, and iteration are building blocks of algorithms.
19.0	Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages. The student will be able to:
19.01	Differentiate between multiple levels of an operating system, translation, and interpretation that support program execution.
19.02	Explain the program execution process (by an interpreter and in CPU hardware).
19.03	Describe object-oriented concepts.

19.04	Explain the characteristics of procedural and object-oriented programming languages.
19.05	Compare and contrast programming languages that are compiled, interpreted, and translated.
19.06	Classify programming languages by paradigm and application domain (e.g., imperative, functional, logic languages and how well suited they are for certain application domains such as web programming, symbolic processing, data/numerical processing).
20.0	Describe the processes, methods, and conventions for software development and maintenance. The student will be able to:
20.01	Describe a software development process that is used to solve problems at different software development stages.
20.02	Describe and demonstrate ethical and responsible use of modern communication media and devices.
20.03	Define alternative methods of program development (e.g., rapid prototyping, waterfall, spiral model, peer coding).
20.04	List and explain the steps in the program development cycle.
20.05	Describe different types of documentation used in the program development cycle (e.g., requirements document, program design documents, test plans).
20.06	Describe different methods used to facilitate version control.
21.0	Explain the types, uses, and limitations of testing for ensuring quality control. The student will be able to:
21.01	Explain the uses and limits of testing in ensuring program quality.
21.02	Explain testing performed at different stages of the program development cycle (e.g., unit testing, system testing, user acceptance testing).
21.03	Describe and identify types of programming errors.
21.04	Analyze and manipulate data collected by a variety of data collection techniques.
21.05	Explain what tools are applied to provide automated testing environments.
22.0	Create a program design document using common design tool. The student will be able to:
22.01	Describe different design methodologies and their uses (e.g., object-oriented design, structured design, rapid application development).
22.02	Describe tools for developing a program design (e.g., Unified Modeling Language, flowcharts, design documents, pseudocode).
22.03	Explain the role of existing libraries and packages in facilitating programmer productivity.
22.04	Participate and contribute to a design review of a program design developed using a common program design tool (e.g., UML, flowcharts, design documents, pseudocode).
22.05	Write a program design document using standard design methodology.
22.06	Define input and output for a program module using standard design methodology.

23.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
23.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
23.02	Employ critical thinking and interpersonal skills to resolve conflicts.
23.03	Identify and document workplace performance goals and monitor progress toward those goals.
23.04	Conduct technical research to gather information necessary for decision-making.
23.05	Discuss digital tools or resources to use for a real-world task based on their efficiency and effectiveness, individually and collaboratively.
24.0	Use information technology tools. The student will be able to:
24.01	Use personal information management (PIM) applications to increase workplace efficiency.
24.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
24.03	Employ computer applications to access, create, manage, integrate, and store information.
24.04	Employ collaborative/groupware applications to facilitate group work.
24.05	Use a development process in creating a computational artifact, individually and collaboratively, followed by reflection, analysis, and iteration (e.g., data-set analysis program for science and engineering fair, capstone project that includes a program, term research project based on program data).
25.0	Describe the importance of security and privacy information sharing, ownership, licensure and copyright. The student will be able to:
25.01	Describe security and privacy issues that relate to computer networks including the permanency of data on the Internet, online identity, and privacy.
25.02	Discuss the impact of government regulation on privacy and security.
25.03	Describe how different types of software licenses (e.g., open source, proprietary licenses) can be used to share and protect intellectual property.
25.04	Explain how access to information may not include the right to distribute the information.
25.05	Describe differences between open source, freeware, and proprietary software licenses, and how they apply to different types of software.
25.06	Discuss security and privacy issues that relate to computer networks.
25.07	Identify computer-related laws and analyze their impact on digital privacy, security, intellectual property, network access, contracts, and harassment.
26.0	Design a computer program to meet specific physical, operational, and interaction criteria. The student will be able to:

26.01	Choose appropriate data types depending on the needs of the program.
26.02	Define appropriate user prompts for clarity and usability (e.g., user guidance for data ranges, data types).
26.03	Design and develop program for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
26.04	Compare techniques for analyzing massive data collections.
26.05	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
26.06	Create mobile computing applications and/or dynamic webpages through the use of a variety of design and development tools, programming languages and mobile devices/emulators.
26.07	Explain the role of an application programming interface (API) in the development of applications and the distinction between a programming language's syntax and the API.
26.08	Identify the tools required to develop a program (e.g., editors, compilers, linkers, integrated development environments, APIs, libraries).
26.09	Use an industrial-strength integrated development environment to implement a program.
27.0	Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types. The student will be able to:
27.01	Use appropriate naming conventions to define program variables and methods.
27.02	Use a program editor to write the source code for a program.
27.03	Write programs that use selection structures.
27.04	Write programs that use repetition structures.
27.05	Write programs that use nested structures.
27.06	Use internal documentation (e.g., single-line and multi-line comments, program headers, module descriptions, meaningful variable and function/module names) to document a program according to accepted standards.
27.07	Compile, run, test and debug programs.
27.08	Write programs that use standard arithmetic operators with different numerical data types.
27.09	Write programs that use standard logic operators.
27.10	Write programs that use a variety of common data types.
27.11	Write programs that perform data conversion between standard data types.
27.12	Write programs that define, use, search, and sort arrays.
27.13	Write programs that use user-defined data types.

27.14	Demonstrate understanding and use of appropriate variable scope.
27.15	Explain recursive programming structure.
27.16	Use global and local scope appropriately in program implementation.
28.0	Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input. The student will be able to:
28.01	Critically examine classical algorithms and implement an original algorithm.
28.02	Write programs that perform user input and output.
28.03	Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
28.04	Write program modules such as functions, subroutines, or methods.
28.05	Write program modules that accept arguments.
28.06	Write program modules that return values.
28.07	Write program modules that validate arguments and return error codes.
28.08	Design and implement a simple simulation algorithm to analyze, represent and understand natural phenomena.
28.09	Use APIs and libraries to facilitate programming solutions.
28.10	Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common programming standards.
29.0	Effectively communicate and collaborate. The student will be able to:
29.01	Evaluate modes of communication and collaboration.
29.02	Select appropriate tools within a project environment to communicate with project team members.
29.03	Utilize project collaboration tools (such as version control systems and integrated development environments) while working on a collaborative software project.
29.04	Generate, evaluate, and prioritize questions that can be researched through digital resources and online tool.
29.05	Perform advanced searches to locate information and/or design a data-collection approach to gather original data.
29.06	Communicate and publish key ideas and details to a variety of audiences using digital tools and media-rich resources.
30.0	Demonstrate responsible use of technology and information. The student will be able to:
30.01	Explain the principles of cryptography by examining encryption, digital signatures, and authentication methods (e.g. explain why and how certificates are used with https for authentication and encryption).
30.02	Implement an encryption, digital signature, or authentication method.

30.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

Course Number: CTS0044
Occupational Completion Point: C
Computer Programmer – 150 Hours – SOC Code 15-1131

31.0	Explain key concepts that distinguish object-oriented programming from procedural programming. The student will be able to:
31.01	Demonstrate the understanding and use of classes, objects, attributes, and behaviors.
31.02	Demonstrate the understanding and use of inheritance.
31.03	Demonstrate the understanding and use of data encapsulation.
31.04	Demonstrate the understanding and use of polymorphism.
31.05	Use predefined functions and parameters, classes, and methods to divide a complex problem into simpler parts by using the principle of abstraction to manage complexity (e.g., by using searching and sorting as abstractions).
32.0	Create a project plan for an object-oriented programming project that defines requirements, structural design, time estimates, and testing elements. The student will be able to:
32.01	Write a project plan for completion of a project that includes gathering program requirements, developing the program, and testing it.
32.02	Write a program requirements document that identifies business purpose, functional requirements, system requirements, and other common components of a requirements document.
32.03	Design an object-oriented program using standard design methodology.
32.04	Work with other team members to develop a project plan for a program.
32.05	Work with other team members to write a design document for a program with multiple functions and shared data.
32.06	Participate in design meetings that review program design documents for conformance to program requirements.
32.07	Estimate the time to develop a program or module.
32.08	Evaluate algorithms by their efficiency, correctness, and clarity (e.g., by analyzing and comparing execution times, testing with multiple inputs or data sets, and by debugging).
33.0	Design, document, and create object-oriented computer programs. The student will be able to:
33.01	Compare and contrast recursive functions to iterative methods.
33.02	Understand the implementation of character strings in the programming language.
33.03	Write programs that perform string processing (e.g., manipulating, comparing strings, concatenation).
33.04	Write programs that implements user-defined data types.
33.05	Decompose a problem by defining new functions and classes.

33.06	Write object-oriented programs that implement inheritance.
33.07	Write object-oriented programs that implement polymorphism.
33.08	Develop class constructors.
33.09	Write programs that define and use program constants.
33.10	Write programs that perform error handling.
33.11	Participate in program code review meetings to evaluate program code for validity, quality, performance, data integrity, and conformance to program design documents.
33.12	Describe the concept of parallel processing as a strategy to solve large problems.
33.13	Demonstrate concurrency by separating processes into threads of execution and dividing data into parallel streams.
33.14	Update a program module to implement enhancements or corrections and demonstrate appropriate documentation (internal and external) related to version control.
33.15	Write programs that use complex data structures (e.g., stacks, queues, trees, linked list).
33.16	Write programs that are event-driven.
33.17	Write programs that perform file input and output (i.e., sequential and random access file input/output).
33.18	Explain intractable problems and understand that problems exist that are computationally unsolvable (undecidable) (e.g., classic intractable problems include Towers of Hanoi, TSP).
33.19	Explain the value of heuristic algorithms to approximate solutions for intractable problems (e.g., a heuristic solution to TSP).
34.0	Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results. The student will be able to:
34.01	Develop a test plan for an object-oriented program.
34.02	Write test plans for event-driven programs.
34.03	Write test plans for programs that perform file input and output.
34.04	Perform test and debug activities on object-oriented programs, including those written by someone else.
34.05	Perform test and debug activities on an event-driven program.
34.06	Perform test and debug activities on programs that perform file input and output and verify the correctness of output files.
34.07	Document the findings of testing in a test report.

35.0	Understand human interactions in intelligence. The student will be able to:
35.01	Describe the unique features of computers embedded in mobile devices and vehicles.
35.02	Describe the common physical and cognitive challenges faced by users when learning to use software and hardware.
35.03	Describe the process of designing software to support specialized forms of human-computer interaction.
35.04	Explain the notion of intelligent behavior through computer modeling and robotics.
35.05	Describe common measurements of machine intelligence (e.g., Turing test).
35.06	Describe a few of the major branches of artificial intelligence (e.g., expert systems, natural language processing, machine perception, machine learning).
35.07	Describe major applications of artificial intelligence and robotics, including, but not limited to, the medical, space, and automotive fields.

Course Number: CTS0062
Occupational Completion Point: D
Database Programmer – 600 Hours – SOC Code 15-1131

36.0	Develop an awareness of the changes taking place in the information age and how they fit into an evolving society. The student will be able to:
36.01	Cite examples of jobs, salary, and opportunities he/she will have as a database programmer.
36.02	Describe the role a database plays in a business.
36.03	Understand the importance of clear communication when discussing business informational requirements.
36.04	Identify important historical contributions in database development and design.
37.0	Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs. The student will be able to:
37.01	Identify and analyze the phases of the database development process.
37.02	Explain what logical data modeling and database design involve.
37.03	Compare database development process with that of the application development process.
37.04	Distinguish between a logical model and a physical implementation.
38.0	Develop the process of creating an entity by identifying relationships. The student will be able to:
38.01	Identify and model various types of entities.
38.02	Identify naming and drawing conventions for entities.
38.03	Sequence the steps that are necessary for creation of an entity.
38.04	Analyze and model the relationships between entities.
39.0	Formulate and assemble initial entity relationship by expanding on modeling concepts. The student will be able to:
39.01	Analyze and model attributes.
39.02	Identify unique identifiers for each entity.
39.03	Develop an entity relationship diagram tagging attributes with optionality.
40.0	Consider the degree and optionality of relationships of entities. The student will be able to:
40.01	Create entity relationship models based on information requirements and interviews.
40.02	Differentiate between one-to-many, many-to-many and one-to-one relationships.
40.03	Identify relationship between two entities by reading a given diagram.

40.04	Create a relationship between instances of the same entity.
40.05	Read an entity relationship model in order to validate it.
41.0	Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams. The student will be able to:
41.01	Identify the significance of an attribute that has more than one value for each entity instance.
41.02	Evaluate appropriate methods of storing validation rules for attributes.
41.03	Recognize unique identifiers inherited from other entities.
41.04	Sequence the steps involved in resolving a many-to-many relationship.
42.0	Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships. The student will be able to:
42.01	Validate that an attribute is properly placed based upon its dependence on its entity's unique identifier (UID).
42.02	Resolve many-to-many relationships with intersection entities.
42.03	Model advanced data constructs including recursive relationships, subtypes, and exclusive relationships.
42.04	Create exclusive entities and relationships by using subtypes and arcs, respectively.
42.05	Identify initial layout for presentation and generate a list of action items for members of group.
42.06	Develop an entity relationship model using subtypes, super-types and an exclusive arc.
43.0	Demonstrate proficiency in designing and adding complexity to a logical model. The student will be able to:
43.01	Revise an entity relationship model according to client requirements.
43.02	Define and give examples of hierarchical and recursive relationships.
43.03	Differentiate between transferable and non-transferable relationships.
43.04	Deliver a professional, formal business style presentation.
43.05	Evaluate and critique presentation layout, design and performance.
43.06	Construct a model using both recursion and hierarchies to express the same logical meaning.
44.0	Apply complex logical information by fine-tuning entities and the process for relating them. The student will be able to:
44.01	Describe a relational database and how it differs from other database systems.
44.02	Define primary keys and foreign keys and describe their purpose.
44.03	Describe what data integrity refers to and list some constraints.

44.04	Explain how database design fits into the database development process.
44.05	Translate a logical model into a relational database design.
45.0	Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved. The student will be able to:
45.01	Demonstrate ability to implement steps for mapping entity relationship models for implementation.
45.02	Document an initial database design on table instance charts.
45.03	Recognize raw data and evaluate the steps for creating a data group in unnormalized form.
46.0	Demonstrate proficiency in the technique of normalization by labeling and organizing all items in a database in such a way as to prevent any confusion or mistakes. The student will be able to:
46.01	Differentiate between normalized and unnormalized data.
46.02	Move data from an unnormalized form through to a third normal form.
46.03	Demonstrate ability to test data groups for third normal form compliance.
46.04	Identify optimized data groups from given groups of normalized data.
47.0	Demonstrate proficiency in table normalization by combining the techniques of an entity relationship model or a top-down, business approach to data with normalization or a bottom-up mathematical approach to data. The student will be able to:
47.01	Compare the normalization and logical techniques in terms of strengths and weaknesses.
47.02	Further define normalization and explain its benefits.
47.03	Place tables in third normal form.
47.04	Explain how logical data modeling rules ensure normalized tables.
47.05	Specify referential integrity constraints and design indices.
48.0	Apply blueprint principles to begin designing a tool for creating a web-based interface access to a database. The student will be able to:
48.01	Evaluate the transformation of business requirements into an initial layout and design for a database.
48.02	Construct simple webpage design for personal work folder.
48.03	Evaluate existing websites and determine quality of design.
49.0	Extend the logical model presentation model by normalizing the data and mapping the management system. The student will be able to:
49.01	Formulate a plan of action for the Database Project using skills previously learned in this course.
49.02	Normalize a logical model to the third normal form (3NF).
49.03	Create a table in the database using a database authoring tool.

49.04	Demonstrate ability to edit tables using a database authoring tool.
49.05	Create forms that will display the table components created with a database authoring tool.
50.0	Apply techniques for building a storage management system by creating a website using templates and wizards. The student will be able to:
50.01	Create a website that displays the database project home.
50.02	Link a website to create a web-enabled interface to the industry database.
50.03	Edit the forms created and specify appropriate field labels for data entry.
51.0	Demonstrate design and functionality by constructing a group business presentation. The student will be able to:
51.01	Evaluate and generate criteria for a formal, business presentation.
51.02	Construct a persuasive group presentation using the guidelines set forth in class.
52.0	Demonstrate comprehension of database modeling competency through group presentation. The student will be able to:
52.01	Deliver a formal business presentation for the class that discusses a logical model and initial database design.
52.02	Demonstrate the functionality of the database and the layout/design capabilities of a database authoring tool.
52.03	Prepare appropriate end-user documentation.
52.04	Self-assess learning experience through the presentation and demonstration of their final database project.
53.0	Demonstrate comprehension that the database management software is a system for organizing the storage unit (or database) according to business needs and rules, through data integrity constraints. The student will be able to:
53.01	Identify the structural elements of a relational database table.
53.02	List and describe the system development life cycle.
53.03	Describe the industry implementation of the relational database management system (RDBMS) and object relational database management system (ORDBMS).
53.04	Explain how SQL and languages that extend SQL are used in the industry product set.
53.05	Identify the advantages of a database management system.
54.0	Demonstrate comprehension of aspects of SQL language interface by writing basic SQL statements. The student will be able to:
54.01	List the capabilities of SQL SELECT statements.
54.02	Execute a basic SELECT statement.
54.03	Differentiate between SQL statements and language commands that extend SQL.

55.0	Demonstrate proficiency working with columns, characters, and rows in SQL. The student will be able to:
55.01	Apply the concatenation operator to link columns to other columns, arithmetic expressions, or constant values to create a character expression.
55.02	Use column aliases to rename columns in the query result.
55.03	Eliminate duplicate rows in the query result.
55.04	Display the structure of a table.
55.05	Apply SQL syntax to restrict the rows returned from a query.
55.06	Demonstrate application of the WHERE clause syntax.
55.07	Construct and produce output using a SQL query containing character strings and date values.
56.0	Demonstrate proficiency in using SQL comparison operators. The student will be able to:
56.01	Apply the proper comparison operator to return a desired result.
56.02	Demonstrate proper use of BETWEEN, IN, and LIKE conditions to return a desired result.
56.03	Distinguish between zero and the value of NULL as unavailable, unassigned, unknown, or inapplicable.
56.04	Explain the use of comparison conditions and NULL.
57.0	Demonstrate proficiency in using logical comparisons and precedence rules. The student will be able to:
57.01	Evaluate logical comparisons to restrict the rows returned based on two or more conditions.
57.02	Apply the rules of precedence to determine the order in which expressions are evaluated and calculated.
57.03	Construct a query to order a results set for single or multiple columns.
57.04	Construct a query to sort a results set in ascending or descending order.
58.0	Demonstrate proficiency using SQL single row functions. The student will be able to:
58.01	Perform calculations on data.
58.02	Modify individual data items.
58.03	Use character, number and date functions in SELECT statements.
58.04	Format data and numbers for display purposes.
58.05	Convert column data types.
59.0	Demonstrate proficiency displaying data from multiple tables. The student will be able to:

59.01	Construct SELECT statements to access data from more than one table using equity and non-equality joins.
59.02	Use outer joins through viewing data that generally does not meet a join condition.
59.03	Join a table to itself.
60.0	Demonstrate proficiency aggregating data using group functions. The student will be able to:
60.01	Identify the available group functions and describe their use.
60.02	Demonstrate the ability to group data through the use of the GROUP BY clause.
60.03	Demonstrate the ability to include or exclude grouped rows by using the HAVING clause.
61.0	Demonstrate proficiency utilizing subqueries. The student will be able to:
61.01	Write a query with an embedded subquery.
61.02	Evaluate and perform a multiple-column subquery.
61.03	Describe and explain the behavior of subqueries when NULL values are retrieved.
61.04	Create a subquery in a FROM clause.
62.0	Demonstrate proficiency producing readable output with SQL language interface, reporting tool, and data manipulation language. The student will be able to:
62.01	Produce queries that require an input variable.
62.02	Customize the SQL language interface and reporting environment using SET commands for control.
62.03	Produce more readable output through the use of the column and break commands.
62.04	Describe data manipulation language (DML) and describe various DML statements.
62.05	Utilize data manipulation language (DML) through inserting, updating and deleting rows from a table.
62.06	Control transactions using COMMIT and ROLLBACK statements.
63.0	Demonstrate proficiency creating and managing database objects. The student will be able to:
63.01	Describe the main database objects.
63.02	Create tables and alter their definitions.
63.03	Describe the data types that can be used when specifying column definition.
64.0	Demonstrate proficiency altering tables and constraints implementing views. The student will be able to:
64.01	Create, drop, rename and truncate tables using SQL.

64.02	Identify and describe various constraints including not NULL, unique, primary key, foreign key, and check.
64.03	Create and maintain constraints including adding, dropping, enabling, disabling, and cascading.
64.04	Recognize views and explain how they are created, how they retrieve data and how they perform DML operations.
65.0	Demonstrate mastery of creating and implementing views, synonyms, indexes and other database objects. The student will be able to:
65.01	Create views, retrieve data through a view, alter the definition of a view and drop a view.
65.02	Categorize information by using Top-N queries to retrieve specified data.
65.03	Identify the features of a sequence and display sequence values using a data dictionary view.
65.04	Identify the characteristics of a cached sequence.
65.05	Modify and remove a sequence using a SQL statement.
65.06	Identify the features of private and public synonyms.
65.07	Identify characteristics of an index and describe different types.
65.08	Create and remove an index using a SQL statement.
66.0	Demonstrate ability to control user access and SQL language interface and reporting tool. The student will be able to:
66.01	Identify the features of database security.
66.02	Create users using SQL statements.
66.03	Grant and revoke object privileges using a SQL language interface and reporting tool.
67.0	Demonstrate comprehension of bundling features of SQL. The student will be able to:
67.01	List and describe the benefits of extension languages to SQL.
67.02	Recognize the basic SQL block and its sections.
67.03	Declare SQL variables and describe their significance.
67.04	Execute a SQL block.
68.0	Demonstrate comprehension working with composite data types by writing executable script files. The student will be able to:
68.01	Recognize the significance of the executable section and decide when to use it.
68.02	Write statements in the executable section.
68.03	Describe the rules of nested blocks.

68.04	Identify and utilize appropriate coding conventions.
68.05	Create a script that will insert, update, merge and delete data in a table.
69.0	Describe the differences between SQL and SQL extension languages. The student will be able to:
69.01	Describe SQL extension languages.
69.02	Differentiate between SQL and SQL extension languages.
69.03	Explain the need for and benefits of SQL extension languages.
70.0	Create program blocks. The student will be able to:
70.01	Describe the structure of a program block.
70.02	Identify the different types of program blocks.
70.03	Identify program programming environments.
70.04	Create and execute an anonymous block.
70.05	Output messages in program blocks.
71.0	Use variables in program blocks. The student will be able to:
71.01	Describe how variables are used in program blocks.
71.02	Identify the syntax for using variables.
71.03	Declare and initialize variables.
71.04	Assign new values to variables.
72.0	Recognize lexical units. The student will be able to:
72.01	Describe the types of lexical units.
72.02	Describe identifiers and identify valid and invalid identifiers.
72.03	Describe and identify reserved words, delimiters, literals, and comments.
73.0	Recognize data types. The student will be able to:
73.01	Describe the data type categories.
73.02	Give examples of scalar, composite, and large object (LOB) data types.
73.03	Identify when an object becomes eligible for garbage collection.

74.0	Use scalar data types. The student will be able to:
74.01	Declare and use scalar data types.
74.02	Define guidelines for declaring and initializing variables.
75.0	Use various types of joins. The student will be able to:
75.01	Construct and execute SELECT statements using an equijoin.
75.02	Construct and execute SELECT statements using a non-equijoin.
75.03	Construct and execute SELECT statements using an outer join.
75.04	Construct and execute SELECT statements that result in cross join.
76.0	Use SQL group functions and subqueries. The student will be able to:
76.01	Construct and execute an SQL query using group functions to determine a sum total, an average amount, and a maximum value.
76.02	Construct and execute an SQL query that groups data based on specified criteria.
76.03	Construct and execute an SQL query that contains a WHERE clause using a single-row subquery.
76.04	Construct and execute an SQL query that contains a WHERE clause using a multiple-row subquery.
77.0	Write executable statements. The student will be able to:
77.01	Construct variable assignment statements.
77.02	Construct statements using built-in SQL functions.
77.03	Differentiate between implicit and explicit data type conversions.
77.04	Describe when implicit data type conversions take place.
77.05	List the drawbacks of implicit data type conversions.
77.06	Construct statements using functions to explicitly convert data types.
77.07	Construct statements using operators.
78.0	Use nested blocks and variable scope. The student will be able to:
78.01	Understand the scope and visibility of variables.
78.02	Write nested blocks and qualify variables with labels.
78.03	Describe the scope of an exception.

78.04	Describe the effect of exception propagation in nested blocks.
79.0	Use good programming practices. The student will be able to:
79.01	List examples of good programming practices.
79.02	Insert comments into code.
79.03	Follow formatting guidelines when writing code.
80.0	Write DML statements to manipulate data. The student will be able to:
80.01	Construct and execute a statement to insert data into a table.
80.02	Construct and execute a statement to update data in a table.
80.03	Construct and execute a statement to delete data from a table.
80.04	Construct and execute a statement to merge data into a table.
81.0	Retrieve data. The student will be able to:
81.01	Identify SQL statements that can be directly included in an executable block.
81.02	Construct and execute an INTO clause to hold values returned by a single-row SELECT statement.
81.03	Construct statements that retrieve data.
82.0	Manipulate data. The student will be able to:
82.01	Describe when to use implicit or explicit cursors.
82.02	Create code to use SQL implicit cursor attributes to evaluate cursor activity.
83.0	Use transaction control statements. The student will be able to:
83.01	Define a transaction and give an example.
83.02	Construct and execute a transaction control statement.
84.0	Use IF conditional control statements. The student will be able to:
84.01	Construct and use an IF statement.
84.02	Construct and use an IF -ELSIF statement.
84.03	Create control statements to handle NULL conditions in an IF statement.
85.0	Use CASE conditional control statements. The student will be able to:

85.01	Construct and use CASE statements.
85.02	Construct and use CASE expressions.
85.03	Include syntax to handle NULL conditions in a CASE statement.
85.04	Include syntax to handle Boolean conditions in IF and CASE statements.
86.0	Use basic LOOP iterative control statements. The student will be able to:
86.01	Describe the types of LOOP statements and their uses.
86.02	Create a program containing a basic loop and an EXIT statement.
86.03	Create a program containing a basic loop and an EXIT statement with conditional termination.
87.0	Use WHILE and FOR loop iterative control statements. The student will be able to:
87.01	Construct and use the WHILE looping construct.
87.02	Construct and use the FOR looping construct.
87.03	Describe when a WHILE loop is used.
87.04	Describe when a FOR loop is used.
88.0	Use nested loop iterative control statements. The student will be able to:
88.01	Construct and execute a program using nested loops.
88.02	Evaluate a nested loop construct and identify the exit point.
89.0	Use explicit cursors. The student will be able to:
89.01	List the guidelines for declaring and controlling explicit cursors.
89.02	Create code to open a cursor and fetch a piece of data into a variable.
89.03	Use a simple loop to fetch multiple rows from a cursor.
89.04	Create code to close a cursor.
90.0	Use explicit cursor attributes. The student will be able to:
90.01	Define a record structure.
90.02	Create code to process the row of an active set using record types in cursors.
90.03	Use cursor attributes to retrieve information about the state of an explicit cursor.

91.0	Use cursor FOR loops. The student will be able to:
91.01	List and explain the benefits of using a cursor FOR loops.
91.02	Create code to declare a cursor and manipulate it in a FOR loop.
91.03	Create code containing a cursor FOR loop using a subquery.
92.0	Use cursors with parameters. The student will be able to:
92.01	List the benefits of using parameters with cursors.
92.02	Create code to declare and manipulate a cursor with a parameter.
93.0	Use cursors for update transactions. The student will be able to:
93.01	Create code to lock rows before an update using the appropriate clause.
93.02	Explain the effect of using NOWAIT in an update cursor declaration.
93.03	Create code to use the current row of the cursor in an UPDATE or DELETE statement.
94.0	Use multiple cursors. The student will be able to:
94.01	Explain the need for using multiple cursors to produce multilevel reports.
94.02	Create code to declare and manipulate multiple cursors within nested loops.
94.03	Create code to declare and manipulate multiple cursors using parameters.
95.0	Handle exceptions. The student will be able to:
95.01	Describe the advantages of including exception handling code.
95.02	Describe the purpose of an EXCEPTION section in a program block.
95.03	Create code to include an EXCEPTION section.
95.04	List the guidelines for exception handling.
96.0	Trap server exceptions. The student will be able to:
96.01	Distinguish between errors defined by the server and those defined by the programmer.
96.02	Differentiate between errors that are handled implicitly and explicitly by the server.
96.03	Write code to trap a predefined server error.
96.04	Write code to trap a non-predefined server error.

96.05	Write code to identify an exception by error code and by error message.
97.0	Trap user-defined exceptions. The student will be able to:
97.01	Write code to name a user-defined exception.
97.02	Write code to raise an exception.
97.03	Write code to handle a raised exception.
98.0	Create procedures. The student will be able to:
98.01	Differentiate between anonymous blocks and subprograms.
98.02	Identify the benefits of using subprograms.
98.03	Describe a stored procedure.
98.04	Create a procedure.
98.05	Describe how a stored procedure is invoked.
99.0	Use parameters in procedures. The student will be able to:
99.01	Describe how parameters contribute to a procedure.
99.02	Define a parameter.
99.03	Create a procedure using a parameter.
99.04	Invoke a procedure that has parameters.
99.05	Distinguish between formal and actual parameters.
100.0	Pass parameters. The student will be able to:
100.01	List the types of parameter modes.
100.02	Create a procedure that passes parameters.
100.03	Identify methods for passing parameters.
100.04	Describe the default option for parameters.
101.0	Create stored functions. The student will be able to:
101.01	Describe the difference between a stored procedure and a stored function.

101.02	Create a program block containing a function.
101.03	Identify ways in which functions may be invoked.
101.04	Create a program block that invokes a function that has parameters.
102.0	Use functions in SQL statements. The student will be able to:
102.01	Describe where user-defined functions can be called from within an SQL statement.
102.02	Describe the restrictions on calling functions from SQL statements.
102.03	Describe the purpose of the Data Dictionary.
102.04	Differentiate different types of Data Dictionary views.
102.05	Write SQL SELECT statements to retrieve information from the Data Dictionary.
103.0	Manage procedures and functions. The student will be able to:
103.01	Describe how exceptions are propagated.
103.02	Remove a function and a procedure.
103.03	Use Data Dictionary views to identify and manage stored procedures.
104.0	Manage object privileges. The student will be able to:
104.01	List and explain several object privileges.
104.02	Explain the function of the EXECUTE object privilege.
104.03	Write SQL statements to grant and revoke object privileges.
105.0	Use invoker's rights. The student will be able to:
105.01	Contrast invoker's rights with definer's rights.
105.02	Create a procedure that uses invoker's rights.
106.0	Create packages. The student will be able to:
106.01	Describe a package, its components, and the reasons for use.
106.02	Create packages containing related variables, cursors, constants, exceptions, procedures, and functions.
106.03	Create a program block that invokes a package construct.

107.0	Manage package constructs. The student will be able to:
107.01	Explain the difference between public and private package constructs.
107.02	Designate a package construct as either public or private.
107.03	Specify the syntax to drop a package.
107.04	Identify Data Dictionary views used to manage packages.
107.05	Identify the guidelines for using packages.
108.0	Use advanced package concepts. The student will be able to:
108.01	Write packages that use the overloading feature.
108.02	Write packages that use forward declarations.
108.03	Explain the purpose of a package initialization block.
108.04	Identify restrictions on using packaged functions in SQL statements.
109.0	Manage persistent state of package variables. The student will be able to:
109.01	Identify persistent states of package variables.
109.02	Control the persistent state of a package cursor.
110.0	Use vendor-supplied packages. The student will be able to:
110.01	Describe common uses for vendor-supplied packages.
110.02	Use the syntax to specify messages for a vendor-supplied package.
110.03	Identify the exceptions used in conjunction with vendor-supplied packages.
111.0	Understand dynamic SQL. The student will be able to:
111.01	Identify the stages through which all SQL statements pass.
111.02	Describe the reasons for using dynamic SQL to create an SQL statement.
111.03	List statements supporting Native Dynamic SQL.
112.0	Understand triggers. The student will be able to:
112.01	Describe database triggers and their uses.
112.02	Differentiate between a database trigger and an application trigger.

112.03	List the guidelines for using triggers.
112.04	Compare and contrast database triggers and stored procedures.
113.0	Create DML triggers. The student will be able to:
113.01	Create a DML trigger and identify its components.
113.02	Create a statement level trigger.
113.03	Describe the trigger firing sequence options.
113.04	Create a DML trigger that uses conditional predicates.
113.05	Create a row level trigger.
113.06	Create a row level trigger that uses OLD and NEW qualifiers.
113.07	Create an INSTEAD OF trigger.
114.0	Create DDL and database event triggers. The student will be able to:
114.01	Describe the events that cause DDL and database event triggers to fire.
114.02	Create a trigger for a DDL statement.
114.03	Create a trigger for a database event.
114.04	Describe the functionality of the CALL statement.
114.05	Describe the cause of a mutating table.
115.0	Manage triggers. The student will be able to:
115.01	View trigger information in the Data Dictionary.
115.02	Disable and enable a database trigger.
115.03	Remove a trigger from the database.
116.0	Use large object data types. The student will be able to:
116.01	Compare and contrast LONG and LOB data types.
116.02	Describe LOB data types and how they are used.
116.03	Differentiate between internal and external LOBs.
116.04	Create and maintain LOB data types.

116.05 Migrate data from LONG to LOB.
117.0 Manage binary types. The student will be able to:
117.01 Define binary column data type.
117.02 Create directory objects and view them in the Data Dictionary.
117.03 Manage and manipulate binary types.
118.0 Manage indexes. The student will be able to:
118.01 Create and manipulate user-defined records.
118.02 Create an index.
118.03 Describe the difference between records, tables, and indexes.
119.0 Manage dependencies. The student will be able to:
119.01 Describe the implications of procedural dependencies.
119.02 Contrast dependent objects and referenced objects.
119.03 View dependency information in the Data Dictionary.
119.04 Use a script to create the objects required to display dependencies.
119.05 Use views to display dependencies.
119.06 Describe how to minimize dependency failures.
120.0 Demonstrate an understanding of Agile Development. The student will be able to:
120.01 Compare Agile project development to the waterfall approach.
120.02 Describe the Agile manifesto and the 12 principles.
120.03 Describe the benefits of Agile development.
121.0 Program a database application. The student will be able to:
121.01 Utilize loop statements.
121.02 Given a scenario, use arithmetic, comparison, and pattern-matching operators.
121.03 Create user-defined functions.
121.04 Utilize common built-in functions.

121.05	Declare variables in modules and procedures.
121.06	Declare arrays, and initialize elements of arrays.
121.07	Declare and use object variables and collections, and use their associated properties and methods.
121.08	Declare symbolic constants, and make them available locally or publicly.
121.09	Respond to events.
122.0	Utilize the basic concepts of database design. The student will be able to:
122.01	Apply basic concepts of normalization.
122.02	Utilize the cascade update and cascade delete options.
123.0	Utilize SQL and union queries. The student will be able to:
123.01	Utilize SQL to write common queries.
123.02	Refer to objects by using SQL.
123.03	Utilize union queries.
124.0	Implement program statements using objects. The student will be able to:
124.01	Determine when to use data access objects.
124.02	Differentiate between objects and collections.
124.03	Write statements that access and modify database objects.
124.04	Utilize data access objects.
124.05	Select appropriate methods and property settings for use with specified objects.
125.0	Utilize debugging tools and write error handlers. The student will be able to:
125.01	Trap errors.
125.02	Utilize debugging tools to suspend program execution, and to examine, step through, and reset execution of code.
125.03	Debug code samples.
125.04	Utilize the Debugger to monitor variable values.
125.05	Write an error handler.
126.0	Demonstrate file I/O. The student will be able to:

126.01	Read from files.
126.02	Write to files.
126.03	Utilize record locking.
127.0	Create forms and identify all the properties of a form. The student will be able to:
127.01	Choose form-specific and report-specific properties to set.
127.02	Choose control properties to set.
127.03	Assign event-handling procedures to controls in a form.
127.04	Define and create form and report modules.
127.05	Identify the scope of a form or report module.
127.06	Open multiple instances of a form, and refer to them.
127.07	Assign values to form properties.
127.08	Use form methods.
128.0	Manipulate data using object models. The student will be able to:
128.01	Connect to a data source.
128.02	Open a recordset.
128.03	Insert, update, merge and delete data.
129.0	Develop custom controls. The student will be able to:
129.01	Set properties for custom controls.
129.02	Customize user interface controls.
130.0	Utilize API functions. The student will be able to:
130.01	Properly declare functions.
130.02	Use the by value and by reference parameters.
131.0	Demonstrate and implement database replication using programming tools. The student will be able to:
131.01	Make a database replicable.
131.02	View a synchronization schedule.

131.03	Explain how synchronization conflicts are resolved.
131.04	Identify the advantages of using replication of synchronization.
131.05	Identify the changes that the database engine makes when it converts a nonreplicable database into replicable database.
132.0	Analyze and implement security options. The student will be able to:
132.01	Analyze a scenario, and recommend an appropriate type of security.
132.02	Explain the steps for implementing security.
132.03	Analyze code to ensure that it sets security options.
132.04	Write code to implement security options.
133.0	Implement client/server applications. The student will be able to:
133.01	Demonstrate SQL pass through queries and application queries.
133.02	Access external data.
133.03	Trap errors that are generated by the server.
133.04	Optimize connections.
133.05	Optimize performance for a given client/server application.
134.0	Optimize the performance of a database. The student will be able to:
134.01	Differentiate between single-field and multiple-field indexes.
134.02	Optimize queries.
134.03	Restructure queries to allow faster execution.
134.04	Optimize performance in distributed applications.
134.05	Optimize performance for client/server applications.
135.0	Perform application distribution. The student will be able to:
135.01	Prepare an application for distribution.
135.02	Analyze various methods to distribute a client/server application.
135.03	Distribute custom controls with an application.
135.04	Provide online help.

136.0	Test and debug databases. The student will be able to:
136.01	Implement error handling.
136.02	Test and debug library databases.
137.0	Describe the difference between relational and NoSQL databases. The student will be able to:
137.01	Describe the advantages and disadvantages of NoSQL databases.
137.02	Describe the types of NoSQL databases (e.g., key-value store, column-based, graph-based, document-based).
137.03	Describe when a NoSQL database should be used for storage.
138.0	Demonstrate an understanding of Data Science and the concept of Data mining. The student will be able to:
138.01	Define Data Science.
138.02	Define Data Mining.
138.03	Describe and compare Structured Data and Non-Structured Data.
138.04	Describe and model the Data Science Life Cycle.
138.05	Describe and compare various Deep Learning Frameworks available to Data Science.
138.06	Describe and compare Data Science and Data Analytics.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: .NET Application Development & Programming
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y700400
CIP Number	0511020314
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of programming and software development; procedural and object-oriented programming; creating .NET-based applications, including testing, monitoring, debugging, documenting, and maintaining .NET applications.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points, with OCPs A, B, C, and D.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0041	Computer Programmer Assistant	BUS ED 1 @2	300 hours	15-1131
C	CTS0044	Computer Programmer	COMPU SCI 6	150 hours	15-1131
D	CTS0032	.NET Programmer	COMP PROG 7G	450 hours	15-1131

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 16.0 Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development.
- 17.0 Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types.
- 18.0 Distinguish between iterative and non-iterative program control structures.
- 19.0 Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages.
- 20.0 Describe the processes, methods, and conventions for software development and maintenance.
- 21.0 Explain the types, uses, and limitations of testing for ensuring quality control.
- 22.0 Create a program design document using Unified Modeling Language (UML) or other common design tool.
- 23.0 Solve problems using critical thinking skills, creativity and innovation.
- 24.0 Use information technology tools.
- 25.0 Describe the importance of security and privacy information sharing, ownership, licensure and copyright.
- 26.0 Design a computer program to meet specific physical, operational, and interaction criteria.
- 27.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
- 28.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
- 29.0 Effectively communicate and collaborate.
- 30.0 Demonstrate responsible use of technology and information.
- 31.0 Explain key concepts that distinguish object-oriented programming from procedural programming.

- 32.0 Create a project plan that defines requirements, structural design, time estimates, and testing elements.
- 33.0 Design, document, and create object-oriented computer programs.
- 34.0 Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results.
- 35.0 Understand human interactions in intelligence.
- 36.0 Develop an awareness of the changes taking place in the information age and how they fit into an evolving society.
- 37.0 Understand .NET primitive data types and their uses.
- 38.0 Describe the types and characteristics of lexical units in the .NET programming language.
- 39.0 Construct statements that use various .NET operators.
- 40.0 Construct and use .NET selection control structures.
- 41.0 Construct and use .NET iterative control structures.
- 42.0 Construct and use .NET structures for error handling.
- 43.0 Write .NET programs that define and use user-defined data types, including classes.
- 44.0 Write .NET programs that define and use methods.
- 45.0 Write programs that perform console input and output in a .NET program.
- 46.0 Use namespaces in a .NET program.
- 47.0 Use arrays in .NET programs.
- 48.0 Write .NET programs that use the object-oriented concept of inheritance.
- 49.0 Write .NET programs that use the object-oriented concept of polymorphism.
- 50.0 Write .NET programs that use the object-oriented concept of encapsulation.
- 51.0 Apply common programming style guidelines and conventions.
- 52.0 Use application life cycle management to develop and maintain .NET programs.
- 53.0 Use nullable values in a .NET program.
- 54.0 Use the .NET String and StringBuilder classes in an application.
- 55.0 Use .NET classes to perform stream input/output.
- 56.0 Use recursive functions to solve problems in .NET programs.
- 57.0 Write .NET programs that use interfaces.
- 58.0 Use .NET collections in applications.
- 59.0 Demonstrate knowledge of different types of .NET applications.
- 60.0 Demonstrate knowledge of .NET architecture and tools.
- 61.0 Demonstrate knowledge of web applications.
- 62.0 Develop webpages using HTML, CSS, JavaScript, and ASP.NET.
- 63.0 Develop .NET Windows Form applications.
- 64.0 Develop Windows Service applications and class libraries.
- 65.0 Demonstrate knowledge of database applications.
- 66.0 Demonstrate knowledge of structured query language (SQL) statements.
- 67.0 Develop .NET database applications.
- 68.0 Successfully work as a member of a software development team.
- 69.0 Manage time according to a plan.
- 70.0 Keep acceptable records of progress problems and solutions.
- 71.0 Plan, organize, and carry out a project plan.
- 72.0 Manage resources.
- 73.0 Use tools, materials, and processes in an appropriate and safe manner.

- 74.0 Demonstrate an understanding of the software development process.
- 75.0 Research content related to the project and document the results following industry conventions.
- 76.0 Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience.
- 77.0 Demonstrate competency in the area of expertise related to developing computer software using the .NET framework.

Florida Department of Education
Student Performance Standards

Program Title: .NET Application Development & Programming
Career Certificate Program Number: Y700400

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: CTS0041
Occupational Completion Point: B
Computer Programmer Assistant – 300 Hours – SOC Code 15-1131

15.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
15.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
15.02	Locate, organize and reference written information from various sources.
15.03	Construct writings and/or communications using developmentally appropriate terminology.
15.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
15.05	Analyze the positive and negative impacts of technology on popular culture and personal life.
15.06	Discuss how technology has changed the way people build and manage organizations and how technology impacts personal life.
15.07	Evaluate ways in which adaptive technologies may assist users with special needs.
15.08	Explain how societal and economic factors are affected by access to critical information.
15.09	Discuss the challenges (e.g., political, social, and economic) in providing equal access and distribution of technology in a global society.
16.0	Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development. The student will be able to:
16.01	Explore a variety of careers to which computing is central.
16.02	Compare and contrast appropriate and inappropriate social networking behaviors.
16.03	Discuss the impact of computing on business and commerce (e.g., automated inventory processing, financial transactions, e-commerce, virtualization, cloud computing).
16.04	Evaluate the impacts of irresponsible use of information (e.g., plagiarism, falsification of data) on collaborative projects.
16.05	Identify tasks performed by programmers.
16.06	Describe how businesses use computer programming to solve business problems.
16.07	Investigate job opportunities in the programming field.
16.08	Explain different specializations and the related training in the computer programming field.
16.09	Explain the need for continuing education and training of computer programmers.
16.10	Understand and identify ways to use technology to support lifelong learning.
16.11	Explain enterprise software systems and how they impact business.

16.12	Describe ethical responsibilities of computer programmers.
16.13	Describe the role of customer support to software program quality.
16.14	Identify credentials and certifications that may improve employability for a computer programmer.
16.15	Identify devices, tools, and other environments for which programmers may develop software.
17.0	Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types. The student will be able to:
17.01	Identify the characteristics (e.g., size, limits) and uses of different numerical and non-numerical data types.
17.02	Explain the types and uses of variables in programs.
17.03	Determine the best data type to use for given programming problems.
17.04	Compare and contrast simple data structures and their uses.
17.05	Identify the types of operations that can be performed on different data types.
17.06	Evaluate arithmetic and logical expressions using appropriate operator precedence.
17.07	Explain how computers store different data types in memory.
17.08	Demonstrate the difference between "data" and "information".
17.09	Use different number systems to represent data.
17.10	Explain how national and international standards (i.e., ASCII, UNICODE) are used to represent non-numerical data.
17.11	Use Boolean logic to perform logical operations.
18.0	Distinguish between iterative and non-iterative program control structures. The student will be able to:
18.01	Create non-iterative programming structures and explain their uses.
18.02	Create iterative programming structures and explain their uses.
18.03	Explain how sequence, selection, and iteration are building blocks of algorithms.
19.0	Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages. The student will be able to:
19.01	Differentiate between multiple levels of an operating system, translation, and interpretation that support program execution.
19.02	Explain the program execution process (by an interpreter and in CPU hardware).
19.03	Describe object-oriented concepts.

19.04	Explain the characteristics of procedural and object-oriented programming languages.
19.05	Compare and contrast programming languages that are compiled, interpreted, and translated.
19.06	Classify programming languages by paradigm and application domain (e.g., imperative, functional, logic languages and how well suited they are for certain application domains such as web programming, symbolic processing, data/numerical processing).
20.0	Describe the processes, methods, and conventions for software development and maintenance. The student will be able to:
20.01	Describe a software development process that is used to solve problems at different software development stages.
20.02	Describe and demonstrate ethical and responsible use of modern communication media and devices.
20.03	Define alternative methods of program development (e.g., rapid prototyping, waterfall, spiral model, peer coding).
20.04	List and explain the steps in the program development cycle.
20.05	Describe different types of documentation used in the program development cycle (e.g., requirements document, program design documents, test plans).
20.06	Describe different methods used to facilitate version control.
21.0	Explain the types, uses, and limitations of testing for ensuring quality control. The student will be able to:
21.01	Explain the uses and limits of testing in ensuring program quality.
21.02	Explain testing performed at different stages of the program development cycle (e.g., unit testing, system testing, user acceptance testing).
21.03	Describe and identify types of programming errors.
21.04	Analyze and manipulate data collected by a variety of data collection techniques.
21.05	Explain what tools are applied to provide automated testing environments.
22.0	Create a program design document using common design tool. The student will be able to:
22.01	Describe different design methodologies and their uses (e.g., object-oriented design, structured design, rapid application development).
22.02	Describe tools for developing a program design (e.g., Unified Modeling Language, flowcharts, design documents, pseudocode).
22.03	Explain the role of existing libraries and packages in facilitating programmer productivity.
22.04	Participate and contribute to a design review of a program design developed using a common program design tool (e.g., UML, flowcharts, design documents, pseudocode).
22.05	Write a program design document using standard design methodology.
22.06	Define input and output for a program module using standard design methodology.

23.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
26.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
26.02	Employ critical thinking and interpersonal skills to resolve conflicts.
26.03	Identify and document workplace performance goals and monitor progress toward those goals.
26.04	Conduct technical research to gather information necessary for decision-making.
26.05	Discuss digital tools or resources to use for a real-world task based on their efficiency and effectiveness, individually and collaboratively.
24.0	Use information technology tools. The student will be able to:
24.01	Use personal information management (PIM) applications to increase workplace efficiency.
24.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
24.03	Employ computer applications to access, create, manage, integrate, and store information.
24.04	Employ collaborative/groupware applications to facilitate group work.
24.05	Use a development process in creating a computational artifact, individually and collaboratively, followed by reflection, analysis, and iteration (e.g., data-set analysis program for science and engineering fair, capstone project that includes a program, term research project based on program data).
25.0	Describe the importance of security and privacy information sharing, ownership, licensure and copyright. The student will be able to:
25.01	Describe security and privacy issues that relate to computer networks including the permanency of data on the Internet, online identity, and privacy.
25.02	Discuss the impact of government regulation on privacy and security.
25.03	Describe how different types of software licenses (e.g., open source, proprietary licenses) can be used to share and protect intellectual property.
25.04	Explain how access to information may not include the right to distribute the information.
25.05	Describe differences between open source, freeware, and proprietary software licenses, and how they apply to different types of software.
25.06	Discuss security and privacy issues that relate to computer networks.
25.07	Identify computer-related laws and analyze their impact on digital privacy, security, intellectual property, network access, contracts, and harassment.
26.0	Design a computer program to meet specific physical, operational, and interaction criteria. The student will be able to:

26.01	Choose appropriate data types depending on the needs of the program.
26.02	Define appropriate user prompts for clarity and usability (e.g., user guidance for data ranges, data types).
26.03	Design and develop program for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
26.04	Compare techniques for analyzing massive data collections.
26.05	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
26.06	Create mobile computing applications and/or dynamic webpages through the use of a variety of design and development tools, programming languages and mobile devices/emulators.
26.07	Explain the role of an application programming interface (API) in the development of applications and the distinction between a programming language's syntax and the API.
26.08	Identify the tools required to develop a program (e.g., editors, compilers, linkers, integrated development environments, APIs, libraries).
26.09	Use an industrial-strength integrated development environment to implement a program.
27.0	Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types. The student will be able to:
27.01	Use appropriate naming conventions to define program variables and methods.
27.02	Use a program editor to write the source code for a program.
27.03	Write programs that use selection structures.
27.04	Write programs that use repetition structures.
27.05	Write programs that use nested structures.
27.06	Use internal documentation (e.g., single-line and multi-line comments, program headers, module descriptions, meaningful variable and function/module names) to document a program according to accepted standards.
27.07	Compile, run, test and debug programs.
27.08	Write programs that use standard arithmetic operators with different numerical data types.
27.09	Write programs that use standard logic operators.
27.10	Write programs that use a variety of common data types.
27.11	Write programs that perform data conversion between standard data types.
27.12	Write programs that define, use, search, and sort arrays.
27.13	Write programs that use user-defined data types.

27.14	Demonstrate understanding and use of appropriate variable scope.
27.15	Explain recursive programming structure.
27.16	Use global and local scope appropriately in program implementation.
28.0	Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input. The student will be able to:
28.01	Critically examine classical algorithms and implement an original algorithm.
28.02	Write programs that perform user input and output.
28.03	Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
28.04	Write program modules such as functions, subroutines, or methods.
28.05	Write program modules that accept arguments.
28.06	Write program modules that return values.
28.07	Write program modules that validate arguments and return error codes.
28.08	Design and implement a simple simulation algorithm to analyze, represent and understand natural phenomena.
28.09	Use APIs and libraries to facilitate programming solutions.
28.10	Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common programming standards.
29.0	Effectively communicate and collaborate. The student will be able to:
29.01	Evaluate modes of communication and collaboration.
29.02	Select appropriate tools within a project environment to communicate with project team members.
29.03	Utilize project collaboration tools (such as version control systems and integrated development environments) while working on a collaborative software project.
29.04	Generate, evaluate, and prioritize questions that can be researched through digital resources and online tool.
29.05	Perform advanced searches to locate information and/or design a data-collection approach to gather original data.
29.06	Communicate and publish key ideas and details to a variety of audiences using digital tools and media-rich resources.
30.0	Demonstrate responsible use of technology and information. The student will be able to:
30.01	Explain the principles of cryptography by examining encryption, digital signatures, and authentication methods (e.g. explain why and how certificates are used with https for authentication and encryption).
30.02	Implement an encryption, digital signature, or authentication method.

30.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

Course Number: CTS0044
Occupational Completion Point: C
Computer Programmer – 150 Hours – SOC Code 15-1131

31.0	Explain key concepts that distinguish object-oriented programming from procedural programming. The student will be able to:
31.01	Demonstrate the understanding and use of classes, objects, attributes, and behaviors.
31.02	Demonstrate the understanding and use of inheritance.
31.03	Demonstrate the understanding and use of data encapsulation.
31.04	Demonstrate the understanding and use of polymorphism.
31.05	Use predefined functions and parameters, classes, and methods to divide a complex problem into simpler parts by using the principle of abstraction to manage complexity (e.g., by using searching and sorting as abstractions).
32.0	Create a project plan for an object-oriented programming project that defines requirements, structural design, time estimates, and testing elements. The student will be able to:
32.01	Write a project plan for completion of a project that includes gathering program requirements, developing the program, and testing it.
32.02	Write a program requirements document that identifies business purpose, functional requirements, system requirements, and other common components of a requirements document.
32.03	Design an object-oriented program using standard design methodology.
32.04	Work with other team members to develop a project plan for a program.
32.05	Work with other team members to write a design document for a program with multiple functions and shared data.
32.06	Participate in design meetings that review program design documents for conformance to program requirements.
32.07	Estimate the time to develop a program or module.
32.08	Evaluate algorithms by their efficiency, correctness, and clarity (e.g., by analyzing and comparing execution times, testing with multiple inputs or data sets, and by debugging).
33.0	Design, document, and create object-oriented computer programs. The student will be able to:
33.01	Compare and contrast recursive functions to iterative methods.
33.02	Understand the implementation of character strings in the programming language.
33.03	Write programs that perform string processing (e.g., manipulating, comparing strings, concatenation).
33.04	Write programs that implements user-defined data types.
33.05	Decompose a problem by defining new functions and classes.

33.06	Write object-oriented programs that implement inheritance.
33.07	Write object-oriented programs that implement polymorphism.
33.08	Develop class constructors.
33.09	Write programs that define and use program constants.
33.10	Write programs that perform error handling.
33.11	Participate in program code review meetings to evaluate program code for validity, quality, performance, data integrity, and conformance to program design documents.
33.12	Describe the concept of parallel processing as a strategy to solve large problems.
33.13	Demonstrate concurrency by separating processes into threads of execution and dividing data into parallel streams.
33.14	Update a program module to implement enhancements or corrections and demonstrate appropriate documentation (internal and external) related to version control.
33.15	Write programs that use complex data structures (e.g., stacks, queues, trees, linked list).
33.16	Write programs that are event-driven.
33.17	Write programs that perform file input and output (i.e., sequential and random access file input/output).
33.18	Explain intractable problems and understand that problems exist that are computationally unsolvable (undecidable) (e.g., classic intractable problems include Towers of Hanoi, TSP).
33.19	Explain the value of heuristic algorithms to approximate solutions for intractable problems (e.g., a heuristic solution to TSP).
34.0	Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results. The student will be able to:
34.01	Develop a test plan for an object-oriented program.
34.02	Write test plans for event-driven programs.
34.03	Write test plans for programs that perform file input and output.
34.04	Perform test and debug activities on object-oriented programs, including those written by someone else.
34.05	Perform test and debug activities on an event-driven program.
34.06	Perform test and debug activities on programs that perform file input and output and verify the correctness of output files.
34.07	Document the findings of testing in a test report.
35.0	Understand human interactions in intelligence. The student will be able to:
35.01	Describe the unique features of computers embedded in mobile devices and vehicles.

35.02	Describe the common physical and cognitive challenges faced by users when learning to use software and hardware.
35.03	Describe the process of designing software to support specialized forms of human-computer interaction.
35.04	Explain the notion of intelligent behavior through computer modeling and robotics.
35.05	Describe common measurements of machine intelligence (e.g., Turing test).
35.06	Describe a few of the major branches of artificial intelligence (e.g., expert systems, natural language processing, machine perception, machine learning).
35.07	Describe major applications of artificial intelligence and robotics, including, but not limited to, the medical, space, and automotive fields.

Course Number: CTS0032
Occupational Completion Point: D
.NET Programmer – 450 Hours – SOC Code 15-1131

36.0	Develop an awareness of the changes taking place in the information age and how they fit into an evolving society. The student will be able to:
36.01	Cite examples of jobs, salary, and opportunities he/she will have as a .NET programmer.
36.02	Describe the role a database plays in a business.
36.03	Explain the value of middleware, such as the .NET framework, in developing software applications.
36.04	Understand the importance of clear communication when discussing business informational requirements.
37.0	Understand .NET primitive data types and their uses. The student will be able to:
37.01	Describe how variables are used in programs.
37.02	Identify the .NET built-in value types, their uses, and the ranges of values supported by each type.
37.03	Identify the default values for built-in value types.
37.04	Write statements that declare and initialize variables.
37.05	Write statements that assign literal values to numeric types.
37.06	Identify the .NET built-in reference types.
37.07	Write statements that assign string literals to string types.
37.08	Explain the memory size requirements for the various data storage types.
37.09	Identify which types are stored on the heap and which are stored on the stack.
37.10	Identify which data type should be used for a given purpose in a program.
37.11	Write statements that create variables with values that cannot be changed (i.e., const, final).
37.12	Identify the syntax for declaring and initializing each of the built-in data types.
37.13	Differentiate between implicit and explicit data type conversions.
37.14	Describe when implicit data type conversions take place.
37.15	Write statements that use explicit type conversion.
37.16	List the drawbacks of implicit data type conversions.

37.17	Compare and contrast boxing and unboxing.
37.18	Describe the scope of a variable.
37.19	Describe how the compiler uses scope to distinguish between variables with the same name.
38.0	Describe the types and characteristics of lexical units in the .NET programming language. The student will be able to:
38.01	Describe the types of lexical units (e.g., keywords, directives, operators).
38.02	Describe identifiers and identify valid and invalid identifiers.
38.03	Describe and identify reserved words, delimiters, literals, and comments.
39.0	Construct statements that use various .NET operators. The student will be able to:
39.01	Construct statements using arithmetic operators.
39.02	Construct statements using relational operators.
39.03	Construct and use statements using logical operators.
39.04	Construct and use statements using assignment operators.
39.05	Construct and execute statements using operator precedence.
39.06	Construct and execute statements using methods and fields of the math class.
40.0	Construct and use .NET selection control structures. The student will be able to:
40.01	Construct and use an if structure in a program.
40.02	Construct and use an if/else structure in a program.
40.03	Construct and use multiple-selection structures (e.g., switch, elseif, select) in programs.
40.04	Construct and use nested selection structures in a program.
40.05	Construct and use a conditional operator.
41.0	Construct and use .NET iterative control structures. The student will be able to:
41.01	Describe the types of iterative control structures and their uses.
41.02	Construct and use a while structures (e.g., while, do/while, do/until) in a program.
41.03	Construct and use a for structure in a program.
41.04	Construct and use a control structure that iterates over each item in a collection (e.g., foreach, for/each/next).

41.05	Describe the limits and advantages of different iterative control structure (i.e., while, do/while, for, foreach or for/each).
41.06	Construct and use nested structures (iterative and selective) in a program.
41.07	Write programs that alter the execution of program loops (e.g., break, continue, exit).
42.0	Construct and use .NET structures for error handling. The student will be able to:
42.01	Describe the different types of software errors.
42.02	Compare and contrast alternatives for handling errors.
42.03	Write programs that validate user input and handle errors.
42.04	Explain the correct method for using multiple catch blocks for exceptions.
42.05	Explain the purpose of the finally block in exception handling.
42.06	Write programs that handle exceptions using the try/catch/finally structure.
42.07	Write programs with nested exception handling.
42.08	Explain the concept of structured exception handling.
42.09	Identify common exceptions and their causes.
42.10	Explain the concept of throwing a new exception.
42.11	Write programs that catch and re-throw exceptions.
42.12	Write exception handlers that use characteristics of the exception argument in the program.
43.0	Write .NET programs that define and use user-defined data types, including classes. The student will be able to:
43.01	Explain the concept of a user-defined data type.
43.02	Distinguish between structures and classes.
43.03	Identify the syntax for declaring enumerations and structures.
43.04	Write programs that use declare and use enumerations.
43.05	Write programs that declare and use structures.
43.06	Explain the characteristics of different class constructs including instance variables, properties, fields, methods, events, object references, and constructors.
43.07	Write programs that declare and use classes.

43.08	Distinguish between different types of classes, including base class, derived class, abstract class, and sealed class.
43.09	Explain the impact of using different access modifiers on user-defined data types.
43.10	Use access modifiers in a program to control visibility to variables and user-defined data types.
43.11	Explain the this reference and its uses.
44.0	Write .NET programs that define and use methods. The student will be able to:
44.01	Identify the benefits of using methods.
44.02	Describe the different types of class methods and their purposes.
44.03	Create class methods that do and do not return values.
44.04	Write statements that invoke a method.
44.05	Create a method using arguments.
44.06	Invoke a method that has arguments.
44.07	Describe a method signature.
44.08	Describe the purpose of overloading methods.
44.09	Write programs that have overloaded methods.
44.10	Define methods that have default arguments.
44.11	Describe the conflict between overloaded methods and default arguments.
44.12	Explain the impact of using different access modifiers on class methods.
44.13	Write methods that use argument modifiers (e.g., out, ref, byref, byval, const).
45.0	Write programs that perform console input and output in a .NET program. The student will be able to:
45.01	Use the Console class to read and write data from the console.
45.02	Write statements that use escape sequences.
45.03	Write statements that format string and numeric output.
45.04	Write statements that use the ToString method to output data.
46.0	Use namespaces in a .NET program. The student will be able to:

46.01	Compare and contrast assemblies and namespaces.
46.02	Describe the use of namespaces in .NET programming.
46.03	Describe commonly used .NET namespaces (e.g., System, System.IO, System.Collections, System.Drawing).
46.04	Identify the correct namespace to include for specified classes.
46.05	Write programs that define a namespace.
46.06	Create namespaces that abide by standard naming convention.
47.0	Use arrays in .NET programs. The student will be able to:
47.01	Write statements to declare and initialize an array.
47.02	Demonstrate the use of initializer lists.
47.03	Write methods that take an array as an argument.
47.04	Write methods that return an array to the calling method.
47.05	Write statements to update, and destroy arrays.
47.06	Explain linear and binary searching.
47.07	Use the static methods of the Array class to perform searches, binary searches, and sorts.
47.08	Demonstrate the use of multidimensional arrays.
47.09	Demonstrate the use of jagged arrays (array of arrays).
48.0	Write .NET programs that use the object-oriented concept of inheritance. The student will be able to:
48.01	Explain the purpose and use of inheritance in object oriented programming.
48.02	Compare and contrast single and multiple inheritance.
48.03	Explain the purpose and implementation of classes that cannot serve as a base class (a sealed class).
48.04	Describe has-a and is-a relationships.
48.05	Create class hierarchies using inheritance.
48.06	Declare and use a class derived from another class (implementing an is-a relationship).
48.07	Declare and use a class where the derived class overrides methods of the base class.

48.08	Declare and use a class that contains another class as a data member (implementing a has-a relationship).
48.09	Write statements that determine at run time whether an instance of a class is derived from a specific base class or interface.
48.10	Write statements that invoke a method of the base class from a derived class.
48.11	Identify which class methods can be inherited and which cannot.
48.12	Explain how access modifiers affect the inheritance of class variables and methods.
49.0	Write .NET programs that use the object-oriented concept of polymorphism. The student will be able to:
49.01	Explain the purpose and implementation of classes that cannot be instantiated (an abstract class).
49.02	Explain the purpose and implementation of virtual class methods that must be overridden by derived classes.
49.03	Explain the use of abstract classes in enforcing polymorphism.
49.04	Create an abstract class.
49.05	Create classes that derive from an abstract class.
49.06	Create a program that uses polymorphism.
50.0	Write .NET programs that use the object-oriented concept of encapsulation. The student will be able to:
50.01	Define and use classes that use access modifiers (e.g., private, public, protected, internal, internal protected) to provide encapsulation of data.
50.02	Explain the restrictions on using accessibility levels.
50.03	Compare and contrast different types of variable scope, including block, procedure, module/class, and project scope.
50.04	Compare and contrast different types of method scope, including public, private, protected, friend, and protectedfriend.
50.05	Write programs that use local variables.
50.06	Describe the scope of a given variable.
50.07	Describe how the compiler uses scope to distinguish between variables with the same name.
50.08	Explain the purpose and use of static classes, variables and methods.
50.09	Write programs that create and use static classes, variables, and methods.
51.0	Apply common programming style guidelines and conventions. The student will be able to:

51.01	List examples of good programming practices.
51.02	Insert comments into code.
51.03	Follow formatting guidelines when writing code.
51.04	Define guidelines for declaring and initializing variables.
52.0	Use application life cycle management to develop and maintain .NET programs. The student will be able to:
52.01	Describe the stages in the life cycle of an application.
52.02	Describe tools used to manage each stage in the life cycle of an application and how each is used to ensure the integrity of the product.
52.03	Describe how the needs of the customer affect the development of an application.
52.04	Describe the different types of testing that are performed on an application.
52.05	Describe the role of tools such as UML (Unified Modeling Language) in ensuring the integrity of the application.
52.06	Describe different types of UML diagrams and guidelines for their use.
52.07	Develop a class based on its description in a UML diagram.
52.08	Read an application specification and translate it into a working program.
52.09	Describe the characteristics of different types of application development (e.g., Agile development).
52.10	Compare and contrast different methodologies for application development (e.g., Scrum, XP, Crystal, FDD, and DSDM).
52.11	Describe different methods for deploying applications.
53.0	Use nullable values in a .NET program. The student will be able to:
53.01	Describe the use of nullable value types.
53.02	Describe the use of the null value in .NET programs.
53.03	Write statements to declare and initialize nullable value types.
53.04	Write statements to determine if a nullable value type currently has a value.
54.0	Use the .NET String and StringBuilder classes in an application. The student will be able to:
54.01	Compare and contrast the String and StringBuilder classes.
54.02	Identify the performance implications of using the String and StringBuilder classes for different purposes.
54.03	Use the methods of the String class to compare, search, format, split and join strings.

54.04	Use the methods of the String and StringBuilder classes to find, replace, delete, and insert substrings.
54.05	Use the methods of the String class to translate a string into uppercase or lowercase.
54.06	Use culture information to modify strings.
55.0	Use .NET classes to perform stream input/output. The student will be able to:
55.01	Compare and contrast .NET classes used to perform file input/output (e.g., StreamReader, StreamWriter, StringReader, StringWriter, MemoryStream, BinaryReader, BinaryWriter).
55.02	Compare and contrast .NET classes used to manipulate files and directories (e.g., Directory, DirectoryInfo, File, FileInfo, Path).
55.03	Use .NET classes to search, add, and delete directories.
55.04	Use .NET classes to search, add, and delete files.
55.05	Use .NET classes to read and write text to a file.
55.06	Use .NET classes to read and write objects of a variety of types to a file.
55.07	Use .NET classes to read and write binary data to a file.
55.08	Compare and contrast .NET classes used to compress data (e.g., GZipStream, DeflateStream).
55.09	Use .NET classes to read and write compressed data to a file.
56.0	Use recursive functions to solve problems in .NET programs. The student will be able to:
56.01	Describe the use of recursive methods in solving problems.
56.02	Describe the difference of iterative and recursive methods.
56.03	Demonstrate the use of direct recursion.
56.04	Demonstrate the use of indirect recursion.
57.0	Write .NET programs that use interfaces. The student will be able to:
57.01	Describe interfaces and their use in .NET programming.
57.02	Declare and use a class that implements a standard interface.
57.03	Compare and contrast inheritance from a base class and inheritance of an interface.
57.04	Identify common interfaces and their purposes (e.g., IComparable, IComparer, IEquatable, IDisposable, IFormattable, IConvertible).
57.05	Define and use a custom interface.

57.06	Write classes that implement common interfaces (e.g., IComparable, IComparer, IEquatable, IDisposable, IFormattable, IConvertible).
57.07	Describe the program to interface principle and its benefits.
58.0	Use .NET collections in applications. The student will be able to:
58.01	Compare and contrast common non-generic collection classes, including ArrayList, BitArray, HashTable, Queue, and Stack.
58.02	Write programs that use common non-generic collection classes.
58.03	Compare and contrast non-generic collection classes to generic collection classes.
58.04	Compare and contrast common generic collection classes, including Dictionary, LinkedList, Queue, SortedDictionary, SortedList, and Stack.
58.05	Write programs that use common generic collection classes.
58.06	Identify the collection class that is the best choice for different application requirements.
58.07	Use iterators to access individual members of different types of collections.
58.08	Use standard methods to add, delete, and modify members of different types of collections.
58.09	Write statements to access members of a dictionary based on a key.
58.10	Write statements to determine the existence of members of a dictionary based on a key or a value.
59.0	Demonstrate knowledge of different types of .NET applications. The student will be able to:
59.01	Compare and contrast different types of .NET applications (e.g., Console, Windows Form, WPF, Windows Service, Class Library, web, and database).
59.02	Choose the best type of application to develop for a given application scenario.
59.03	Describe the characteristics and capabilities of a console application.
59.04	Develop, test, and debug a console application.
59.05	Write a console application that uses command-line arguments.
60.0	Demonstrate knowledge of .NET architecture and tools. The student will be able to:
60.01	Describe components of the .NET architecture, including the Common Language Runtime (CLR), just-in-time (JIT) compiler, intermediate language (IL).
60.02	Describe the steps required for a managed assembly to be built and run in the .NET environment.
60.03	Compile single-file and multi-file assemblies using command-line tools.

60.04	Describe common command-line tools used in developing .NET applications (e.g., Al.exe, Caspol.exe, Ildasm.exe, Makecert.exe, Sn.exe, Gacutil.ext) and their purposes.
60.05	Use a signing tool to sign an assembly.
60.06	Use a disassembly tool to view the classes, members, and methods of an assembly.
60.07	Describe the garbage collection process.
61.0	Demonstrate knowledge of web applications. The student will be able to:
61.01	Describe the web as a platform for applications.
61.02	Compare and contrast static and dynamic content.
61.03	Describe how webpages are loaded to a computer from the Internet including the hardware, software, servers, and protocols required.
61.04	Compare and contrast server-side and client-side programming.
61.05	Describe how a web browser downloads and renders a webpage.
61.06	Describe options and methodology for website deployment.
61.07	Compare and contrast different web development technologies, including HTML, CSS, JavaScript, CGI scripts, XML, and ASP.NET.
61.08	Describe common webpage terminology (e.g., page life cycle, the webpage event model, webpage state management, cookies, virtual directories).
61.09	Define the steps in the page life cycle of an ASP.NET webpage.
61.10	Describe state management as it related to maintenance of page information.
61.11	Describe how web services are accessed from a client application.
61.12	Describe thePostBack mechanism for posting data to a webpage using ASP.NET.
61.13	Describe the role of Internet Information Services (IIS).
61.14	Describe the role of Internet Service Providers (ISP) and the services they provide.
61.15	Describe web services and related tools (e.g., Extensible Markup Language (XML), Simple Object Access Protocol (SOAP) and Web Service Definition Language (WSDL)).
61.16	Describe the characteristics and purposes of Application objects and Session objects that are maintained by the ASP.NET run-time engine.
61.17	Describe the common ASP.NET events for applications and sessions (i.e., application start, application end, application error, session start, session end).
61.18	Describe entities that define standards for Internet applications (e.g., WS3, OASIS, WS-I).
62.0	Develop webpages using HTML, CSS, JavaScript, and ASP.NET. The student will be able to:

62.01	Describe the characteristics and capabilities of a web application.
62.02	Develop webpages using HTML (Hyper-text Markup Language) that include commonly used tags to define webpages with hyperlinks, tables, text, headings, images, backgrounds, and frames.
62.03	Develop webpages using CSS (cascading style sheets) to define a uniform appearance across multiple webpages.
62.04	Develop webpages using JavaScript to define and implement interactive content.
62.05	Define and use functions in JavaScript.
62.06	Define and use local and global variables using JavaScript.
62.07	Use conditional operators in JavaScript to selectively perform specific function.
62.08	Use Boolean conditions in JavaScript to selectively perform with multiple conditions.
62.09	Use JavaScript loops to perform iteration.
62.10	Use string objects and escape sequences in a JavaScript.
62.11	Use JavaScript to access, use, and modify HTML elements.
62.12	Use JavaScript to handle common events, including mouse events, key events, and page events.
62.13	Use JavaScript to create and manage forms within a webpage.
62.14	Develop webpages that use ASP.NET to provide interactivity.
62.15	Describe standards for making webpages accessible to individuals with disabilities.
62.16	Develop webpages that conform to accessibility standards.
63.0	Develop .NET Windows Form applications. The student will be able to:
63.01	Describe the characteristics and capabilities of a Windows Forms application.
63.02	Compare and contrast common objects used in Windows Forms applications (e.g., Button, CheckBox, ColorDialog, ComboBox, DateTimePicker, GroupBox, Label, LinkLabel, ListBox, MenuStrip, Panel, PictureBox, RadioButton, ToolTip).
63.03	Develop an interactive Windows Forms application that uses a variety of objects for input and output.
63.04	Perform data validation on input fields.
63.05	Describe the Windows Forms event model.
63.06	Create Windows Forms application that respond to common events, including mouse events, keyboard events, load events, click events, resize events, and drag events.

63.07	Define Windows Forms applications with graphical user interfaces (GUI) that conform to appropriate usability guidelines.
63.08	Create Windows Forms applications that use Multiple Document Interface (MDI) and Single Document Interface (SDI).
63.09	Describe visual inheritance.
63.10	Develop a Windows Forms application that inherits a form from a base application.
64.0	Develop Windows Service applications and class libraries. The student will be able to:
64.01	Describe the characteristics and capabilities of a Windows Service application.
64.02	Describe the states in the lifetime of a service.
64.03	Describe the ServiceBase and ServiceController classes and their role in developing and controlling Windows Service applications.
64.04	Develop a Windows Service application.
64.05	Develop an installer for a Windows Service application.
64.06	Install and deploy a Windows Service application.
64.07	Test and debug a Windows Service application.
64.08	Uninstall a Windows Service application.
64.09	Develop, test, and debug a Class Library.
65.0	Demonstrate knowledge of database applications. The student will be able to:
65.01	Explain common database terminology (e.g., relationships, normalization, fields, records, data integrity, referential integrity).
65.02	Describe the benefits and characteristics of relational databases.
65.03	Define primary keys and foreign keys and describe their purposes.
65.04	Explain how database design fits into the database application development process.
65.05	Translate an entity-relationship model into a relational database design.
65.06	Differentiate between one-to-one, one-to-many, and many-to-many relationships.
65.07	Move data from an unnormalized form through to a third normal form.
65.08	Based on information requirements, define database tables that ensure data integrity and reduce redundant data.
65.09	Describe routine maintenance for databases.
66.0	Demonstrate knowledge of structured query language (SQL) statements. The student will be able to:

66.01	Describe the data manipulation language (DML) and describe various DML statements.
66.02	List the capabilities of SQL SELECT statements.
66.03	Write and execute a basic SELECT statement.
66.04	Write and execute SELECT statements using the WHERE clause with common operators (i.e., =, <>, >, <, >=, <=, BETWEEN, LIKE, IN).
66.05	Write and execute SELECT statements using the WHERE clause with logical operators, including AND and OR.
66.06	Write and execute SELECT statements using the ORDER BY clause.
66.07	Write and execute SELECT statements using wildcards.
66.08	Write and execute UPDATE statements to modify rows in a table.
66.09	Write and execute INSERT statements to insert rows into a table.
66.10	Write and execute DELETE statements to delete rows in a table.
66.11	Write and execute statements using JOIN to select data from two or more related tables.
66.12	Write and execute statements that use SQL to perform common calculations (e.g., AVG, MAX, MIN, SUM).
67.0	Develop .NET database applications. The student will be able to:
67.01	Describe the purpose of ActiveX Data Objects (ADO).
67.02	Describe the purpose of the ADO connection object.
67.03	Write statements to connect to a database.
67.04	Write statements to open a database.
67.05	Write statements to create a recordset.
67.06	Write statements to commit a transaction to a database.
67.07	Write statements to rollback a transaction to a database.
67.08	Write statements to close a connection to a database.
67.09	Develop, test, and debug a database application.
67.10	Develop, test, and debug a WPF application.
68.0	Successfully work as a member of a software development team. The student will be able to:

68.01	Accept responsibility for specific tasks in a given situation.
68.02	Document progress, and provide feedback on work accomplished in a timely manner.
68.03	Complete assigned tasks in a timely and professional manner.
68.04	Reassign responsibilities when the need arises.
68.05	Complete daily tasks as assigned on one's own initiative.
69.0	Manage time according to a plan. The student will be able to:
69.01	Set realistic time frames and schedules.
69.02	Keep a written record of work accomplished on a daily basis.
69.03	Meet goals and objectives set by the team.
69.04	Identify individual priorities.
69.05	Complete a weekly evaluation of accomplishments, and reevaluate goals, objectives and priorities, as needed.
70.0	Keep acceptable records of progress problems and solutions. The student will be able to:
70.01	Develop and use a record keeping system to record daily progress.
70.02	Use a project journal to identify problem statement.
70.03	Develop a portfolio of work accomplished to include requirements documents, design documents and UML, project and test plans, and prototypes.
71.0	Plan, organize, and carry out a project plan. The student will be able to:
71.01	Identify a substantive problem that can be addressed with a .NET software solution.
71.02	Identify and document the potential customers for the project.
71.03	Identify and document the customer requirements for the project including use case definitions.
71.04	Document the proposed user interface for the project using common tools (e.g., mockups, event planning documents).
71.05	Identify the hardware and software requirements for the project.
71.06	Identify the programming tools required to develop the project.
71.07	Write a detailed design document for the project.
71.08	Write a detailed test plan for the project that addresses varying levels of testing including system testing and usability testing.
71.09	Determine the scope of a project.

71.10	Organize the team according to individual strengths.
71.11	Assign specific tasks within a team.
71.12	Determine project priorities.
71.13	Identify required resources to complete the project.
71.14	Plan, research, design, develop, and evaluate activities, as required.
71.15	Carry out the project plan to successful completion.
71.16	Document design problems, test results, product defects, and resolutions.
72.0	Manage resources. The student will be able to:
72.01	Identify required resources for each stage of the project plan.
72.02	Determine the methods needed to acquire needed resources.
72.03	Demonstrate good judgment in the use of resources.
72.04	Recycle and reuse resources where appropriate.
72.05	Demonstrate an understanding of proper legal and ethical treatment of copyrighted material.
73.0	Use tools, materials, and processes in an appropriate and safe manner. The student will be able to:
73.01	Identify the proper tool for a given job.
73.02	Use tools and machines in a safe manner.
73.03	Adhere to laboratory or job site safety rules and procedures.
73.04	Identify the application of processes appropriate to the task at hand.
73.05	Identify materials appropriate to their application.
74.0	Demonstrate an understanding of the software development process. The student will be able to:
74.01	State the goals of the software application clearly.
74.02	Identify and write a plan to achieve each goal.
74.03	Develop a list of materials and content required for each goal.
74.04	Develop a step-by-step procedure for developing the application.
74.05	Follow a written procedure.

74.06	Record data from evaluation activities.
74.07	Document conclusions and solutions based on evaluation results, observations and data.
74.08	Document progress using a project log.
74.09	Write an abstract describing the project plan.
75.0	Research content related to the project and document the results following industry conventions. The student will be able to:
75.01	Identify the basic research needed to develop the project plan.
75.02	Identify available resources for completing background research required in the project plan.
75.03	Demonstrate the ability to locate resource materials in a library, database, Internet and other research resources.
75.04	Demonstrate the ability to organize information retrieval.
75.05	Demonstrate the ability to prepare a topic outline.
75.06	Write a draft of the research report.
75.07	Edit and proof the research report. Use proper form for a bibliography, footnotes, quotations, and references.
75.08	Prepare an electronically composed research paper in proper form.
75.09	Conduct an alpha and beta evaluation of the project's product.
75.10	Write a report on the evaluations, documenting results, data, observations, and design changes based on the results.
76.0	Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience. The student will be able to:
76.01	Prepare a multi-media presentation on the completed project.
76.02	Make an oral presentation about the project using the multi-media materials.
76.03	Review the presentation, and make changes in the delivery method(s) to improve presentation skills.
77.0	Demonstrate competency in the area of expertise related to developing computer software using the .NET framework. The student will be able to:
77.01	Demonstrate a mastery of the content of the selected subject area.
77.02	Demonstrate the ability to use related technological tools, materials and processes related to the specific program area.
77.03	Demonstrate the ability to apply the knowledge, experience and skill developed in the previous program completion to the successful completion of this demonstration.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: Web Application Development & Programming
Program Type: Career Preparatory
Career Cluster: Information Technology

Career Certificate Program

Program Number	Y700500
CIP Number	0511020102
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the <u>Program Structure</u> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of programming and software development; procedural and object-oriented programming; creating web-based applications, including testing, monitoring, debugging, documenting, and maintaining applications.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points, with OCPs A, B, C, and D.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0041	Computer Programmer Assistant	BUS ED 1 @2	300 hours	15-1131
C	CTS0044	Computer Programmer	COMP SCI 6	150 hours	15-1131
D	CTS0034	Web Programmer	COMP PROG 7 G	450 hours	15-1131

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

Standards

Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 16.0 Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development.
- 17.0 Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types.
- 18.0 Distinguish between iterative and non-iterative program control structures.
- 19.0 Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages.
- 20.0 Describe the processes, methods, and conventions for software development and maintenance.
- 21.0 Explain the types, uses, and limitations of testing for ensuring quality control.
- 22.0 Create a program design document using Unified Modeling Language (UML) or other common design tool.
- 23.0 Solve problems using critical thinking skills, creativity and innovation.
- 24.0 Use information technology tools.
- 25.0 Describe the importance of security and privacy information sharing, ownership, licensure and copyright.
- 26.0 Design a computer program to meet specific physical, operational, and interaction criteria.
- 27.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
- 28.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
- 29.0 Effectively communicate and collaborate.
- 30.0 Demonstrate responsible use of technology and information.

- 31.0 Explain key concepts that distinguish object-oriented programming from procedural programming.
- 32.0 Create a project plan that defines requirements, structural design, time estimates, and testing elements.
- 33.0 Design, document, and create object-oriented computer programs.
- 34.0 Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results.
- 35.0 Understand human interactions in intelligence.
- 36.0 Demonstrate proficiency using HTML and XHTML to create web content.
- 37.0 Demonstrate proficiency using cascading style sheets (CSS) to format webpages.
- 38.0 Demonstrate proficiency using basic client-side scripting to control the content and the behavior of HTML and XHTML documents.
- 39.0 Demonstrate an understanding of JavaScript programming fundamentals.
- 40.0 Demonstrate proficiency in assigning and handling variables in JavaScript programs and functions.
- 41.0 Use event handlers in JavaScript programs and functions.
- 42.0 Recognize and assign data types appropriate to their use.
- 43.0 Demonstrate proficiency in using appropriate operators to achieve a planned output.
- 44.0 Write executable statements.
- 45.0 Demonstrate an understanding of variable scope.
- 46.0 Use good programming practices.
- 47.0 Demonstrate use of the Document Object Module (DOM).
- 48.0 Use conditional control statements in JavaScript.
- 49.0 Use iterative control statements in JavaScript.
- 50.0 Use nested loop iterative control statements in JavaScript.
- 51.0 Use JavaScript to produce input and output for programs.
- 52.0 Demonstrate proficiency in using Form Objects in JavaScript programs and functions.
- 53.0 Demonstrate proficiency in using methods in JavaScript programs and functions.
- 54.0 Demonstrate proficiency in using parameters in JavaScript programs and functions.
- 55.0 Utilize debugging techniques in programs.
- 56.0 Recognize security risks in programs.
- 57.0 Use plug-ins and libraries.
- 58.0 Demonstrate proficiency in programming for mobile delivery technology (e.g., iPhone/Android).
- 59.0 Demonstrate an understanding of Personal Home Page (PHP) programming language.
- 60.0 Demonstrate proficiency in PHP configuration.
- 61.0 Demonstrate an understanding of PHP language basics.
- 62.0 Demonstrate proficiency in the use of server processes.
- 63.0 Demonstrate an understanding of object-oriented programming in PHP.
- 64.0 Demonstrate proficiency in writing PHP code to handle file input/output (I/O) operations.
- 65.0 Demonstrate proficiency in creating, populating, and using arrays in PHP.
- 66.0 Demonstrate proficiency handling strings in PHP.
- 67.0 Demonstrate proficiency in using PHP to access databases via Open Database Connectivity (ODBC).
- 68.0 Demonstrate proficiency in applying best practices for ensuring creation of a secure program.
- 69.0 Demonstrate an understanding of key technologies, protocols, and architectures associated with web development and programming.

Florida Department of Education
Student Performance Standards

Program Title: Web Application Development & Programming
Career Certificate Program Number: Y700500

Course Number: OTA0040
Occupational Completion Point: A
Information Technology Assistant – 150 Hours – SOC Code 15-1151

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

Course Number: CTS0041
Occupational Completion Point: B
Computer Programmer Assistant – 300 Hours – SOC Code 15-1131

15.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. The student will be able to:
15.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
15.02	Locate, organize and reference written information from various sources.
15.03	Construct writings and/or communications using developmentally appropriate terminology.
15.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
15.05	Analyze the positive and negative impacts of technology on popular culture and personal life.
15.06	Discuss how technology has changed the way people build and manage organizations and how technology impacts personal life.
15.07	Evaluate ways in which adaptive technologies may assist users with special needs.
15.08	Explain how societal and economic factors are affected by access to critical information.
15.09	Discuss the challenges (e.g., political, social, and economic) in providing equal access and distribution of technology in a global society.
16.0	Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development. The student will be able to:
16.01	Explore a variety of careers to which computing is central.
16.02	Compare and contrast appropriate and inappropriate social networking behaviors.
16.03	Discuss the impact of computing on business and commerce (e.g., automated inventory processing, financial transactions, e-commerce, virtualization, cloud computing).
16.04	Evaluate the impacts of irresponsible use of information (e.g., plagiarism, falsification of data) on collaborative projects.
16.05	Identify tasks performed by programmers.
16.06	Describe how businesses use computer programming to solve business problems.
16.07	Investigate job opportunities in the programming field.
16.08	Explain different specializations and the related training in the computer programming field.
16.09	Explain the need for continuing education and training of computer programmers.
16.10	Understand and identify ways to use technology to support lifelong learning.
16.11	Explain enterprise software systems and how they impact business.

16.12	Describe ethical responsibilities of computer programmers.
16.13	Describe the role of customer support to software program quality.
16.14	Identify credentials and certifications that may improve employability for a computer programmer.
16.15	Identify devices, tools, and other environments for which programmers may develop software.
17.0	Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types. The student will be able to:
17.01	Identify the characteristics (e.g., size, limits) and uses of different numerical and non-numerical data types.
17.02	Explain the types and uses of variables in programs.
17.03	Determine the best data type to use for given programming problems.
17.04	Compare and contrast simple data structures and their uses.
17.05	Identify the types of operations that can be performed on different data types.
17.06	Evaluate arithmetic and logical expressions using appropriate operator precedence.
17.07	Explain how computers store different data types in memory.
17.08	Demonstrate the difference between "data" and "information".
17.09	Use different number systems to represent data.
17.10	Explain how national and international standards (i.e., ASCII, UNICODE) are used to represent non-numerical data.
17.11	Use Boolean logic to perform logical operations.
18.0	Distinguish between iterative and non-iterative program control structures. The student will be able to:
18.01	Create non-iterative programming structures and explain their uses.
18.02	Create iterative programming structures and explain their uses.
18.03	Explain how sequence, selection, and iteration are building blocks of algorithms.
19.0	Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages. The student will be able to:
19.01	Differentiate between multiple levels of an operating system, translation, and interpretation that support program execution.
19.02	Explain the program execution process (by an interpreter and in CPU hardware).
19.03	Describe object-oriented concepts.

19.04	Explain the characteristics of procedural and object-oriented programming languages.
19.05	Compare and contrast programming languages that are compiled, interpreted, and translated.
19.06	Classify programming languages by paradigm and application domain (e.g., imperative, functional, logic languages and how well suited they are for certain application domains such as web programming, symbolic processing, data/numerical processing).
20.0	Describe the processes, methods, and conventions for software development and maintenance. The student will be able to:
20.01	Describe a software development process that is used to solve problems at different software development stages.
20.02	Describe and demonstrate ethical and responsible use of modern communication media and devices.
20.03	Define alternative methods of program development (e.g., rapid prototyping, waterfall, spiral model, peer coding).
20.04	List and explain the steps in the program development cycle.
20.05	Describe different types of documentation used in the program development cycle (e.g., requirements document, program design documents, test plans).
20.06	Describe different methods used to facilitate version control.
21.0	Explain the types, uses, and limitations of testing for ensuring quality control. The student will be able to:
21.01	Explain the uses and limits of testing in ensuring program quality.
21.02	Explain testing performed at different stages of the program development cycle (e.g., unit testing, system testing, user acceptance testing).
21.03	Describe and identify types of programming errors.
21.04	Analyze and manipulate data collected by a variety of data collection techniques.
21.05	Explain what tools are applied to provide automated testing environments.
22.0	Create a program design document using common design tool. The student will be able to:
22.01	Describe different design methodologies and their uses (e.g., object-oriented design, structured design, rapid application development).
22.02	Describe tools for developing a program design (e.g., Unified Modeling Language, flowcharts, design documents, pseudocode).
22.03	Explain the role of existing libraries and packages in facilitating programmer productivity.
22.04	Participate and contribute to a design review of a program design developed using a common program design tool (e.g., UML, flowcharts, design documents, pseudocode).
22.05	Write a program design document using standard design methodology.
22.06	Define input and output for a program module using standard design methodology.

23.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
23.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
23.02	Employ critical thinking and interpersonal skills to resolve conflicts.
23.03	Identify and document workplace performance goals and monitor progress toward those goals.
23.04	Conduct technical research to gather information necessary for decision-making.
23.05	Discuss digital tools or resources to use for a real-world task based on their efficiency and effectiveness, individually and collaboratively.
24.0	Use information technology tools. The student will be able to:
24.01	Use personal information management (PIM) applications to increase workplace efficiency.
24.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
24.03	Employ computer applications to access, create, manage, integrate, and store information.
24.04	Employ collaborative/groupware applications to facilitate group work.
24.05	Use a development process in creating a computational artifact, individually and collaboratively, followed by reflection, analysis, and iteration (e.g., data-set analysis program for science and engineering fair, capstone project that includes a program, term research project based on program data).
25.0	Describe the importance of security and privacy information sharing, ownership, licensure and copyright. The student will be able to:
25.01	Describe security and privacy issues that relate to computer networks including the permanency of data on the Internet, online identity, and privacy.
25.02	Discuss the impact of government regulation on privacy and security.
25.03	Describe how different types of software licenses (e.g., open source, proprietary licenses) can be used to share and protect intellectual property.
25.04	Explain how access to information may not include the right to distribute the information.
25.05	Describe differences between open source, freeware, and proprietary software licenses, and how they apply to different types of software.
25.06	Discuss security and privacy issues that relate to computer networks.
25.07	Identify computer-related laws and analyze their impact on digital privacy, security, intellectual property, network access, contracts, and harassment.
26.0	Design a computer program to meet specific physical, operational, and interaction criteria. The student will be able to:
26.01	Choose appropriate data types depending on the needs of the program.

26.02	Define appropriate user prompts for clarity and usability (e.g., user guidance for data ranges, data types).
26.03	Design and develop program for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
26.04	Compare techniques for analyzing massive data collections.
26.05	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
26.06	Create mobile computing applications and/or dynamic webpages through the use of a variety of design and development tools, programming languages and mobile devices/emulators.
26.07	Explain the role of an application programming interface (API) in the development of applications and the distinction between a programming language's syntax and the API.
26.08	Identify the tools required to develop a program (e.g., editors, compilers, linkers, integrated development environments, APIs, libraries).
26.09	Use an industrial-strength integrated development environment to implement a program.
27.0	Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types. The student will be able to:
27.01	Use appropriate naming conventions to define program variables and methods.
27.02	Use a program editor to write the source code for a program.
27.03	Write programs that use selection structures.
27.04	Write programs that use repetition structures.
27.05	Write programs that use nested structures.
27.06	Use internal documentation (e.g., single-line and multi-line comments, program headers, module descriptions, meaningful variable and function/module names) to document a program according to accepted standards.
27.07	Compile, run, test and debug programs.
27.08	Write programs that use standard arithmetic operators with different numerical data types.
27.09	Write programs that use standard logic operators.
27.10	Write programs that use a variety of common data types.
27.11	Write programs that perform data conversion between standard data types.
27.12	Write programs that define, use, search, and sort arrays.
27.13	Write programs that use user-defined data types.

27.14	Demonstrate understanding and use of appropriate variable scope.
27.15	Explain recursive programming structure.
27.16	Use global and local scope appropriately in program implementation.
28.0	Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input. The student will be able to:
28.01	Critically examine classical algorithms and implement an original algorithm.
28.02	Write programs that perform user input and output.
28.03	Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
28.04	Write program modules such as functions, subroutines, or methods.
28.05	Write program modules that accept arguments.
28.06	Write program modules that return values.
28.07	Write program modules that validate arguments and return error codes.
28.08	Design and implement a simple simulation algorithm to analyze, represent and understand natural phenomena.
28.09	Use APIs and libraries to facilitate programming solutions.
28.10	Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common programming standards.
29.0	Effectively communicate and collaborate. The student will be able to:
29.01	Evaluate modes of communication and collaboration.
29.02	Select appropriate tools within a project environment to communicate with project team members.
29.03	Utilize project collaboration tools (such as version control systems and integrated development environments) while working on a collaborative software project.
29.04	Generate, evaluate, and prioritize questions that can be researched through digital resources and online tool.
29.05	Perform advanced searches to locate information and/or design a data-collection approach to gather original data.
29.06	Communicate and publish key ideas and details to a variety of audiences using digital tools and media-rich resources.
30.0	Demonstrate responsible use of technology and information. The student will be able to:
30.01	Explain the principles of cryptography by examining encryption, digital signatures, and authentication methods (e.g. explain why and how certificates are used with https for authentication and encryption).

30.02 Implement an encryption, digital signature, or authentication method.

30.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

Course Number: CTS0044
Occupational Completion Point: C
Computer Programmer – 150 Hours – SOC Code 15-1131

31.0	Explain key concepts that distinguish object-oriented programming from procedural programming. The student will be able to:
31.01	Demonstrate the understanding and use of classes, objects, attributes, and behaviors.
31.02	Demonstrate the understanding and use of inheritance.
31.03	Demonstrate the understanding and use of data encapsulation.
31.04	Demonstrate the understanding and use of polymorphism.
31.05	Use predefined functions and parameters, classes, and methods to divide a complex problem into simpler parts by using the principle of abstraction to manage complexity (e.g., by using searching and sorting as abstractions).
32.0	Create a project plan for an object-oriented programming project that defines requirements, structural design, time estimates, and testing elements. The student will be able to:
32.01	Write a project plan for completion of a project that includes gathering program requirements, developing the program, and testing it.
32.02	Write a program requirements document that identifies business purpose, functional requirements, system requirements, and other common components of a requirements document.
32.03	Design an object-oriented program using standard design methodology.
32.04	Work with other team members to develop a project plan for a program.
32.05	Work with other team members to write a design document for a program with multiple functions and shared data.
32.06	Participate in design meetings that review program design documents for conformance to program requirements.
32.07	Estimate the time to develop a program or module.
32.08	Evaluate algorithms by their efficiency, correctness, and clarity (e.g., by analyzing and comparing execution times, testing with multiple inputs or data sets, and by debugging).
33.0	Design, document, and create object-oriented computer programs. The student will be able to:
33.01	Compare and contrast recursive functions to iterative methods.
33.02	Understand the implementation of character strings in the programming language.
33.03	Write programs that perform string processing (e.g., manipulating, comparing strings, concatenation).
33.04	Write programs that implements user-defined data types.
33.05	Decompose a problem by defining new functions and classes.

33.06	Write object-oriented programs that implement inheritance.
33.07	Write object-oriented programs that implement polymorphism.
33.08	Develop class constructors.
33.09	Write programs that define and use program constants.
33.10	Write programs that perform error handling.
33.11	Participate in program code review meetings to evaluate program code for validity, quality, performance, data integrity, and conformance to program design documents.
33.12	Describe the concept of parallel processing as a strategy to solve large problems.
33.13	Demonstrate concurrency by separating processes into threads of execution and dividing data into parallel streams.
33.14	Update a program module to implement enhancements or corrections and demonstrate appropriate documentation (internal and external) related to version control.
33.15	Write programs that use complex data structures (e.g., stacks, queues, trees, linked list).
33.16	Write programs that are event-driven.
33.17	Write programs that perform file input and output (i.e., sequential and random access file input/output).
33.18	Explain intractable problems and understand that problems exist that are computationally unsolvable (undecidable) (e.g., classic intractable problems include Towers of Hanoi, TSP).
33.19	Explain the value of heuristic algorithms to approximate solutions for intractable problems (e.g., a heuristic solution to TSP).
34.0	Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results. The student will be able to:
34.01	Develop a test plan for an object-oriented program.
34.02	Write test plans for event-driven programs.
34.03	Write test plans for programs that perform file input and output.
34.04	Perform test and debug activities on object-oriented programs, including those written by someone else.
34.05	Perform test and debug activities on an event-driven program.
34.06	Perform test and debug activities on programs that perform file input and output and verify the correctness of output files.
34.07	Document the findings of testing in a test report.

35.0	Understand human interactions in intelligence. The student will be able to:
35.01	Describe the unique features of computers embedded in mobile devices and vehicles.
35.02	Describe the common physical and cognitive challenges faced by users when learning to use software and hardware.
35.03	Describe the process of designing software to support specialized forms of human-computer interaction.
35.04	Explain the notion of intelligent behavior through computer modeling and robotics.
35.05	Describe common measurements of machine intelligence (e.g., Turing test).
35.06	Describe a few of the major branches of artificial intelligence (e.g., expert systems, natural language processing, machine perception, machine learning).
35.07	Describe major applications of artificial intelligence and robotics, including, but not limited to, the medical, space, and automotive fields.

Course Number: CTS0034
Occupational Completion Point – D
Web Programmer – 450 Hours – SOC Code 15-1131

36.0	Demonstrate proficiency using HTML and XHTML to create web content. The student will be able to:
36.01	Use storyboarding techniques for designing a website (e.g., linear, hierarchical).
36.02	Identify elements of a webpage.
36.03	Create webpages using HTML and XHTML tags that create basic elements (e.g., links, lists, formatted text, tables).
36.04	Create webpages that utilize tables to achieve complex layout.
36.05	Add graphic content to webpages.
36.06	Create webpages that utilize client-side image maps.
36.07	Develop, integrate, and apply the use of forms in website design.
36.08	Optimize web content for desirable search engine placement.
36.09	Demonstrate an understanding of browser compatibility issues by designing pages that comply with the current web Content Accessibility Guidelines issued by the World Wide Web Consortium (W3C).
36.10	Demonstrate an understanding of web accessibility issues by developing pages that meet Bobby accessibility checker criteria.
36.11	Explain basic XML syntax and how XHTML conforms to the XML standard.
36.12	Use a WYSIWYG editor to develop and manage a website.
36.13	Use markup validation tools to test HTML and XHTML documents for well-formed elements and make all corrections necessary to ensure compliance with W3C standards.
36.14	Analyze and modify HTML and XHTML source code developed by others.
37.0	Demonstrate proficiency using cascading style sheets (CSS) to format webpages. The student will be able to:
37.01	Explain the advantages and disadvantages of using Cascading Style Sheets (CSS) to format webpages.
37.02	Describe the difference between linked, embedded, imported and inline styles and explain how styles are inherited.

37.03	Explain the difference between classes, id, and span elements.
37.04	Utilize CSS properties within webpages to control page layout, fonts, colors, backgrounds, and other presentation effects.
37.05	Demonstrate understanding of the Box Model.
37.06	Demonstrate proficiency in creating 1 to 3 column layouts.
37.07	Create navigation system through CSS.
38.0	Demonstrate proficiency using basic client-side scripting to control the content and the behavior of HTML and XHTML documents. The student will be able to:
38.01	Describe the difference between server-side and client-side processing.
38.02	Describe the term “scripting language” and explain how scripting languages differ from compiled languages.
38.03	Create webpages that employ client-side scripting to control content and display.
39.0	Demonstrate an understanding of JavaScript programming fundamentals. The student will be able to:
39.01	Describe server side versus client side applications including interpreters.
39.02	Describe the purpose and use of an interpreter in relation to JavaScript.
39.03	Describe differences in different types of JavaScript implementations (i.e., Jscript, ECMA).
39.04	Declare and initialize variables.
39.05	Assign new values to variables.
39.06	Create and use constant variables.
39.07	Describe the difference of programming languages versus scripting languages.
39.08	Describe object based nature and platform independence.
39.09	Describe and demonstrate inline scripting.
40.0	Demonstrate proficiency in assigning and handling variables in JavaScript programs and functions. The student will be able to:
40.01	Describe how variables are used in programs.
40.02	Identify which data type should be used for a given value.
40.03	Identify the syntax for using variables.

40.04	Declare and initialize variables.
40.05	Assign new values to variables.
40.06	Create and use constant variables.
40.07	Describe and demonstrate the use of properties.
40.08	Describe identifiers and identify valid and invalid identifiers.
40.09	Describe and identify reserved words, delimiters, literals, and comments.
41.0	Use event handlers in JavaScript programs and functions. The student will be able to:
41.01	Describe the event model and five events (form, image, map, link, and window).
41.02	Demonstrate and use the window events load, focus, blur, and unload.
41.03	Demonstrate and use the form events change, reset, and submit.
41.04	Demonstrate and use the text events cut, paste, select, and copy.
41.05	Demonstrate and use the mouse events mousemove, mousedown, click, mousewheel, mouseover, mouseout and mouseover.
41.06	Demonstrate and use the keyboard events keyup, keydown, keypress.
41.07	Demonstrate using the appropriate event handlers with their associated events.
42.0	Recognize and assign data types appropriate to their use. The student will be able to:
42.01	Describe the data type categories.
42.02	Give examples of var, primitives, null, and undefined data types.
42.03	Demonstrate the use of var in relation to other datatypes.
43.0	Demonstrate proficiency in using appropriate operators to achieve a planned output. The student will be able to:
43.01	Construct statements using arithmetic operators.
43.02	Construct statements using relational operators.
43.03	Construct and use statements using logical operators.
43.04	Construct and use statements using string concatenation, and strict comparison.

43.05	Construct and use statements using assignment operators.
43.06	Construct and execute statements using operator precedence.
44.0	Write executable statements. The student will be able to:
44.01	Construct variable assignment statements.
44.02	Construct statements using built-in functions.
44.03	Describe when implicit data type conversions take place.
44.04	List the drawbacks of implicit data type conversions.
44.05	Construct statements using functions to explicitly convert data types.
45.0	Demonstrate an understanding of variable scope. The student will be able to:
45.01	Understand the scope and visibility of variables.
45.02	Write programs using local variables.
45.03	Describe the scope of a variable.
46.0	Use good programming practices. The student will be able to:
46.01	List examples of good programming practices.
46.02	Insert comments into code.
46.03	Demonstrate the use of <no script> tag.
46.04	Follow formatting guidelines when writing code.
46.05	Understand the different types of errors produced by programs.
47.0	Demonstrate use of the Document Object Module (DOM). The student will be able to:
47.01	Create and use user defined objects.
47.02	Create user defined objects with properties and methods.
47.03	Describe and Use the Array Object including its parameters, properties, and methods (chop, join, pop, push, splice, split).
47.04	Describe and Use the Date Object including its multiple constructors, properties, and methods (getDay, getMonth, getYear, getMinutes, getHous, getTime).

47.05	Describe and use the Window Object including \properties, and methods.
47.06	Describe and use the Image Object including its properties, and methods.
47.07	Describe and use the History Object including its properties, and methods.
47.08	Describe and use the RegEx Object for basic and complex regular expressions.
47.09	Describe and use the String Object including its properties, and methods.
47.10	Describe and use the Math Object including its properties, and methods.
48.0	Use conditional control statements in JavaScript. The student will be able to:
48.01	Construct and use an if statement.
48.02	Construct and use a switch statement.
48.03	Construct and use a while, do while, and for loop.
48.04	Construct and use a conditional operator.
49.0	Use iterative control statements in JavaScript. The student will be able to:
49.01	Describe the types of loop statements and their uses.
49.02	Construct and use the while and do while loop.
49.03	Construct and use the for loop.
49.04	Describe when a while loop is used.
49.05	Describe when a for loop is used.
50.0	Use nested loop iterative control statements in JavaScript. The student will be able to:
50.01	Construct and execute a program using nested loops.
50.02	Construct and execute a loop using break and continue.
50.03	Evaluate a nested loop construct and sentinel value.
51.0	Use JavaScript to produce input and output for programs. The student will be able to:

51.01	Describe and use the prompt() and confirm() to input data into programs.
51.02	Describe and demonstrate the use of the alert() to produce output to the console.
51.03	Describe and demonstrate how to input data using JavaScript Events.
51.04	Describe and demonstrate how to output using the document.write().
51.05	Explain the difference of prompt() and confirm() functions.
51.06	Create and use escape sequences.
52.0	Demonstrate proficiency in using Form Objects in JavaScript programs and functions. The student will be able to:
52.01	Use Form objects to validate input.
52.02	Access the value of the form object through its associated method.
52.03	Describe and use button, checkbox, textarea, select, radio, hidden, and text objects.
52.04	Access and modify values and attributes at runtime using getElementById, getElementsByName, getElementsByTagName, and inner HTML.
53.0	Demonstrate proficiency in using methods in JavaScript programs and functions. The student will be able to:
53.01	Differentiate between anonymous methods and methods.
53.02	Identify the benefits of using methods.
53.03	Describe and use inner method.
53.04	Create a method.
53.05	Describe how a method is invoked.
54.0	Demonstrate proficiency in using parameters in JavaScript programs and functions. The student will be able to:
54.01	Describe how parameters are passed into functions.
54.02	Define a parameter.
54.03	Create a method using a parameter.

54.04	Invoke a method that has parameters.
54.05	Distinguish between formal and actual parameters.
55.0	Utilize debugging techniques in programs. The student will be able to:
55.01	Use the display property to enable/disable code blocks.
55.02	Use document.write() to log program execution.
55.03	Test program in different browsers and mobile devices for compatibility errors.
55.04	Use comments as a flow control while debugging.
56.0	Recognize security risks in programs. The student will be able to:
56.01	Describe the security risk of cookies and browsers.
56.02	Identify security responsibilities of browsers and operating system.
56.03	Describe security systems such as frame to frame URL changing.
56.04	Describe the use of signed scripts.
56.05	Create and use cookies in a secure manner.
57.0	Use plug-ins and libraries. The student will be able to:
57.01	Use external libraries in the program.
57.02	Describe and contrast the following industry libraries JQuery, Dojo, LightBox, and Moo Tools, PhoneGap.
57.03	Describe different types of libraries full, effects, tools, graphing, math, cryptography, and AJAX.
57.04	Identify how load and reference external and user made scripts.
57.05	Describe AJAX elements and procedures.
57.06	Describe XML.
57.07	Demonstrate the use of XMLHttpRequest to retrieve data.
58.0	Demonstrate proficiency in programming for mobile delivery technology (e.g., iPhone/Android). The student will be able to:

58.01	Respond to multi-touch and gesture events.
58.02	Describe and demonstrate the use of webkit CSS.
58.03	Use the meta tag to enable native look and feel.
58.04	Create a splash screen.
58.05	Describe and demonstrate app caching.
58.06	Describe and demonstrate use of JQuery for mobile development.
58.07	Describe how to publish the app using XCode.
59.0	Demonstrate an understanding of Personal Home Page (PHP) programming language. The student will be able to:
59.01	Describe the evolution of PHP as a programming language.
59.02	Discuss the strengths and limitations of PHP.
60.0	Demonstrate proficiency in PHP configuration. The student will be able to:
60.01	Set up a PHP host (wamp, mamp, online).
60.02	Configure PHP for File Transfer Protocol (FTP) access.
60.03	Configure the config.php file.
61.0	Demonstrate an understanding of PHP language basics. The student will be able to:
61.01	Describe how variables are declared, referenced, and passed.
61.02	Describe the control structures inherent with PHP programming.
61.03	Describe the three types of arrays used in PHP.
61.04	Describe how functions in PHP are created, called, and controlled.
62.0	Demonstrate proficiency in the use of server processes. The student will be able to:
62.01	Describe a session and explain its importance and use in web programming.
62.02	Describe the server processes associated with forms handling.
62.03	Compare and contrast the use of GET and POST.

62.04	Describe cookies and explain their use, population, control, and risks.
62.05	Describe HTTP Headers and their role in web development.
62.06	Describe HTTP Authentication.
63.0	Demonstrate an understanding of object-oriented programming in PHP. The student will be able to:
63.01	Create classes using PHP.
63.02	Describe inheritance and its role in PHP programming.
63.03	Write PHP code to handle exceptions.
63.04	Write PHP code to accommodate different interfaces.
64.0	Demonstrate proficiency in writing PHP code to handle file input/output (I/O) operations. The student will be able to:
64.01	Write PHP code to perform open, read, and write operations on files.
64.02	Write PHP code to initiate file system functions.
64.03	Write PHP code to handle streams.
65.0	Demonstrate proficiency in creating, populating, and using arrays in PHP. The student will be able to:
65.01	Create, populate and write code to extract information from a numeric array in PHP.
65.02	Create, populate and write code to extract information from an associative array in PHP.
65.03	Create, populate and write code to extract information from a multidimensional array in PHP.
66.0	Demonstrate proficiency handling strings in PHP. The student will be able to:
66.01	Write PHP code to retrieve or extract one or more characters from a string.
66.02	Write PHP code to convert a string from data type to another.
66.03	Write PHP code to manipulate the display characteristics of string data.
66.04	Write PHP code that uses string date to control program flow.
66.05	Write PHP code to join array elements with a string.
67.0	Demonstrate proficiency in using PHP to access databases via Open Database Connectivity (ODBC). The student will be able to:
67.01	Write PHP code to create an ODBC connection and retrieve information from a database using the appropriate Structured Query

	Language (SQL) statement.
67.02	Describe a prepared statement and discuss its primary advantages (e.g., code efficiency, SQL Injection prevention).
67.03	Create a prepared statement to perform specific SQL actions.
67.04	Describe a PHP Data Object (PDO) transaction and explain its primary advantages.
67.05	Create a prepared statement and associated result set using PDOStatement.
68.0	Demonstrate proficiency in applying best practices for ensuring creation of a secure program. The student will be able to:
68.01	Describe an SQL Injection, its consequences, and ways in which it may be prevented via programming.
68.02	Describe the Remote Code Injection vulnerability in PHP and ways in which it may be prevented.
68.03	Describe the risk of session hijacking in PHP and ways to program around it.
68.04	Describe the risks associated with uploading files in PHP and ways in which risks might be mitigated.
68.05	Describe Secure Sockets Layer (SSL) and usage issues related to PHP.
69.0	Demonstrate an understanding of key technologies, protocols, and architectures associated with web development and programming. The student will be able to:
69.01	SimpleXML functions.
69.02	Extensible Markup Language (XML) Extension.
69.03	XML Path Language (Xpath).
69.04	Web Services.
69.05	Simple Object Access Protocol (SOAP).
69.06	Representational State Transfer (REST).
69.07	JavaScript Object Notation (JSON).
69.08	Asynchronous JavaScript and XML (AJAX).

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.