Florida Department of Education

Curriculum Frameworks

Engineering & Technology Education

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Florida Department of Education
Curriculum Framework

Program Title: **Technical Design**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8401000
CIP Number	0650040900
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of technical design. This program focuses on transferable skills and stresses understanding and operation of complex two and three-dimensional graphics, editing, and image analysis tools to better understand, illustrate, explain, and present technical concepts and principles. Science, math, and visual design concepts are reinforced throughout each course.

The content includes, but is not limited to, a study of the purposes, instruments, processes, and technical skills associated with technologies used in the design, creation, and deployment of technical design renderings. In addition to complex illustration tools, the content of this program includes the development of essential computer application skills (e.g., word processing, spreadsheet, presentation). The content and activities will also include the study of entrepreneurship, safety, and leadership 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 three credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8401010	Technical Design 1	DRAFTING @7 7G ENG 7G GRAPH ARTS @4 TEC ED 1 @2 ENG&TEC ED1@2	1 credit	3	CT
8401020	Technical Design 2		1 credit	3	CT
8401030	Technical Design 3		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 the characteristics and scope of technology.
02.0 Demonstrate an understanding of the core concepts of technology.
03.0 Demonstrate an understanding of the relationships among technologies and other fields of study.
04.0 Demonstrate an understanding of the influence of technology on history.
05.0 Demonstrate an understanding of the attributes of design.
06.0 Apply the principles of engineering design in the creation and evaluation of a prototype.
07.0 Be able to select and use information and communication technologies.
08.0 Demonstrate an understanding of the processes and technologies employed in the design and production of technical illustrations and drawings.
09.0 Demonstrate technical knowledge and skills about the use and care of drafting instruments, equipment, and materials.
10.0 Demonstrate technical skills and applications common to all types of drafting.
11.0 Demonstrate technical knowledge and skills for making basic orthographic drawings.
12.0 Demonstrate technical knowledge and skills for making pictorial drawings.
13.0 Demonstrate technical knowledge and skills for making auxiliary view drawings.
14.0 Demonstrate technical knowledge and skills for making sectional view drawings.
15.0 Demonstrate technical knowledge and skills for making working drawings.
16.0 Identify computer components and their functions.
17.0 Demonstrate proficiency with common computer peripherals, including connections to standard input and output devices.
18.0 Demonstrate knowledge of computer file management.
19.0 Demonstrate proficiency using the Internet to locate information.
20.0 Demonstrate an understanding of Internet safety and ethics.
21.0 Develop and apply word processing and document manipulation skills.
22.0 Develop a design portfolio.
23.0 Demonstrate an understanding of the various approaches used in problem solving.
24.0 Demonstrate abilities to apply the design process.
25.0 Create architectural drawings to industry standards.
26.0 Create a reverse engineered drawing (as built) from a solid object.
27.0 Create technical illustrations.
28.0 Demonstrate proficiency in using presentation software.
29.0 Develop and apply fundamental spreadsheet skills.
30.0 Demonstrate an understanding of color theory and its role in technical design.
31.0 Demonstrate an understanding of the elements and principles of graphic design.
32.0 Create technical illustrations using illustration software applications.
33.0 Create technical drawings using software applications.
34.0 Maintain a design portfolio.
35.0 Demonstrate technical writing skills.

36.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
37.0 Demonstrate the abilities to use and maintain technological products and systems.
38.0 Demonstrate the ability to assess the impact of products and systems.
39.0 Demonstrate technical knowledge and skills for making engineering drawings.
40.0 Demonstrate and present a research and design project.
41.0 Demonstrate an understanding of career opportunities and requirements in the field of drafting/illustrative design technology.
42.0 Demonstrate familiarity with techniques associated with digital photorealism.
43.0 Create complex technical drawings using appropriate software applications.
44.0 Prepare and present a design portfolio of work samples in a professional, presentable format.

Florida Department of Education
Student Performance Standards

Course Title: **Technical Design 1**
Course Number: **8401010**
Course Credit: **1**

Course Description:

This course provides students with instruction in the characteristics and evolution of technology, underlying principles of design, and fundamental knowledge and skills in the use of illustration and drafting software. Included in the content is the use of essential application software.
The ultimate output of this course is a design portfolio created by the student. Each item or product included in the portfolio should include a narrative description and an explanation of the technical approach or techniques used to create the item. Consideration should be given to having students present the portfolio using presentation software.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Discuss the nature and development of technological knowledge and processes.
01.02	Conduct specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Explain systems thinking and the relationship between logic, creativity, and compromise in solving complex problems.
02.02	Describe technological systems and their role within larger technological, social, and environmental systems.
02.03	Describe the trade-offs between competing values (e.g., availability, cost, desirability, waste, et al) in the selection of resources.
02.04	Describe the criteria and constraints of a solution and how they affect the final result.
02.05	Describe management and associated dynamics as they relate to technological development.
03.0	Demonstrate an understanding of the relationships among technologies and other fields of study. The student will be able to:
03.01	Discuss technology transfer and its role in the evolution of technology.
03.02	Describe the impact of sharing ideas, knowledge, or skills within a technology, among technologies, or across other fields.
03.03	Explain how technological progress promotes advancement of science and mathematics.

CTE Standards and Benchmarks	
04.0	Demonstrate an understanding of the influence of technology on history. The student will be able to:
04.01	Relate the advancement of technology to the evolution of civilization.
04.02	Describe ways in which technology helps to shape social, cultural, political, and economic aspects of society.
04.03	Describe the major technological developments that characterized the Industrial Revolution and their impact on society.
04.04	Describe the major technological developments that characterized the Information Age and their impact on society.
05.0	Demonstrate an understanding of the attributes of design. The student will be able to:
05.01	Describe the essential activities that comprise the design process.
05.02	Write a problem statement in sufficient clarity to enable design goals, requirements, and constraints to be identified.
05.03	Critique the design of a solution and revise the design as needed.
05.04	Explain how a design's criteria, constraints, and efficiency can compete with each other.
06.0	Apply the principles of engineering design in the creation and evaluation of a prototype. The student will be able to:
06.01	Describe the fundamental principles of design (i.e., flexibility, balance, function, and proportion) and how each guides the design process.
06.02	Describe how personal characteristics and collaborative effort influence the design process.
06.03	Test a design concept by creating a prototype suitable for determining the effectiveness of the design.
06.04	Identify factors taken into account in the process of engineering design.
07.0	Be able to select and use information and communication technologies. The student will be able to:
07.01	Describe and give examples of the essential elements of a communication system (i.e., inputs, processes, and outputs).
07.02	Describe and give examples of human to human, human to machine, machine to human, and machine to machine communications.
07.03	Use information and communication systems to inform, persuade, entertain, control, manage, and educate.
07.04	Compare and contrast the means of communicating visual messages (i.e., graphically, electronically) and associated forms (e.g., digital, analog, and multimedia).
07.05	Compare and contrast the forms for communicating technological information (e.g., symbols, icons, graphic, measurement, et al).

CTE Standards and Benchmarks	
08.0	Demonstrate an understanding of the processes and technologies employed in the design and production of technical illustrations and drawings. The student will be able to:
08.01	Differentiate between the types of computer generated illustrations (i.e., renderings, images, collages, and animations) and their appropriateness.
08.02	Describe the activities and rationale for each step in the technical illustration process (i.e., information gathering, model creation, scene creation, rendering, and post production).
08.03	Describe the range of activities involved in producing technical drawings, from rough sketch to final rendering.
08.04	Compare and contrast the technologies used to produce technical illustrations and drawings using manual and computer methods.
09.0	Demonstrate technical knowledge and skills about the use and care of drafting instruments, equipment, and materials. The student will be able to:
09.01	Identify and demonstrate technical knowledge and skills about the use and care of drafting instruments and equipment.
09.02	Demonstrate technical knowledge and skills about the properties, specifications, and use of drafting materials and supplies.
10.0	Demonstrate technical skills and applications common to all types of drafting. The student will be able to:
10.01	Apply lettering techniques.
10.02	Make freehand sketches.
10.03	Use drafting symbols and alphabet of lines in accordance with technical standards and practices.
10.04	Apply measuring techniques.
10.05	Apply industry standard dimensioning techniques.
10.06	Apply geometric construction techniques.
10.07	Interpret information from drawings, prints, and sketches.
10.08	Apply coordinate systems.
10.09	Produce and reproduce drawings using modern technical methods for drafting reproduction.
11.0	Demonstrate technical knowledge and skills for making basic orthographic drawings. The student will be able to:
11.01	Explain the theory of orthographic projection.
11.02	Identify the six principal views of an object.

CTE Standards and Benchmarks
11.03 Produce a three-view orthographic drawing using traditional drafting methods.
11.04 Produce a three-view orthographic drawing using CAD software.
12.0 Demonstrate technical knowledge and skills for making pictorial drawings. The student will be able to:
12.01 Explain methods of pictorial drawing.
12.02 Produce an isometric drawing using traditional drafting methods.
12.03 Produce an isometric drawing using CAD software.
12.04 Produce an oblique drawing using traditional drafting methods.
12.05 Produce an oblique drawing using CAD software.
12.06 Produce a perspective drawing using traditional drafting methods.
12.07 Produce a perspective drawing using CAD software.
13.0 Demonstrate technical knowledge and skills for making auxiliary view drawings. The student will be able to:
13.01 Explain terminology and concepts associated with auxiliary view drawings.
13.02 Produce an auxiliary view drawing using traditional drafting methods.
13.03 Produce an auxiliary view drawing using CAD software.
13.04 Develop a pattern using surface development techniques.
14.0 Demonstrate technical knowledge and skills for making sectional view drawings. The student will be able to:
14.01 Define sectional view and types of sectional views.
14.02 Illustrate the types of breaks and symbols used in drawing sectional views.
14.03 Produce a sectional view drawing using traditional drafting methods.
14.04 Produce a sectional view drawing using CAD software.
15.0 Demonstrate technical knowledge and skills for making working drawings. The student will be able to:
15.01 Produce detailed machine drawings.

CTE Standards and Benchmarks	
	15.02 Produce detailed assembly drawings.
	15.03 Produce a technical illustration.
16.0	Identify computer components and their functions. The student will be able to:
	16.01 Identify the internal components of a computer (e.g., power supply, hard drive, mother board, I/O cards/ports, cabling, etc.).
	16.02 Identify various computer input devices (e.g., mouse, keyboard, phone, camera) and describe their use.
	16.03 Identify various computer output devices (e.g., monitor, printer, phone) and describe their use.
	16.04 Identify various storage devices (e.g., flash drive, phone, external hard drive, etc.)
17.0	Demonstrate proficiency with common computer peripherals, including connections to standard input and output devices. The student will be able to:
	17.01 Identify the types and purposes of common input devices (e.g., mouse, keyboard, camera, microphone, scanner).
	17.02 Identify the types and purposes of specialized input devices (e.g., digital cameras, mobile devices, GPS devices).
	17.03 Describe the types and purposes of various computer connections (e.g., USB, firewire, parallel, serial, Ethernet, WiFi, et al).
	17.04 Connect an input device (e.g., mouse, keyboard, cell phone, camera, et al) and verify proper operation.
	17.05 Connect an output device (e.g., printer, monitor, projector, et al) and verify proper operation.
18.0	Demonstrate knowledge of computer file management. The student will be able to:
	18.01 Describe and use conventional file naming conventions.
	18.02 Demonstrate proficiency with file management tasks (e.g., folder creation, file creation, backup, copy, delete, open, save).
	18.03 Be able to identify file types by extension (e.g., .doc, .txt, .wav, xls, etc.).
19.0	Demonstrate proficiency using the Internet to locate information. The student will be able to:
	19.01 Identify and use web terminology.
	19.02 Define Universal Resource Locators (URLs) and associated protocols (e.g., http, ftp, telnet, mailto).
	19.03 Compare and contrast the types of Internet domains (e.g., .com, .org, .edu, .gov, .net, .mil).

CTE Standards and Benchmarks	
	19.04 Demonstrate proficiency using search engines, including Boolean search techniques.
	19.05 Apply the rules for properly citing works or other information obtained from the Internet.
	19.06 Identify and apply Copyright Fair Use guidelines.
	19.07 Evaluate online information for credibility and quality using basic guidelines and indicators (e.g., authority, affiliation, purpose, etc.).
20.0	Demonstrate an understanding of Internet safety and ethics. The student will be able to:
	20.01 Describe cyber-bullying and its impact on perpetrators and victims.
	20.02 Differentiate between viruses and malware, specifically their sources, ploys, and impact on personal privacy and computer operation, and ways to avoid infection.
	20.03 Demonstrate proficiency running an antivirus scan to remove viruses and malware.
	20.04 Describe risks associated with social networking sites and ways to mitigate these risks.
	20.05 Adhere to cyber safety practices with regard to conducting Internet searches, email, chat rooms, and other social network websites.
	20.06 Adhere to Acceptable Use Policies when accessing the Internet.
21.0	Develop and apply word processing and document manipulation skills. The student will be able to:
	21.01 Apply and adjust margins, tabs, line spacing and paragraph indents.
	21.02 Insert and manipulate text, graphics, and images.
	21.03 Format text using the font interface and styles interface.
	21.04 Adjust the size, position, and layout wrapping settings of a graphic/image.
	21.05 Use the status bar to determine the number of pages, words, and characters in a document.
	21.06 Insert codes for current date and time.
	21.07 Copy text between documents using mouse, menu, and keyboard techniques.
	21.08 Move text in a document using mouse, menu, and keyboard techniques.
	21.09 Create bulleted and numbered lists.
	21.10 Create a table – Inserting, moving and entering data.

CTE Standards and Benchmarks	
	21.11 Create a table – format rows, columns and cells.
	21.12 Insert page breaks.
	21.13 Adjust magnification of document display single and multiple pages.
	21.14 Understand printing options including shrink to fit, gutters, and document orientation.
	21.15 Create a report or essay that contains a title page, text, and a graphic/image.
22.0	Develop a design portfolio. The student will be able to:
	22.01 Identify the proper elements of a fully developed portfolio.
	22.02 Identify and discuss the ethical issues surrounding portfolio artifacts.
	22.03 Create a design portfolio that is well organized and displays their work.

Florida Department of Education
Student Performance Standards

Course Title: **Technical Design 2**
Course Number: **8401020**
Course Credit: **1**

Course Description:

In this course, students learn more about the nature of design and drafting techniques for architectural purposes. Students are also provided with instruction in a variety of technical illustrations commonly produced to depict architectural concepts and designs. Students are expected to continue collating their portfolio using exemplars of their work. As with previous portfolio pieces, each exemplar should include a narrative description of the item with an explanation of any special techniques used to create the item.

CTE Standards and Benchmarks	
23.0	Demonstrate an understanding of the various approaches used in problem solving. The student will be able to:
23.01	Employ research and development processes to assess the functional, economic, and ethical viability of a product or prototype.
23.02	Research a problem and determine the most appropriate problem-solving method to employ.
23.03	Determine whether the solution to a specific problem is technology-based.
23.04	Utilize a multidisciplinary approach to solving technological problems.
24.0	Demonstrate abilities to apply the design process. The student will be able to:
24.01	Determine whether an illustrative design problem is worthy of being resolved or addressed.
24.02	Identify the criteria and constraints associated with an illustrative design problem and select the most appropriate solution based on these factors.
24.03	Evaluate the quality, efficiency, and productivity of an existing or proposed design and refine the design accordingly.
24.04	Evaluate an existing design using conceptual, physical, and mathematical models and note aspects for improvement.
24.05	Design and develop an illustrative design solution using the design process.
24.06	Create and deliver a visual presentation to communicate the design process and final solution to an illustrative or technical design problem.
25.0	Create architectural drawings to industry standards. The student will be able to:

CTE Standards and Benchmarks
25.01 Produce a dimensioned floor plan showing walls, windows, doors, cabinets, stairs, appliances, fixtures, and other details.
25.02 Produce a dimensioned foundation plan with details.
25.03 Produce an architectural electrical plan.
25.04 Produce an architectural plumbing plan.
25.05 Produce an architectural climate control plan (HVAC).
25.06 Produce a dimensioned roof plan with details.
25.07 Produce a detailed information sheet including wall section and schedules.
25.08 Produce a dimensioned plot plan.
25.09 Produce dimensioned elevation drawings showing grade lines, floors, ceilings, windows, doors, and other details.
26.0 Create a reverse engineered drawing (as built) from a solid object. The student will be able to:
26.01 Identify and apply advanced measuring tools and techniques.
26.02 Apply precision dimensioning standards.
26.03 Produce a detailed multi view orthographic drawing.
26.04 Produce an enhanced pictorial drawing.
26.05 Produce an auxiliary view drawing.
26.06 Produce a section view drawing.
27.0 Create technical illustrations. The student will be able to:
27.01 Produce a colored or shaded pictorial rendering for presentation.
27.02 Produce a labeled graph or chart for display.
28.0 Demonstrate proficiency in using presentation software. The student will be able to:
28.01 Describe presentation software and the ways in which it may be used.
28.02 Create or download a presentation layout.

CTE Standards and Benchmarks
28.03 Adjust or edit presentation layout.
28.04 Add and format titles, subtitles, and talking points to a presentation layout.
28.05 Insert date and time code and number sequence to presentation layout.
28.06 Insert and format images/graphics onto layout.
28.07 Insert new or duplicate layout.
28.08 Adjust layout transition to include animation if appropriate.
28.09 Insert and adjust sound settings and timing in presentation if appropriate.
28.10 Adjust the sequence of the presentation.
28.11 Produce a presentation that includes text, graphics, and digital images and present it using a projection system.
28.12 Adjust presentation to loop show continuously.
29.0 Develop and apply fundamental spreadsheet skills. The student will be able to:
29.01 Describe a spreadsheet and the ways in which it may be used.
29.02 Identify the parts of the spreadsheet display.
29.03 Insert and format text information into cells.
29.04 Insert and format numeric information into cells.
29.05 Insert and format date and time information into cells.
29.06 Select multiple cells using the mouse.
29.07 Copy information from one or more cells to another part of the spreadsheet.
29.08 Move information from one or more cells to another part of the spreadsheet.
29.09 Sum the numeric values of multiple cells.
29.10 Use the sort function to alphabetize a table of information.
29.11 Create and navigate through a worksheet.

CTE Standards and Benchmarks	
	29.12 Change column width and row height.
	29.13 Insert columns and rows.
	29.14 Merge cells.
	29.15 Use Undo and Redo features.
	29.16 Insert arithmetic formulas into a spreadsheet.
	29.17 Create and print a table that displays and sums the quantities or values of different categories of data.
	29.18 Create a chart based on data sets defined in a spreadsheet.
	29.19 Adjust chart types to appropriately represent base data.
30.0	Demonstrate an understanding of color theory and its role in technical design. The student will be able to:
	30.01 Describe the spectral colors in the visible light spectrum.
	30.02 Describe the difference between color and light.
	30.03 Differentiate between spectral and primary colors.
	30.04 Describe the difference between additive and subtractive color mixing.
	30.05 Compare and contrast the RGB and CYMK color models as used in technical design.
	30.06 Demonstrate knowledge in terms relating to color such as: chroma, lightness, saturation, hue, intensity, luminance/value, shade, tint, etc.
	30.07 Demonstrate an understanding relating to the meanings of color (the psychology of color and the application of color in design).
	30.08 Demonstrate a working knowledge and technical skills relating to Application of color theory to design practices.
31.0	Demonstrate an understanding of the elements and principles of graphic design. The student will be able to:
	31.01 Describe the elements of graphic design (e.g., line, shape, mass, texture, color, lighting).
	31.02 Describe the principles of graphic design (e.g., balance, unity, contrast, rhythm, proportion, scaling).
	31.03 Distinguish between criteria and constraints for a given technical design problem.

CTE Standards and Benchmarks	
32.0	Create technical illustrations using illustration software applications. The student will be able to:
32.01	Demonstrate proficiency in the use of common functions and features of illustration software.
32.02	Prepare images using illustration software.
32.03	Demonstrate technical skill and knowledge in the composition of a technical illustration.
32.04	Demonstrate proficiency in manipulating a technical illustration to achieve a desired result.
33.0	Create technical drawings using software applications. The student will be able to:
33.01	Demonstrate proficiency in the use of common functions and features of technical drawing software.
33.02	Prepare technical drawings using CAD software.
33.03	Create technical drawings according to technical design specifications.
33.04	Apply rendering techniques as appropriate.
34.0	Maintain a design portfolio. The student will be able to:
34.01	Select appropriate items for showcasing in a design portfolio.
34.02	Modify/adjust a design portfolio to accommodate additional exemplars.
35.0	Demonstrate technical writing skills. The student will be able to:
35.01	Create a resume highlighting technical skills for non-technical readers.
35.02	Write a proposal for a technical project.
35.03	Draft an Engineering Change Order/Request.
35.04	Interpret revisions to technical drawings that have been made according to standard change symbols.

Florida Department of Education
Student Performance Standards

Course Title: **Technical Design 3**
Course Number: **8401030**
Course Credit: **1**

Course Description:

In addition to exploring the implications of applying technologies, this course provides students with instruction in advanced imaging techniques relative to both static and animated illustrations. In addition to learning more advanced techniques, students will have an opportunity to research a project, design an appropriate solution, and present their results. The ultimate output of this course is the student's presentation of a completed portfolio illustrating their best exemplars. The portfolio should include a narrative description of the scenario, the approach to data collection, resulting renderings, and an interpretation of each chart/graph. Research references should be cited appropriately. Given the advanced nature of this course, students should be encouraged to produce the portfolio using presentation software suitable for dissemination via the Internet.

CTE Standards and Benchmarks	
36.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
36.01	Discuss changes caused by the use of technology ranging from gradual to rapid and from subtle to obvious.
36.02	Evaluate the use of technology involving weighing the trade-offs between the positive and negative effects.
36.03	Debate the cultural, social, economic, and political changes caused by the transfer of technology from one society to another.
37.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
37.01	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
37.02	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
37.03	Operate systems so that they function in the way they were designed.
37.04	Use computers and calculators to access, retrieve, organize process, maintain, interpret, and evaluate data and information in order to communicate.
38.0	Demonstrate the ability to assess the impact of products and systems. The student will be able to:
38.01	Collect information and evaluate its quality.
38.02	Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and environment.

CTE Standards and Benchmarks	
	38.03 Apply assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
	38.04 Design forecasting techniques to evaluate the results of altering natural systems.
39.0	Demonstrate technical knowledge and skills for making engineering drawings. The student will be able to:
	39.01 Produce an advanced detailed machine drawing with tolerances, hidden surfaces and other mechanical details.
	39.02 Produce detailed electrical and electronic schematics with appropriate components.
	39.03 Produce a contour map with a cut and fill drawing annotated in accordance with government codes.
40.0	Demonstrate and present a research and design project. The student will be able to:
	40.01 Identify and research a design problem related to one of the following technologies (medical, GIS, agriculture, energy & power, information & communication, transportation, manufacturing, and construction).
	40.02 Identify criteria and constraints.
	40.03 Produce a virtual or physical model of the solution.
	40.04 Test and evaluate the solution.
	40.05 Deliver a professional quality presentation of the design process and solution (e.g., a rendering, 3D model, walk-through, fly-over, or animation of a design).
41.0	Demonstrate an understanding of career opportunities and requirements in the field of drafting/illustrative design technology. The student will be able to:
	41.01 Discuss individual interests related to a career in drafting/illustrative design technology.
	41.02 Explore career opportunities related to a career in drafting/illustrative design technology.
	41.03 Explore secondary education opportunities related to drafting/illustrative design technology.
	41.04 Conduct a job search.
	41.05 Complete a job application form correctly.
	41.06 Demonstrate competence in job interview techniques.
	41.07 Create a professional resume and letter of introduction.
	41.08 Pursue letters of recommendation and research scholarship and award opportunities.

CTE Standards and Benchmarks	
42.0	Demonstrate familiarity with techniques associated with digital photorealism. The student will be able to:
42.01	Describe digital photorealism and its role in technical design.
42.02	Describe techniques that infuse photorealism into 3D drawings (e.g., beveling, gamma corrections, photometric lighting, depth of field, chromatic aberration, specular maps, texturing, and asymmetry).
42.03	Use advanced functions in illustration software used to achieve photorealism.
43.0	Create complex technical drawings using appropriate software applications. The student will be able to:
43.01	Demonstrate proficiency in the use of advanced functions and features of technical drawing software.
43.02	Prepare complex technical drawings using CAD or 3D illustration software.
43.03	Integrate special effects into complex 3D technical drawings.
43.04	Create complex technical drawings according to technical design specifications.
43.05	Apply advanced rendering techniques as appropriate.
44.0	Prepare and present a design portfolio of work samples in a professional, presentable format. The student will be able to:
44.01	Select appropriate items for showcasing in a design portfolio.
44.02	Modify/adjust a design portfolio to accommodate additional exemplars.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Applied Engineering Technology**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8401100
CIP Number	0614130100
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of applied engineering and its effect on our lives and the choosing of an occupation. The content and activities will also include the study of entrepreneurship, safety, and leadership skills. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

The content includes but is not limited to study in mechanical, electrical, civil, and environmental engineering disciplines.

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 credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8401110	Applied Engineering Technology I	ENG 7G ENG TEC 7G TEC ED 1 @2 ENG&TEC ED1@2	1 credit	3	CT
8401120	Applied Engineering Technology II		1 credit	3	CT
8401130	Applied Engineering Technology III		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 the characteristics, scope and core concepts of technology.
02.0 Demonstrate an understanding of the attributes of design and the engineering design process.
03.0 Describe the functional characteristics of the engineering design team.
04.0 Demonstrate skill in technical sketching and drawing as it relates to engineering design.
05.0 Successfully work as a member of a team.
06.0 Demonstrate basic computer-aided design (CAD) knowledge and skills.
07.0 Demonstrate foundational knowledge and skills associated with the design of engineering systems (e.g., mechanical, fluid, thermal, electrical, and electronic systems).
08.0 Demonstrate technical knowledge and skills for machining.
09.0 Demonstrate technical knowledge and skills in the designing, engineering, and analysis of constructed works.
10.0 Demonstrate foundational knowledge and skills associated with common computer peripherals and computer functions.
11.0 Demonstrate knowledge of computer file management.
12.0 Demonstrate proficiency using the Internet to locate information.
13.0 Develop fundamental business productivity software skills.
14.0 Develop an understanding of computer programming concepts.
15.0 Demonstrate safe and appropriate use of tools.
16.0 Demonstrate an understanding of the various approaches used in problem-solving.
17.0 Demonstrate the ability to apply the design process.
18.0 Demonstrate proficiency using business productivity software skills.
19.0 Apply fundamental computer programming concepts.
20.0 Perform an engineering project requiring the design or re-design of an engineering system (e.g., mechanical, fluid, thermal, electrical, and electronic systems)
21.0 Demonstrate and apply computer-aided design (CAD) knowledge and skills.
22.0 Demonstrate fundamental math and science knowledge and skills for mechanical, fluid, thermal, and/or electrical/electronic systems.
23.0 Demonstrate safe and appropriate use of basic tools and machines.
24.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
25.0 Demonstrate an understanding of the effects of technology on the environment.
26.0 Demonstrate the ability to assess the impact of products and systems.
27.0 Plan, organize, and carry out a project plan.
28.0 Manage resources.
29.0 Use tools, materials, and processes in an appropriate and safe manner.

Mechanical Engineering Discipline

30.0 Demonstrate an understanding of the design and development of solutions involving mechanical engineering, their environments, and their associated design constraints.
31.0 Design and build a mechanically engineered solution suitable for a particular application in a defined environment.

Electrical Engineering Discipline

30.0 Demonstrate an understanding of the design and development of solutions involving electrical engineering, their environments, and their associated design constraints.

31.0 Demonstrate technical knowledge and skills associated with the design of electrical and electronic systems.

32.0 Design and build a mechanically engineered solution suitable for a particular application in a defined environment.

Civil Engineering Discipline

30.0 Demonstrate an understanding of design and development of solutions involving civil engineering, their environments, and their associated design constraints.

31.0 Design and build a mechanically engineered solution suitable for a particular application in a defined environment.

Environmental Engineering Discipline

30.0 Demonstrate an understanding of design and development of solutions involving mechanical engineering, their environments, and their associated design constraints.

31.0 Design and build a mechanically engineered solution suitable for a particular application in a defined environment.

Florida Department of Education
Student Performance Standards

Course Title: **Applied Engineering Technology I**
Course Number: **8401110**
Course Credit: **1**

Course Description:
This course helps students understand the field of engineering/engineering technology and prepares them for postsecondary engineering programs by developing a more in-depth mastery of the associated mathematics, science, and technology knowledge and skills. The course also includes essential concepts of technology and design, as well as concerns about the social and political implications of technological change.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics, scope and core concepts of technology. The student will be able to:
01.01	Explain the rapid increase in the rate of technological development and the trade-offs between competing values (e.g., availability, cost, desirability, waste, et al) in the selection of resources.
01.02	Discuss current technological developments that are/were driven by profit motive and the market.
01.03	Explain how technological progress promotes advancement of science and mathematics.
01.04	Identify new technologies that create new processes and describe ways in which technology helps to shape social, cultural, political, and economic aspects of society.
02.0	Demonstrate an understanding of the attributes of design and the engineering design process. The student will be able to:
02.01	Describe the essential activities and the sequence of steps associated with the design process.
02.02	Discuss why the engineering design process must begin with a clearly stated problem and write a problem statement in sufficient clarity to enable design goals, requirements, and constraints to be identified.
02.03	Critique the design of a solution and revise the design as needed.
02.04	Explain the relationship between design criteria and design constraints and how a design's criteria, constraints, and efficiency can compete with each other.
02.05	Demonstrate brainstorming techniques.
02.06	Identify the factors that ensure the safety and sustainability of an engineering design or product.
02.07	Compare and contrast creative and analytic problem-solving strategies to the engineering design process.
02.08	Identify safety considerations when designing a product.

CTE Standards and Benchmarks	
	02.09 Apply engineering notebook standards and protocols.
	02.10 Explain the forms of analysis used in evaluating potential solutions, particularly those forms associated with engineering principles, estimation, economics, and worst case scenario.
	02.11 Describe a decision table and how it is used to evaluate proposed solutions to an engineering problem.
03.0	Describe the functional characteristics of the engineering design team. The student will be able to:
	03.01 Describe how work breakdown structure (WBS) impacts the makeup and organization of an engineering design team.
	03.02 Compare functional and hierarchical schemes for organizing an engineering design team.
	03.03 Describe the function of management in general and project management in particular.
	03.04 Describe a typical design project team structure.
	03.05 Outline a research methodology.
	03.06 Explain the role of ethics as a part of responsible decision making.
04.0	Demonstrate skill in technical sketching and drawing as it relates to engineering design. The student will be able to:
	04.01 Explain the concepts of technical sketching and drawing.
	04.02 Understand and interpret basic engineering drawings.
	04.03 Create an orthographic sketch or drawing with appropriate layout, dimensions, and details for construction.
	04.04 Create an isometric sketch or drawing.
05.0	Successfully work as a member of a team. The student will be able to:
	05.01 Accept responsibility for specific tasks in a given situation.
	05.02 Maintain a positive relationship with other team members.
	05.03 Document progress, and provide feedback on work accomplished in a timely manner.
	05.04 Complete assigned tasks in a timely and professional manner.
	05.05 Reassign responsibilities when the need arises.
	05.06 Complete daily tasks as assigned on one’s own initiative.

CTE Standards and Benchmarks	
06.0	Demonstrate basic computer-aided design (CAD) knowledge and skills. The student will be able to:
06.01	Demonstrate use of the various functions of CAD software.
06.02	Apply basic CAD skills to a mechanical drawing (e.g., layers, linetype, lineweight, viewport, scaling, units, limits, etc)
06.03	Create a part using a solid modeling CAD software platform.
06.04	Create an assembly drawing using a CAD software platform.
06.05	Create a pictorial drawing using a CAD software platform (e.g., isometric, perspective, oblique)
06.06	Create an orthographic drawing using a CAD software platform.
06.07	Create a bill of materials generated from a CAD application.
07.0	Demonstrate foundational knowledge and skills associated with the design of engineering systems (e.g., mechanical, fluid, thermal, electrical, and electronic systems). The student will be able to:
07.01	Measure and calculate dimensions of parts using metric and U.S. customary systems.
07.02	Identify simple machines.
07.03	Calculate mechanical advantage.
07.04	Define and calculate scientific quantities that are used in engineering designs (e.g., mass, weight, force, torque, friction, pressure, flow rate, voltage, current, resistance).
07.05	Draw and read system schematics (e.g., electrical and fluid circuits).
07.06	Define scientific principles as they relate to the design of mechanical and electrical systems (e.g., Newton's Laws of motion, Ohm's Law, the three laws of thermodynamics).
07.07	Compare and contrast between related scientific and engineering principles (e.g., pneumatics and hydraulics, heat and temperature, series and parallel circuits, alternating and direct current).
07.08	Assemble, operate, and identify the parts of a mechanical system.
08.0	Demonstrate technical knowledge and skills for machining. The student will be able to:
08.01	Measure dimensions using precision measurement tools, such as rulers, scales, calipers, and micrometers.
08.02	Identify appropriate tools for machining purposes (e.g., drilling, turning, milling, sawing, and grinding).
08.03	Explain steps for assembly and fabrication of products.

CTE Standards and Benchmarks	
09.0	Demonstrate technical knowledge and skills in the designing, engineering, and analysis of constructed works. The student will be able to:
09.01	Define terminology associated with engineering products and systems.
09.02	Define and describe the experimental method as it is applied to design.
09.03	Describe simulation.
09.04	Prepare a model of a design solution to an engineering problem.
09.05	Prepare a graphical solution to an engineering problem.
09.06	Prepare a mathematical solution to an engineering problem (using either a calculator or computer).
09.07	Present a technical report on an engineering design problem, concept or issue.
10.0	Demonstrate foundational knowledge and skills associated with common computer peripherals and computer functions. The student will be able to:
10.01	Identify and describe the various internal and external components of a computer and their functions (e.g., power supply, hard drive, RAM, mother board, I/O cards/ports, cabling, etc.).
10.02	Describe and connect types and purposes of various computer input devices (e.g., USB, firewall, parallel and serial, Ethernet, printers, camera).
11.0	Demonstrate knowledge of computer file management. The student will be able to:
11.01	Describe and use conventional file naming conventions.
11.02	Demonstrate proficiency with file management tasks (e.g., folder creation, file creation, backup, copy, delete, open, save).
11.03	Be able to identify file types by extension (e.g., .doc, .txt, .wav, xls, dwg, etc.).
12.0	Demonstrate proficiency using the Internet to locate information. The student will be able to:
12.01	Identify and use web terminology.
12.02	Define Universal Resource Locators (URLs) and associated protocols (e.g., http, ftp, telnet, mailto).
12.03	Compare and contrast the types of Internet domains (e.g., .com, .org, .edu, .gov, .net, .mil).
12.04	Demonstrate proficiency using search engines, including Boolean search techniques.
12.05	Apply the rules for properly citing works or other information obtained from the Internet.

CTE Standards and Benchmarks
12.06 Identify and apply Copyright Fair Use guidelines.
12.07 Evaluate online information for credibility and quality using basic guidelines and indicators (e.g., authority, affiliation, purpose, etc.).
13.0 Develop fundamental business productivity software skills. The students will be able to:
13.01 Use appropriate functions in a word processing program. (e.g., format text, insert tables, create bulleted lists).
13.02 Describe a spreadsheet and the ways in which it may be used.
13.03 Use appropriate functions in a spreadsheet program. (e.g., insert and format text, merge cells, sort data, insert columns and rows).
13.04 Describe presentation software, the ways it may be used and appropriate presentation delivery skills.
13.05 Use appropriate functions in a presentation software program. (e.g., insert images, duplicate slides, format text).
14.0 Develop an understanding of computer programming concepts. The student will be able to:
14.01 Create a flowchart that visually describes a basic task.
14.02 Describe different computer programming languages and functions.
14.03 Create a basic computer program.
15.0 Demonstrate safe and appropriate use of tools. The student will be able to:
15.01 Select appropriate tools, procedures, and/or equipment.
15.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
15.03 Follow laboratory safety rules and procedures.
15.04 Demonstrate good housekeeping at workstation within total laboratory.
15.05 Identify color-coding safety standards.
15.06 Explain fire prevention and safety precautions and practices for extinguishing fires.
15.07 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.

Florida Department of Education
Student Performance Standards

Course Title: **Applied Engineering Technology II**
Course Number: **8401120**
Course Credit: **1**

Course Description:
This course provides students with opportunities to further their mastery of engineering-related math and science principles to design solutions to real world problems. The course also includes a more in-depth look into the relationship between technology and design.

CTE Standards and Benchmarks	
16.0	Demonstrate an understanding of the various approaches used in problem-solving. The student will be able to:
16.01	Employ research and development processes to assess the functional, economic, and ethical viability of a product or prototype.
16.02	Research a problem and determine the most appropriate problem-solving method to employ.
16.03	Utilize a multidisciplinary approach to solving technological problems.
17.0	Demonstrate the ability to apply the design process. The student will be able to:
17.01	Determine whether a design problem is worthy of being resolved or addressed.
17.02	Identify the criteria and constraints associated with a design problem and select the most appropriate solution based on pre-determined factors.
17.03	Evaluate the quality, efficiency, and viability of an existing or proposed design and refine the design accordingly.
17.04	Evaluate an existing design using conceptual, physical, and mathematical models and note aspects for improvement.
17.05	Devise and develop a problem solution using the design process.
17.06	Create and deliver a presentation to communicate the design process and final solution to a design problem.
05.0	Successfully work as a member of a team. The student will be able to:
05.01	Accept responsibility for specific tasks in a given situation.
05.02	Maintain a positive relationship with other team members.
05.03	Document progress, and provide feedback on work accomplished in a timely manner.

CTE Standards and Benchmarks	
	05.04 Complete assigned tasks in a timely and professional manner.
	05.05 Reassign responsibilities when the need arises.
	05.06 Complete daily tasks as assigned on one's own initiative.
18.0	Demonstrate proficiency using business productivity software skills. The students will be able to:
	18.01 Create a report or essay that contains a title page, text, a graphic/image, and data table.
	18.02 Create a spreadsheet to analyze and present data.
	18.03 Produce a presentation that includes text, graphics, and digital images and present it using a projection system.
19.0	Apply fundamental computer programming concepts. The student will be able to:
	19.01 Create a flowchart to communicate the solution to an engineering design problem.
	19.02 Use a computer programming language to create code to accomplish a specific goal.
20.0	Perform an engineering project requiring the design or re-design of an engineering system (e.g., mechanical, fluid, thermal, electrical, and electronic systems). The student will be able to:
	20.01 Identify an engineering problem or product for improvement using engineering design methodology.
	20.02 Develop a written plan of work for the engineering team to carry out the project.
	20.03 Show evidence of technical research in support of the project.
	20.04 Perform skills related to the engineering project.
	20.05 Document the project's progress in an engineering notebook.
	20.06 Complete the project as planned.
	20.07 Demonstrate and present an engineering design solution to a fluid, electrical, thermal, or mechanical system problem.
	20.08 Formulate conclusions based on the analysis of engineered products.
21.0	Demonstrate and apply computer-aided design (CAD) knowledge and skills. The student will be able to:
	21.01 Apply CAD skills to an engineering project.
	21.02 Create a part using a solid modeling CAD software platform to be incorporated into an assembly.

CTE Standards and Benchmarks	
	21.03 Create an assembly drawing using a CAD software platform.
	21.04 Create working drawings using a CAD software platform.
	21.05 Create a bill of materials generated from a CAD application.
22.0	Demonstrate fundamental math and science knowledge and skills for mechanical, fluid, thermal, and/or electrical/electronic systems. The student will be able to:
	22.01 Define and calculate quantities using Hooke's Law, Boyle's Law, heat and temperature, and/or Ohm's Law.
	22.02 Assemble, operate, and identify the parts of a mechanical, fluid, thermal, and/or electrical/electronic system.
	22.03 Demonstrate and apply principles of force, work, rate, resistance, energy, power, and force transformers relating to mechanical, fluid, thermal, and/or electrical/electronic system.
	22.04 Calculate the mechanical advantage of a mechanical, fluid, and/or thermal system.
	22.05 Design a mechanical, fluid, thermal, and/or electrical/electronic system.
23.0	Demonstrate safe and appropriate use of basic tools and machines. The student will be able to:
	23.01 Select appropriate tools, procedures, and/or equipment.
	23.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
	23.03 Follow laboratory safety rules and procedures.
	23.04 Demonstrate good housekeeping at workstation within total laboratory.
	23.05 Identify color-coding safety standards.
	23.06 Explain fire prevention and safety precautions and practices for extinguishing fires.
	23.07 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.

Florida Department of Education
Student Performance Standards

Course Title: **Applied Engineering Technology III**
Course Number: **8401130**
Course Credit: **1**

Course Description:
This course provides opportunities for students to apply their acquired knowledge and skills in engineering scenarios. The course features multiple options for providing context-based projects oriented to specific fields of engineering. This feature enables instruction in complex projects involving multi-faceted project teams by providing instruction oriented to four key engineering disciplines: mechanical, electrical, civil, and environmental. **Students need only complete standards #30, #31, and #32 for ONE of the engineering disciplines, in addition to the other standards.**

CTE Standards and Benchmarks	
24.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
24.01	Discuss changes in cultural, social, economic, and political behavior caused by the use of technology.
24.02	Describe the consequences of weighing the trade-offs between the positive and negative effects of technology.
24.03	Discuss the ethical considerations in developing, selecting, and using technology.
24.04	Debate the cultural, social, economic, and political changes caused by the transfer of a technology from one society to another.
25.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
25.01	Describe the trade-offs of developing technologies to reduce the use of resources.
25.02	Describe how the alignment of technological and natural processes impacts the environment.
25.03	Identify technologies developed for the purpose of reducing negative consequences of other technologies.
25.04	Debate the implementation of technologies having positive and negative effects on the environment.
26.0	Demonstrate the ability to assess the impact of products and systems. The student will be able to:
26.01	Collect information and evaluate its quality.
26.02	Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.
26.03	Apply assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.

CTE Standards and Benchmarks
26.04 Design forecasting techniques to evaluate the results of altering natural systems.
05.0 Successfully work as a member of a team. The student will be able to:
05.01 Accept responsibility for specific tasks in a given situation.
05.02 Maintain a positive relationship with other team members.
05.03 Document progress, and provide feedback on work accomplished in a timely manner.
05.04 Complete assigned tasks in a timely and professional manner.
05.05 Reassign responsibilities when the need arises.
05.06 Complete daily tasks as assigned on one's own initiative.
27.0 Plan, organize, and carry out a project plan. The student will be able to:
27.01 Determine the scope of a project.
27.02 Organize the team according to individual strengths.
27.03 Assign specific tasks within a team.
27.04 Determine project priorities.
27.05 Identify required resources.
27.06 Record project progress in an engineering notebook.
27.07 Record and account for budget expenses during the life of the project.
27.08 Carry out the project plan to successful completion and delivery.
28.0 Manage resources. The student will be able to:
28.01 Identify required resources and associated costs for each stage of the project plan.
28.02 Create a project budget based on the identified resources.
28.03 Determine the methods needed to acquire needed resources.
28.04 Demonstrate good judgment in the use of resources.

CTE Standards and Benchmarks	
	28.05 Recycle and reuse resources where appropriate.
	28.06 Demonstrate an understanding of proper legal and ethical waste disposal.
29.0	Use tools, materials, and processes in an appropriate and safe manner. The student will be able to:
	29.01 Identify the proper tool for a given job.
	29.02 Use tools and machines in a safe manner.
	29.03 Adhere to laboratory safety rules and procedures.
	29.04 Identify the application of processes appropriate to the task at hand.
	29.05 Identify materials appropriate to their application.
18.0	Demonstrate proficiency using business productivity software skills. The students will be able to:
	18.01 Create a report or essay that contains a title page, text, a graphic/image, and data table.
	18.02 Create a spreadsheet to analyze and present data.
	18.03 Produce a presentation that includes text, graphics, and digital images and present it using a projection system.
21.0	Demonstrate and apply computer-aided design (CAD) knowledge and skills. The student will be able to:
	21.01 Apply CAD skills to an engineering project.
	21.02 Create a part using a solid modeling CAD software platform to be incorporated into an assembly.
	21.03 Create an assembly drawing using a CAD software platform.
	21.04 Create working drawings using a CAD software platform.
	21.05 Create a bill of materials generated from a CAD application.
Mechanical Engineering Discipline	
30.0	Demonstrate an understanding of the design and development of solutions involving mechanical engineering, their environments, and their associated design constraints. The student will be able to:
	30.01 Describe mechanically engineered assemblies used in industrial manufacturing, the technologies they employ, their design criteria, and constraints.

CTE Standards and Benchmarks	
	30.02 Describe mechanically engineered assemblies used in aviation and aerospace, the technologies they employ, their design criteria, and constraints.
	30.03 Describe mechanically engineered assemblies used in hazardous or dangerous environments (e.g., underground, damaged buildings, et al), the technologies they employ, their design criteria, and constraints.
	30.04 Describe mechanically engineered assemblies used in the medical field, the technologies they employ, their design criteria, and constraints.
	30.05 Describe mechanically engineered assemblies used in underwater environments, the technologies they employ, their design criteria, and constraints.
	30.06 Describe mechanically engineered assemblies used in high speed/repetitive manufacturing or processing environments, the technologies they employ, their design criteria, and constraints.
31.0	Design and build a mechanically engineered solution suitable for a particular application in a defined environment. The student will be able to:
	31.01 Design and build a solution to a problem using the principles of mechanical engineering.
	31.02 Incorporate principles of electricity, thermodynamics, hydraulics, and pneumatics, as appropriate, into the design of a mechanically engineered solution.
	31.03 Incorporate at least one advanced feature into the solution's design.
	31.04 Create a project portfolio describing the project and the solution, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results.
	31.05 Present your portfolio to a review committee.
Electrical Engineering Discipline	
30.0	Demonstrate an understanding of the design and development of solutions involving electrical engineering, their environments, and their associated design constraints. The student will be able to:
	30.01 Describe electrical engineering applications used in power distribution and transmission systems, the technologies they employ, their design criteria, and constraints.
	30.02 Describe electrical engineering applications used in control systems (e.g., PLC's, microcontrollers), the technologies they employ, their design criteria, and constraints.
	30.03 Describe electrical engineering applications used in DC and AC electronics, the technologies they employ, their design criteria, and constraints.
	30.04 Describe electrical engineering applications used in signal processing and telecommunications, the technologies they employ, their design criteria, and constraints.
	30.05 Describe electrical engineering applications used in sensors and instrumentation applications, the technologies they employ, their design criteria, and constraints.
	30.06 Describe electrical engineering applications used in consumer electronics and computer applications, the technologies they employ, their design criteria, and constraints.

CTE Standards and Benchmarks	
31.0	Demonstrate technical knowledge and skills associated with the design of electrical and electronic systems. The student will be able to:
31.01	Understand the connectivity between the major components. Identify Address and data buses, power signals and peripheral devices.
31.02	Recognize the schematic symbols for basic electronic components (e.g., resistors, capacitors, inductors, transistors, and black box components such as microprocessors).
31.03	Describe basic logic devices (e.g., AND, NAND, OR, NOR) and their role in the design of electrical/electronic systems.
31.04	Create and apply the truth tables for the basic logical elements (i.e., AND, NAND, OR, and NOR gates).
31.05	Identify electrical connections between devices on an electrical schematic.
31.06	Use Boolean algebra to minimize logic equations and implement them in breadboard devices.
31.07	Design and create a prototype of a basic electronic system to demonstrate knowledge of a series and parallel logic circuitry.
32.0	Design and build a mechanically engineered solution suitable for a particular application in a defined environment. The student will be able to:
32.01	Design and build a solution to a problem using the principles of electrical engineering.
32.02	Incorporate principles of electricity, AC/DC circuits and electronics, microcontrollers or PLC's, electronic sensors, transducers and instrumentation, or communications/RF systems, as appropriate, into the design of an electrically engineered solution.
32.03	Incorporate at least one advanced feature into the solution’s design.
32.04	Create a project portfolio describing the project and the solution, including drawings and specifications, the tasks and rationale, process journal, budget report, and statistical analysis of the results.
32.05	Present your portfolio to a review committee.
Civil Engineering Discipline	
30.0	Demonstrate an understanding of the design and development of solutions involving civil engineering, their environments, and their associated design constraints. The student will be able to:
30.01	Describe civil engineered solutions used in coastal area planning, construction and structural design, transportation, GIS and surveying, urban and water resources.
30.02	Describe civil engineering solutions, the technologies they employ, their design criteria, and constraints.
30.03	Describe civil engineering solutions used in coastal areas (e.g., bridges, dams, locks, levees, waterways, ports, etc.), the technologies they employ, their design criteria, and constraints.
30.04	Describe civil engineering solutions used in structural design and structural analysis of buildings, bridges, towers, tunnels, etc., the technologies they employ, their design criteria, and constraints.

CTE Standards and Benchmarks	
	30.05 Describe civil engineering solutions used in designing, constructing, and maintaining transportation infrastructure (e.g., including roadways, railways, airports and mass transit systems, et al.).
	30.06 Describe technologies used in the basics of surveying and mapping, as well as geographic information systems to correctly size and position structures, and lay out routes for railways, roadways, and pipelines.
	30.07 Describe civil engineering solutions used in urban and metropolitan planning (e.g., designing, constructing, and maintaining streets, sidewalks, water supply networks, sewers, street lighting, solid waste management and disposal, public parks, et al), the technologies they employ, their design criteria, and constraints.
31.0	Design and build a mechanically engineered solution suitable for a particular application in a defined environment. The student will be able to:
	31.01 Design and build a solution to a problem using the principles of civil engineering.
	31.02 Incorporate one or more principles of structural design and analysis, surveying, planning and design of traffic system logistics, coastal defense, materials science, water resource and waste management, or urban planning as appropriate, into the design of a civil engineering solution.
	31.03 Incorporate at least one advanced feature into the solution's design.
	31.04 Create a project portfolio describing the project and the solution, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results.
	31.05 Present your portfolio to a review committee.
Environmental Engineering Discipline	
30.0	Demonstrate an understanding of the design and development of solutions involving environmental engineering, their environments, and their associated design constraints. The student will be able to:
	30.01 Describe environmental engineered solutions, the technologies they employ, their design criteria, and constraints.
	30.02 Describe environmental engineered solutions related to water supply and treatment, the technologies they employ, their design criteria, and constraints.
	30.03 Describe environmental engineered solutions related to waste management, the technologies they employ, their design criteria, and constraints.
	30.04 Describe environmental engineered solutions related to air and water pollution, the technologies they employ, their design criteria, and constraints.
	30.05 Describe environmental engineered solutions related to coastal and intercoastal environments, the technologies they employ, their design criteria, and constraints.
	30.06 Describe environmental engineered solutions related to agricultural environments, the technologies they employ, their design criteria, and constraints.
	30.07 Describe environmental engineered solutions related to industrial environments, the technologies they employ, their design criteria, and constraints.

CTE Standards and Benchmarks	
31.0	Design and build an environmental engineered solution suitable for a particular application in a defined environment. The student will be able to:
31.01	Design and build a solution to a problem using the principles of environmental engineering.
31.02	Incorporate principles of contamination control, pollution control, emission control, hazardous material disposal, and physical, biological, and chemical processes, as appropriate, into the design of an environmental engineered solution.
31.03	Incorporate at least one advanced feature into the solution's design.
31.04	Create a project portfolio describing the project and the solution, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results.
31.05	Present your portfolio to a review committee.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Maritime Technology**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8404100
CIP Number	0649039903
Grade Level	9-12
Program Length	4 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provide coherent and rigorous content aligned with challenging academic standards, relevant technical knowledge, and skills needed to prepare students for postsecondary education and careers in the Engineering and Technology Education career cluster. This sequence provides technical skill proficiency that 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, occupation-specific skills, and knowledge of all aspects of the Engineering and Technology Education career cluster.

The content includes but is not limited to broad transferable skills that stress understanding and demonstration of the following elements of the maritime industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

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 credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8404110	Maritime 1	SEAMANSHIP 7G TEC ED 1 @2 ENG&TEC ED1@2	1 credit	3	CT
8404120	Maritime 2		1 credit	3	CT
8404130	Maritime 3		1 credit	3	CT
8404140	Maritime 4		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 relating to the historical origins of the maritime industry as it relates to vessel development, culture, and trade.
02.0 Demonstrate proficiency in understanding the various career paths in the maritime industry.
03.0 Demonstrate an understanding of required skills sets by mariners, including safety training, regulations, and leadership.
04.0 Demonstrate proficiency in using engineering methods for ship construction and design.
05.0 Describe how models and simulators can be used to solve real-world issues in science and engineering.
06.0 Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.
07.0 Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use, and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.
08.0 Demonstrate an understanding of common navigation systems used in the maritime industry.
09.0 Describe how models and simulators can be used to solve real-world issues in science and engineering.
10.0 Identify and explain various vessels and their and their use.
11.0 Evaluate the environmental impact of the maritime industry.
12.0 Demonstrate an understanding of the business of shipping as related to port operations.
13.0 Demonstrate an understanding of various cargo and cargo management systems.
14.0 Explain the importance of vessel and ship security.
15.0 Examine the potential and use of marine resources.
16.0 Demonstrate an understanding of oceanography and Marine Biology concepts.
17.0 Demonstrate an understanding of the fundamentals of marine biology.
18.0 Examine the legal aspects of the marine industry.
19.0 Demonstrate an understanding of the business of maritime as related to shipping operations.

Florida Department of Education
Student Performance Standards

Course Title: **Maritime 1**
Course Number: **8404110**
Course Credit: **1**

Course Description:

This course provides students with an understanding of the field of maritime studies and prepares for postsecondary programs, as well as the world of work, by developing an in-depth mastery of maritime industry related concepts and their relationship to the business of shipping. The course also includes various concepts of history, science, technology, engineering, and mathematics, as well as social and political implications of the maritime industry on the international scale.

CTE Standards and Benchmarks	
01.0	Demonstrate knowledge relating to the historical origins of the maritime industry from vessel development, cultural, and trade perspectives. The student will be able to:
01.01	Identify different types of ships and their origins.
01.02	Construct a three-dimensional model of a historical ship.
01.03	Create a timeline showing significant milestones in maritime history.
01.04	Describe the significance of the Phoenicians, Vikings, and Asians on maritime cultures and traditions.
02.0	Demonstrate proficiency in understanding the various career paths in the maritime industry. The student will be able to:
02.01	Identify important factors to choosing a career.
02.02	Explain the importance of planning for a career.
02.03	Evaluate the impact of education on long term career success.
02.04	Describe the many career paths in the maritime industry.
02.05	Describe the skills and personal qualities needed for maritime careers.
02.06	Describe the everyday life of people working in maritime careers.
02.07	Create a personal maritime career path based on interest.
02.08	Describe careers in the shipyard.

CTE Standards and Benchmarks	
	02.09 Explain the skills and education needed to work in various shipyard careers.
	02.10 Describe careers located in ports.
	02.11 Explain the skills and education needed to work in various port careers.
	02.12 Describe careers working on at sea.
	02.13 Explain the skills and education needed to work in various careers at sea.
03.0	Demonstrate an understanding of required skills sets by mariners including, safety training, regulations, and leadership. The student will be able to:
	03.01 Create a timeline explaining the evolution of the U.S. Coast Guard.
	03.02 Explain the main functions of the U.S. Coast Guard.
	03.03 Describe the U.S. Coast Guard and its place in the U.S. military.
	03.04 Describe the organization and leadership hierarchy on a vessel.
	03.05 Explain Master's Level of Authority.
	03.06 Describe the importance of leadership and chain-of-command on a vessel.
	03.07 Describe the process of watch keeping, navigation, boat handling, anchoring, and mooring.
	03.08 Use seamanship terminology.
04.0	Demonstrate proficiency in using engineering methods for ship construction and design. The student will be able to:
	04.01 Identify and describe two types of marine engines.
	04.02 Explain how wind has been used to propel ships.
	04.03 Explain how a ship made of steel is able to float.
	04.04 Work in teams to using the engineering process to create solutions for a maritime problem.
	04.05 Describe how models and simulators can be used to solve real-world issues in science and engineering.
05.0	Describe how models and simulators can be used to solve real-world issues in science and engineering.
06.0	Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

CTE Standards and Benchmarks	
07.0	Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use, and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.
08.0	Identify and explain various vessels and their and their use. The student will be able to:
	08.01 Identify various types of ships.
	08.02 Explain specific reasons for different types of ships.
	08.03 Describe different types of cargo vessels and cargo types.
	08.04 Describe different types of passenger vessels and their purpose
09.0	Evaluate the environmental impact of the maritime industry. The student will be able to:
	09.01 Explain the role of maritime in protection of the environment.
	09.02 Describe the environmental regulations on the maritime industry.
10.0	Demonstrate an understanding of the business of shipping as related to port operations. The student will be able to:
	10.01 Describe the main functions of a port.
	10.02 Explain the importance of infrastructure networks to ports.
	10.03 Evaluate specific ports on their design and transport connections.
11.0	Demonstrate an understanding of various cargo and cargo management systems. The student will be able to:
	11.01 Provide examples of liquid bulk cargo.
	11.02 Provide examples of bulk cargo.
	11.03 Explain the history on containerization.
12.0	Explain the importance of vessel and ship security. The student will be able to:
	12.01 Describe the function of the U.S. Coast Guard.
	12.02 Explain the position of the U.S. Coast Guard within the U.S. military system.
	12.03 Explain the regulatory operations of U.S. flag ships by the U.S. Coast Guard.
	12.04 Explain how the U.S. Coast Guard protects U.S. coasts.

CTE Standards and Benchmarks
12.05 Explain port state control and how it is administered around the world.
13.0 Demonstrate an understanding of oceanography and Marine Biology concepts. The student will be able to:
13.01 Explain oceanography's role as a marine science disciple and its areas of investigation.
13.02 Explain the causes of tides.
13.03 Describe the various types of tides and why they are monitored throughout the maritime industry.
13.04 Evaluate the difference between tides, currents, and waves.
13.05 Identify various ways wave energy is created and how it moves through the ocean.
13.06 Describe how humans have impacted the world's oceans and steps used to limit these impacts.
14.0 Demonstrate an understanding of the fundamentals of marine biology. The student will be able to:
14.01 Explain underground water movements and their connection with the oceans.
14.02 Identify the various types of currents that interact with the water and land at the beach.
14.03 Explain the ecological importance of mangroves in water filtration and runoff.
14.04 Explain the role of mangroves in high energy events and environmental concerns for their removal.

Florida Department of Education
Student Performance Standards

Course Title: **Maritime 2**
Course Number: **8404120**
Course Credit: **1**

Course Description:

This course provides students with opportunities to further their mastery on maritime related concepts in preparation for postsecondary education and the world of work. The course builds on material presented in Maritime 1 by increasing the depth and breadth of student knowledge.

CTE Standards and Benchmarks	
01.0	Demonstrate knowledge relating to the historical origins of the maritime industry from vessel development, cultural, and trade perspectives. The student will be able to:
01.01	Describe important naval conflicts through the ages.
01.02	Describe the Greek and Roman impact on sailing culture.
01.03	Describe important naval conflicts through the ages.
01.04	Explain the role of trade on ancient empire development.
01.05	Describe the modern seagoing life.
02.0	Demonstrate proficiency in understanding the various career paths in the maritime industry. The student will be able to:
02.15	Explain the difference between charter boat and commercial boat fishing operations.
02.16	Describe the duties of a charter boat captain and mate.
02.17	Describe the duties of a commercial fishing vessel captain and mate.
02.18	Explain the licensing requirements for a charter vessel captain.
02.19	Explain the licensing requirements for a commercial fishing captain.
03.0	Demonstrate understanding of required skills sets by mariners including, safety training, regulations, and leadership. The student will be able to:
03.10	Explain the role of communications technology to the maritime industry.
03.11	List the electronic systems used aboard modern vessels.

CTE Standards and Benchmarks
03.12 Identify modern ship to shore communication systems.
03.13 Describe modern vessel tracking systems.
03.14 Describe the most common short range communications system found on modern vessels.
03.15 Describe the most common long rage communications systems found on modern vessels
03.16 Explain the use of emergency communications systems such as SSAS, EPIRB, and flares.
03.17 Explain the process for sending and emergency distress signal.
03.18 Describe common first aid practices and equipment.
03.19 Explain the process for acquiring U.S. Coast Guard certification.
03.20 Explain the roles of the IMO, USCG, Ports State Control and Class societies in regulating safety management systems.
03.21 Explain the requirements for STCW, TOAR, Radar, Firefighting, and PIC licensing.
03.22 Describe the need and restrictions of different types of licenses.
03.23 Describe the types of service a mariner can perform based on held license.
04.0 Demonstrate proficiency in using engineering methods for ship construction and design. The student will be able to:
04.12 Identify and use two common measurement systems.
04.13 List materials commonly used in ship construction.
04.14 Describe properties of ship construction materials.
04.15 Identify parameters relevant to ship design.
04.16 Develop a set of parameters for a ship design.
04.17 Use the engineering method to solve problems.
04.18 Identify an engineering problem relevant to maritime studies.
04.19 Identify software used in ship design.
04.20 Describe the ship design process.

CTE Standards and Benchmarks	
08.0	Demonstrate understanding of common navigation systems used in the maritime industry. The student will be able to:
08.01	Describe the purpose and history of charts.
08.02	Describe the various features of charts.
08.03	Describe the history of navigation instruments and how they evolved over time.
08.04	Describe four common navigation instruments used in modern times.
08.05	Describe the purpose of a sextant.
08.06	Explain the marine rules of the road, their origin, and responsible entity.
08.07	Use maritime whistle signals to transmit messages.
08.08	Identify night conditions by following vessel light configurations.
08.09	Explain the procedure for passing another vessel.
08.10	Explain how to overtake a vessel when navigating a river.
08.11	Explain early communication processes using flags and lights.
08.12	Explain worldwide ship communication abilities and how they are used.
08.13	Explain the modern use of flags aboard merchant vessels.
08.14	Explain the need for AIS and LRIT systems on modern ships.
08.15	Describe the history and function of RADAR.
08.16	Plot CPA on a RADAR output.
08.17	Explain the history and function of GPS.
08.18	Explain the history and function of the depth finder.
08.19	Explain the history and function of the RDF.
08.20	Describe the operation of the ECDIS.
08.21	Explain the various navigation systems as used for ship security.

CTE Standards and Benchmarks	
09.0	Identify and explain various vessels and their and their use. The student will be able to:
09.05	Explain why there is a need for different types of ships.
09.06	Identify different types of ships based on their roles.
09.07	Provide examples of takers, dry bulk, container, and break bulk vessels.
09.08	Describe the need for a class of industrial vessels.
09.09	Explain Archimedes' Principle.
09.10	Calculate the displacement of a vessel.
10.0	Evaluate the environmental impact of the maritime industry. The student will be able to:
07.03	Explain the impact of the maritime industry on air pollution, global warming, and climate change including the Great Lakes.
07.04	Describe the process for control of invasive species as related to shipping.
07.05	Evaluate current invasive species problems and formulate solutions.
07.06	Describe the occurrence of habitat loss due to the maritime industry needs.
11.0	Demonstrate an understanding of the business of shipping as related to port operations. The student will be able to:
11.05	Describe the main characteristics of the different types of terminals.
11.06	Compare private and public terminals.
11.07	Explain the need for terminal tariffs.
11.08	Describe the scheduling process for loading and unloading cargo at terminals.
11.09	Explain the operations of the stevedores and husbandry.
11.10	Evaluate the layouts of the three main terminal designs.
11.11	List all services terminal operators provide.
11.12	Explain the operation of a Foreign Trade Zone.
11.13	Describe the different types of marine surveys.

CTE Standards and Benchmarks
11.14 Explain the reasons for performing a cargo survey.
11.15 Explain the reasons for performing a vessel damage survey.
11.16 Describe a draft survey.
11.17 Explain the reasons for performing a deadweight survey.
11.18 Explain the reasons for performing an incline survey.
11.19 Explain an allusion and how marine surveys play a role in its investigation.
11.20 Provide examples of situations where multiple surveyors are needed for the same event.
12.0 Demonstrate an understanding of various cargo and cargo management systems. The student will be able to:
12.04 Explain different types of liquid bulk cargo.
12.05 Explain the process of measuring standard liquid bulk cargo.
12.06 Identify liquid bulk carriers and explain their special characteristics.
12.07 Identify liquid bulk trade routes and major global ports.
12.08 Explain different types of dry bulk cargo.
12.09 Explain the process of measuring dry bulk cargo.
12.10 Describe the characteristic of dry bulk carriers.
12.11 Identify dry bulk trade routes and major global ports.
14.0 Examine the legal aspects of the maritime industry. The student will be able to:
14.04 Explain when admiralty law applies to cases.
14.05 Explain the Jones Act.
10.0 Explain the importance of vessel and ship security. The student will be able to:
10.04 Describe the Maritime Transportation Security Act (MTSA).
10.05 Describe the roles of the U.S. Coast Guard and the Border Patrol in preventing terrorist acts on U.S. soil.

CTE Standards and Benchmarks
10.06 Explain the methods used by U.S agencies to prevent terrorist attacks.
10.07 Explain the purpose of the Transportation Worker's Identification Credential (TWIC).
11.0 Examine the potential and use of marine resources. The student will be able to:
11.04 Identify biological resources found in the ocean and explain how society benefits from their use.
11.05 Identify various types of energy that can be harvested at the surface of the ocean and at depth.
11.06 Explain the impact aquaculture has on world populations.
11.07 Describe the potential harm that is associated with aquaculture practices.
11.08 Describe the process of desalination and molecular activity that occurs during this process.
11.09 Compare and contrast the chemical properties of fresh and salt water.
11.10 Identify substances, such as medications and drugs that have been found in the marine environment.
12.0 Demonstrate an understanding of oceanography and Marine Biology concepts. The student will be able to:
12.04 Explain the role of chemical oceanography as a marine science.
12.05 Explain the importance for water through research of its properties.
12.06 Conduct an experiment to yield freshwater from a saltwater solution.
12.07 Explain the molecular structure of fresh and salt water.
12.08 Measure salinity of water using various methods.
12.09 Research salinity levels of the world's oceans and identify areas with higher than average salt concentrations.
12.10 Investigate reasons for higher than average slat concentrations in various seas and oceans.
12.11 Investigate the interaction of fresh and salt water in estuary systems.
12.12 Explain the study of toxicology as it relates to the marine environment.
12.13 Explain the process of ocean acidification.

Florida Department of Education
Student Performance Standards

Course Title: **Maritime 3**
Course Number: **8404130**
Course Credit: **1**

Course Description:

This course provides students with opportunities to further their mastery on maritime related concepts in preparation for postsecondary education and the world of work. The course builds on material presented in Maritime 2 by increasing the depth and breadth of student knowledge.

CTE Standards and Benchmarks	
02.0	Demonstrate proficiency in understanding the various career paths in the maritime industry. The student will be able to:
02.20	Explain the specialized training required for a career in admiralty law.
02.21	Compare careers in naval architecture, design engineering, and operating engineering.
02.22	Describe the main responsibilities of a chief engineer.
02.23	Explain the process for achieving a position of chief engineer.
02.24	Describe the main responsibilities of a design engineer.
02.25	Explain the licensing requirements to attaining a position of a practicing engineer.
02.26	List the careers associated with the offshore drilling industry.
03.0	Demonstrate an understanding of required skills sets by mariners including, safety training, regulations, and leadership. The student will be able to:
03.24	Explain the reasons for proper knot tying and line handling.
03.25	Demonstrate splicing techniques.
03.26	Demonstrate common knots used in the maritime industry (The bowline, Cleat-Hitch, Clove-Hitch, Double-overhand, Square Knot, etc.)
03.27	Explain the use of a stopper.
03.28	Evaluate various materials used to construct mooring lines.
04.0	Demonstrate proficiency in using engineering methods for ship construction and design. The student will be able to:

CTE Standards and Benchmarks
04.01 Explain the Laid Keel method of shipbuilding.
04.02 Explain the modular method of shipbuilding.
04.03 Research the construction of a present day vessel.
04.04 Explain the effects of the pitch of a propeller.
04.05 Explain the two modes of propeller action.
04.06 Explain the characteristics of the three types of rudders.
04.07 Describe modern methods of attaching and controlling rudders.
04.08 Describe modern methods of steering that do not use rudders.
04.09 Research the development of side thrusters in use on modern vessels.
05.0 Demonstrate an understanding of common navigation systems used in the maritime industry. The student will be able to:
05.29 Explain the importance of tides to ship navigation systems.
05.30 Explain the importance of currents to ship navigation.
05.31 Describe effect currents have on ships in open waters.
05.32 Describe the effect currents have on ships in restricted waters.
05.33 Evaluate the effect of currents and tides on dead reckoning navigation.
05.34 Describe the various types of buoys and where they are used.
05.35 Explain the purpose of a day mark and how it is used.
05.36 Explain the purpose of a range and how it is used.
05.37 Describe the purpose of lighthouses and their use.
05.38 Evaluate different port structures found on charts and their application in navigation.
06.0 Identify and explain various vessels and their and their use. The student will be able to:
06.16 Describe the general class of service vessels.

CTE Standards and Benchmarks	
	06.17 Describe various types of service vessels.
	06.18 Describe the general class of miscellaneous vessels.
	06.19 Name two types of miscellaneous vessels.
	06.20 Describe the function of specific miscellaneous vessels.
	06.21 Describe various research vessels.
	06.22 Describe various military vessels.
08.0	Demonstrate an understanding of the business of shipping as related to port operations. The student will be able to:
	08.22 Explain the development and personnel behind the change to containerization.
	08.23 Describe the reasons for the success of worldwide containerization.
	08.24 Research the impact of containerization on daily American lives.
	08.25 Design a container terminal.
	08.26 Describe the types of modern ship fuels.
	08.27 Explain the evolution of ship fuels and their environmental impact.
	08.28 Explain the ship refueling process.
09.0	Demonstrate an understanding of various cargo and cargo management systems. The student will be able to:
	09.12 Describe the movement of a product from abroad to an American store through the intermodal transportation process.
	09.13 Describe different container sizes.
	09.14 Identify different container ports and global shipping routes.
	09.15 Explain the stresses that are associated with cargo loading.
15.0	Demonstrate an understanding of international trade and its impact on the world economy. The student will be able to:
	15.20 Explain the importance of ship registries.
	15.21 Explain the concept of flags of convenience.

CTE Standards and Benchmarks
15.22 Describe how U.S. commercial vessel ownership has changed over the years.
14.0 Examine the legal aspects of the maritime industry. The student will be able to:
14.08 Describe three types of marine insurance coverage.
14.09 Explain the concept of duty of utmost faith.
14.10 Describe a warranty of seaworthiness.
14.11 Explain the five perils commonly covered by marine insurance.
10.0 Explain the importance of vessel and ship security. The student will be able to:
10.01 Explain the concept of terrorism at sea.
10.02 Describe the protocol for preparing a commercial vessel for adverse weather conditions.
10.03 Explain the process used by the master to avoid storms.
10.04 Describe the tools used by mariners in traffic during conditions of restricted visibility.

Florida Department of Education
Student Performance Standards

Course Title: **Maritime 4**
Course Number: **8404140**
Course Credit: **1**

Course Description:

This course provides students with opportunities to further their mastery on maritime related concepts in preparation for postsecondary education and the world of work. The course builds on the material presented in Maritime 3 by increasing the depth and breadth of student knowledge.

CTE Standards and Benchmarks	
02.0	Demonstrate proficiency in understanding the various career paths in the maritime industry. The student will be able to:
02.30	Explain the training needed for careers in marine science.
02.31	Describe the main responsibilities of a stevedore.
02.32	Describe the main responsibilities of a salvage master.
02.33	Describe the licensing and training required to become a salvage master.
02.34	Explain the role of the International Salvage Union.
02.35	Describe the main responsibilities of a commercial diver.
02.36	Explain the training and licensing requirements for commercial divers.
02.37	Describe the duties of a diving superintendent.
02.38	Explain the focus on Hyperbaric Medicine.
03.0	Demonstrate an understanding of required skills sets by mariners including, safety training, regulations, and leadership. The student will be able to:
03.32	Describe the purpose, function, and scope of operations of the International Maritime Organization (IMO).
03.33	Explain how the U.S. became a member in the IMO.
03.34	Explain the relationship between U.S. agencies and their regulations and the IMO conventions and treaties.
03.35	Describe the Marine Pollution (MARPOL) Annexes and their main functions.

CTE Standards and Benchmarks
03.36 Explain which MARPOL Annexes have been adopted by the U.S.
03.37 Describe the Safety of Life at Sea (SOLAS) requirements.
03.38 Explain the Standards for Training, Certification, and Watch-Standing (STCW) and why they are needed.
03.39 Describe maritime aspects that are covered by the Federal Communications Commission (FCC).
03.40 Explain the FCC certifications that are required for mariners and vessels.
03.41 Describe the different types of emergencies that can occur aboard a vessel at sea or in port.
03.42 Explain the use of emergency plans aboard a vessel.
03.43 Explain the origination of the Incident Command Center.
03.44 Describe the involvement of the Incident Command Center at the vessel, company, state, and federal level.
03.45 Explain the effects of hyperthermia on the body as related to water temperature.
03.46 Describe the use of survival suits aboard ocean going vessels.
03.47 Explain fire prevention and safety precautions when dealing with fires.
03.48 Describe how to extinguish a fire.
03.49 Explain the different types of fires that can be found on ships.
03.50 Explain the processes for fighting each specific type of fire.
03.51 Explain the mariner training process for firefighting.
03.52 Describe the use of fire escape plans and posting regulations.
03.53 Explain the importance of lifeboats and the practice of performing drills.
03.54 Explain a no sail command issued by the U.S. Coast Guard.
03.55 Explain the concept of seaworthiness and its legal importance.
03.56 Explain the role of the Florida Fish & Wildlife Conservation Commission (FWC) in the safety of local boating and fishing.
03.57 Describe the requirements and process for becoming an FWC Officer

CTE Standards and Benchmarks
03.58 Compare organizations that serve similar functions to the FWC from other states/countries
04.0 Demonstrate proficiency in using engineering methods for ship construction and design. The student will be able to:
04.41 Explain the responsibilities of a naval architect.
04.42 Describe and interpret drawings used in ship design and construction.
04.43 Identify software used in modern engineering design.
04.44 Research alternative methods of ship propulsion.
04.45 Research various incidents of vessel damage.
04.46 Explain the engineering process as related to the repair of damaged vessels.
06.0 Identify and explain various vessels and their and their use. The student will be able to:
06.23 Describe the major global ports of call for each type of vessel.
06.24 Explain various reasons for specific vessel ports of call.
07.0 Evaluate the environmental impact of the maritime industry on global warming and climate change. The student will be able to:
07.08 Explain the process of shoreline erosion and its impact on the maritime industry.
07.09 Explain the impact and function of human structures and barriers on waterways.
07.10 Describe the changes in the chemical composition of salt water in heavy marine traffic areas.
07.11 Describe laws designed to limit human environmental impact on marine systems.
07.12 Describe the impact of ocean dumping on marine ecology.
07.13 Evaluate the impact of coastal population increases on marine ecosystems.
07.14 Explain the process of dredging and its impact on marine ecosystems.
07.15 Evaluate the environmental impact of using long lines and netting as part of commercial fishing practice.
14.0 Demonstrated an understanding of the business of maritime as related to shipping operations. The student will be able to:
14.01 Explain the procurement process for materials and goods need on ships prior to voyage.

CTE Standards and Benchmarks	
	14.02 Describe the purpose of load lines as established by the IMO.
	14.03 Calculate consumption and voyage time.
	14.04 Describe the vessel crewing process from major crew markets and training facilities.
08.0	Demonstrate an understanding of the business of shipping as related to port operations. The student will be able to:
	08.29 Describe the organization of a typical port and major functions.
	08.30 Explain the roles of engineering, real estate, operations, security, sales/marketing, finance, government relations, and executive entities in a typical port.
	08.31 Describe the roles and impact of stevedores and longshoremen.
	08.32 Explain the responsibilities of a shipping agent.
	08.33 Describe the responsibilities of a terminal operator.
	08.34 Compare a public and private terminal operator.
	08.35 Explain shipping agent authority as related to the vessel owner.
	08.36 Compare the difference between a full service shipping agent and a protective agent.
	08.37 Explain the role of the labor union as related to stevedores.
	08.38 Explain the organization and function of the port authority.
	08.39 Compare operating ports and landlord ports.
	08.40 Describe the port master plan and its purpose.
	08.41 Explain the role of a port as an economic engine.
	08.42 Explain how a port authority determines rates for services, berthing, etc.
	08.43 Describe the role of real estate and its importance to the port authority.
	08.44 Explain the social impact of the port authority on the local community.
	08.45 Describe methods ports use to maintain positive customer relations with the local community.
14.0	Examine the legal aspects of the maritime industry. The student will be able to:

CTE Standards and Benchmarks
14.12 Explain the Jones Act.
14.13 Explain the legal definition of unseaworthiness.
14.14 Explain the use of the legal term maintenance and cure.
14.15 Explain the Longshoremen and Harbor Workers Compensation Act.
14.16 Explain the role of the Department of Occupational Safety and Health Act.
14.17 Describe the use of maritime liens.
14.18 Explain how a maritime lien is enforced.
14.19 Describe the Carriage of Goods at Sea/Harter Act.
14.20 Explain how fault is established in a maritime casualty.
14.21 Explain appointment of liability and how it is established.
14.22 Defined the legal term of economic losses.
14.23 Define the legal term of cargo losses.
14.24 Describe the purpose and operation of maritime salvage.
14.25 List three laws governing pollution control.
14.26 Describe the liability and damages resultant from marine pollution.
10.0 Explain the importance of vessel and ship security. The student will be able to:
10.15 Describe the primary functions of the Customs and Border Patrol (CBP) and hot the agency is structure within the U.S. government.
10.16 Explain how the CBP regulates mariners in both the U.S. and foreign flag ships.
10.17 Describe how the CBP regulates the flow of cargoes in the U.S.
10.18 Explain the Merchant Mariners' Document (MMD) and how it is obtained.
11.0 Examine the potential and use of marine resources. The student will be able to:
11.24 Describe how research studies onboard the JOIDES Resolution has contributed to what we know about the Earth and the oceans.

CTE Standards and Benchmarks
11.25 Explain how collecting and analyzing seafloor sediment samples has helped scientist learn about the Earth and oceans.
11.26 Compare the experiments onboard the JOIDES Resolution from a quantitative and qualitative perspective.
11.27 Describe how robotic exploration has help scientists learn more about the ocean at greater depths.
11.28 Explain the life style onboard a research vessel.
11.29 Analyze the various land-based careers and sea-based careers that are needed to maintain research vessels.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Aerospace Technologies**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8600080
CIP Number	0821011800
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of Aerospace Technologies, its effect upon our lives, and the choosing of an occupation. The content and activities will also include the study of safety and leadership skills. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

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 credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8600580	Aerospace Technologies I	AEROSPACE 7G ENG 7G ENG TEC 7G TEC ED 1 @2 ENG&TEC ED1@2	1 credit	3	EQ
8600680	Aerospace Technologies II		1 credit	3	EQ
8601780	Aerospace Technologies III		1 credit	3	EQ

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 the characteristics and scope of technology.
02.0 Demonstrate an understanding of the core concepts of technology.
03.0 Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study.
04.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
05.0 Demonstrate an understanding of the effects of technology on the environment.
06.0 Demonstrate an understanding of the influence of aerospace technology on history.
07.0 Demonstrate an understanding of the attributes of engineering design.
08.0 Demonstrate an understanding of and be able to select and use information and communication technologies.
09.0 Demonstrate an understanding of and be able to select and use transportation technologies.
10.0 Demonstrate safe and appropriate use of tools and machines in aviation/aerospace technologies.
11.0 Demonstrate an understanding of the history and development of aviation and space transportation.
12.0 Describe the function of various aviation organizations.
13.0 Describe the aviation/aerospace environment.
14.0 Describe and demonstrate an understanding of the principles of flight.
15.0 Demonstrate an understanding of aviation electrical, mechanical, hydraulic, and pneumatic systems.
16.0 Demonstrate an understanding of power systems including, internal combustion engines, jet engines, rocket engines, solar cells and nuclear power used in aviation/aerospace applications.
17.0 Demonstrate knowledge of robotics as it relates to the aviation/aerospace industry.
18.0 Demonstrate a knowledge and understanding of various traditional and composite materials as related to aerospace technologies.
19.0 Demonstrate an understanding of career opportunities and requirements in the field of aerospace technologies.
20.0 Demonstrate problem solving using troubleshooting, research and development, invention and innovation, and experimentation.
21.0 Demonstrate the abilities to use and maintain technological products and systems.
22.0 Demonstrate the abilities to assess the impact of products and systems.
23.0 Demonstrate an understanding of the development of aviation and space transportation.
24.0 Assess the impact of various aviation organizations on aerospace activities.
25.0 Assess the aviation/aerospace environments' effects on flying and spaceflight.
26.0 Demonstrate an understanding of electrical, mechanical, fluid, and pneumatic systems that could be used in aerospace environments.
27.0 Demonstrate knowledge and understanding of processing skills on materials and composites as they relate to aviation/aerospace technologies.
28.0 Describe and demonstrate principles of navigation.
29.0 Demonstrate an understanding of the effects of flight as it relates to physiology.
30.0 Demonstrate the abilities to apply the design process.
31.0 Describe various factors critical to aircraft performance.
32.0 Demonstrate an understanding of electrical, mechanical, fluid, and pneumatic systems that could be used on/in aviation/aerospace environments.
33.0 Demonstrate technical knowledge of computer control as it is related to aviation/aerospace projects.

34.0 Explore the role of civilian spacecraft in the exploration and colonization of space.
35.0 Perform advanced study and technical skills related to aerospace technologies.

Florida Department of Education
Student Performance Standards

Course Title: **Aerospace Technologies I**
Course Number: **8600580**
Course Credit: **1**

Course Description:

This course provides students with an introduction to the knowledge, human relations, and technological skills found today in Aerospace Technologies.

Lab Statement:

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error, and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Discuss the nature and development of technological knowledge and processes.
01.02	Explain the rapid increase in the rate of technological development and diffusion.
01.03	Conduct specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Define technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.
03.0	Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study. The student will be able to:
03.01	Identify technology transfer and innovation occurring when a new user applies an existing technology innovation developed for one purpose in a different function.
04.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
04.01	Classify the use of technology involving weighing the trade-offs between the positive and the negative effects.

CTE Standards and Benchmarks	
04.02	Identify ethical considerations important in the development, selection, and use of technologies.
05.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
05.01	List trade-offs of developing technologies to reduce the use of resources.
05.02	Identify technologies devised to reduce the negative consequences of other technologies.
06.0	Demonstrate an understanding of the influence of aerospace technology on history. The student will be able to:
06.01	Define the history of aerospace technology as a powerful force in reshaping the social, cultural, political, and economic landscape.
07.0	Demonstrate an understanding of the attributes of engineering design. The student will be able to:
07.01	Recognize the engineering design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
07.02	Check and critique a design continually, and improve and revise the idea of the design as needed.
07.03	List competing requirements of a design, such as criteria, constraints, and efficiency.
07.04	Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the engineering design process.
07.05	Construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.
08.0	Demonstrate an understanding of and be able to select and use information and communication technologies. The student will be able to:
08.01	Discuss information and communication technologies including the inputs, processes, and outputs associated with sending and receiving information.
08.02	Classify information and communication systems that allow information to be transferred as human to human, human to machine, machine to human, or machine to machine.
08.03	Use information and communication systems to inform, plan, and manage tasks.
08.04	Identify components of a communications system, including source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.
08.05	Identify many ways to communicate information, such as graphic and electronic means.
08.06	Communicate technological knowledge and processes using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.
09.0	Demonstrate an understanding of and be able to select and use transportation technologies. The student will be able to:

CTE Standards and Benchmarks	
09.01	Analyze the vital role played by transportation in the development and operation of other technologies and commerce.
09.02	Discuss how transportation services and methods have led to increased societal mobility.
10.0	Demonstrate safe and appropriate use of tools and machines in aviation/aerospace technologies. The student will be able to:
10.01	Select appropriate tools, procedures, and/or equipment.
10.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
10.03	Maintain and troubleshoot equipment used in a variety of technological systems.
10.04	Follow laboratory safety rules and procedures.
10.05	Demonstrate good housekeeping at workstation within total laboratory.
10.06	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
11.0	Demonstrate an understanding of the history and development of aviation and space transportation. The student will be able to:
11.01	Describe early attempts at flight prior to the Wright Brothers flight in 1902.
11.02	Outline the early attempts at heavier than air powered flight.
11.03	Describe the effect of air power on the outcome of world conflict.
11.04	Describe the history of aviation in Florida.
11.05	Outline the beginnings of commercial aviation.
11.06	Identify the early research centers for aeronautics in the United States.
11.07	Describe the role of aviation research and development.
11.08	Outline the development of space exploration.
11.09	Describe the role of NACA, NASA, and commercial entities in the development of aeronautics and space exploration.
11.10	Prepare a forecast of aerospace developments, and interplanetary space travel.
11.11	Demonstrate an understanding of the expanding role that Unmanned Aerial Systems (UAS) are making throughout the field of aeronautics.
11.12	Identify the legal operating restrictions related to UAVs as defined by the FAA.

CTE Standards and Benchmarks	
	11.13 Demonstrate an understanding of the critical roles that Aeronautical Decision Making (ADM) and Crew Resource (CRM) play in aircrew decision making.
	11.14 Demonstrate an understanding of the major innovations in both technology and procedures that the military has made in the advancement of aeronautics.
12.0	Describe the function of various aviation organizations. The student will be able to:
	12.01 Describe the function of various governmental organizations.
	12.02 Describe the function of various non-governmental organizations.
13.0	Describe the aviation/aerospace environment. The student will be able to:
	13.01 Identify atmospheric regions and elements.
	13.02 Describe the roles of water and particulate matter in the atmosphere.
	13.03 Describe and identify the elements of the atmosphere in motion.
	13.04 Explain the role weather forecasting has as it relates to Aerospace Technologies.
	13.05 Demonstrate an understanding of the principal bodies of the solar system.
	13.06 Utilize astronomical principles, and technology to study the solar systems.
	13.07 Define interplanetary space.
	13.08 Describe the physical properties of interplanetary space including the structure, formation, forces, and bodies.
	13.09 Describe interstellar and intergalactic space.
14.0	Describe and demonstrate an understanding of the principles of flight. The student will be able to:
	14.01 Define terminology associated with flight and flight principles.
	14.02 Identify the structural components of aircraft.
	14.03 Construct and test flying aircraft models.
	14.04 Demonstrate an understanding of aircraft lift and the use of control surfaces to control pitch, yaw, and roll.
	14.05 Demonstrate an understanding of rocketry design and systems.

CTE Standards and Benchmarks	
	14.06 Develop and construct models to test flight characteristics of powered aircraft.
	14.07 Explain the application of Newton's laws and Bernoulli's Principle to flight and rocketry.
15.0	Demonstrate an understanding of aviation electrical, mechanical, hydraulic, and pneumatic systems. The student will be able to:
	15.01 State which aircraft systems are powered by electricity, mechanics, hydraulics and pneumatics.
16.0	Demonstrate an understanding of power systems including, internal combustion engines, jet engines, rocket engines, solar cells and nuclear power used in aviation/aerospace applications. The student will be able to:
	16.01 Identify the basic types of engines used for aircraft propulsion.
	16.02 Describe the change from linear motion to rotary motion in a reciprocating engine.
	16.03 Identify the elements of an aircraft engine and fuel system.
	16.04 Describe the operation of aircraft turbine and ramjet engines.
	16.05 Explain chemical propulsion systems.
	16.06 Explain advanced propulsion systems including heavy lift launch systems, electrical propulsion, and nuclear propulsion.
	16.07 Describe the use and operation of solar cells to generate electrical power.
	16.08 Perform experimental testing, including designing test devices to determine the power (thrust) of a model rocket engine.
17.0	Demonstrate knowledge of robotics as it relates to the aviation/aerospace industry. The student will be able to:
	17.01 Identify different types of robots.
	17.02 State the function of effectors, sensors, controllers, and auxiliary parts in robotics system.
	17.03 Explain how robotics technology is used in the space program.
	17.04 Forecast how robotics technology will be used in the exploration of space, space colonization or interplanetary space travel.
	17.05 Explain how UAS's are a type of robot to include sensors, controllers, and auxiliary parts.
18.0	Demonstrate a knowledge and understanding of various traditional and composite materials as related to aerospace technologies. The student will be able to:
	18.01 Identify various structural materials used over the history of aviation manufacturing.

CTE Standards and Benchmarks
18.02 Compare traditional vs. composite materials and their effect on aerospace vehicle design.
19.0 Demonstrate an understanding of career opportunities and requirements in the field of aerospace technologies. The student will be able to:
19.01 Discuss individual interests related to a career in Aerospace Technologies.
19.02 Explore career opportunities related to Aerospace Technologies.
19.03 Explore secondary education opportunities related to Aerospace Technologies.

Florida Department of Education
Student Performance Standards

Course Title: **Aerospace Technologies II**
Course Number: **8600680**
Course Credit: **1**

Course Description:

This program provides students with an intermediate understanding of the knowledge, human relations, and technological skills found today in Aerospace Technologies.

Lab Statement:

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error, and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Students will demonstrate routine basic flight skills using computer flight simulation. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences.

CTE Standards and Benchmarks	
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Define and develop a management system as the process of planning, organizing, and controlling work.
02.02	Identify and assess the stability of a technological system and its influence by all of the components in the system, especially those in the feedback loop.
02.03	Identify and analyze resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.
02.04	Identify the criteria and constraints of a product or system and determine how they affect the final design and development.
03.0	Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study. The student will be able to:
03.01	Give examples of technology transfer occurring when a new user applies an existing technology innovation developed for one purpose in a different function.
04.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
04.01	Compare the use of technology involving weighing the trade-offs between the positive and the negative effects.

CTE Standards and Benchmarks	
	04.02 Discuss ethical considerations important in the development, selection, and use of technologies.
06.0	Demonstrate an understanding of the influence of aerospace technology on history. The student will be able to:
	06.01 Research the history of technology as a powerful force in reshaping the social, cultural, political, and economic landscape.
	06.02 Discuss the Information Age and its effect on the processing and exchange of information in the aerospace environment.
	06.03 Explain how military aviation and technological developments in the 20th century led to major innovations in aerospace up to and including major recent contributions to UAS's.
07.0	Demonstrate an understanding of the attributes of engineering design. The student will be able to:
	07.01 Apply the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
	07.02 Evaluate a design continually, and improve and revise the idea of the design as needed.
	07.03 Analyze competing requirements of a design, such as criteria, constraints, and efficiency.
	07.04 Investigate design principles used to evaluate existing designs, to collect data, and to guide the design process.
	07.05 Construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.
08.0	Demonstrate an understanding of and be able to select and use information and communication technologies. The student will be able to:
	08.01 Compare information and communication technologies including the inputs, processes, and outputs associated with sending and receiving information.
	08.02 Select appropriate information and communication systems to be used to transfer information human to human, human to machine, machine to human, and machine to machine.
	08.03 Use information and communication systems to inform, plan, and manage tasks.
	08.04 Compare components of a communications system, including source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.
	08.05 Compare and contrast many ways to communicate information, such as graphic and electronic means.
	08.06 Communicate technological knowledge and processes using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.
10.0	Demonstrate safe and appropriate use of tools and machines in aviation/aerospace technologies. The student will be able to:
	10.01 Select appropriate tools, procedures, and/or equipment.

CTE Standards and Benchmarks	
	10.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
	10.03 Maintain and troubleshoot equipment used in a variety of technological systems.
	10.04 Follow laboratory safety rules and procedures.
	10.05 Demonstrate good housekeeping at workstation within total laboratory.
	10.06 Explain color-coding safety standards.
	10.07 Demonstrate fire prevention and safety precautions and practices for extinguishing fires.
	10.08 Analyze the harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
14.0	Describe and demonstrate an understanding of the principles of flight. The student will be able to:
	14.01 Assess the structural components of aircraft.
	14.02 Demonstrate an understanding of aircraft lift and the use of control surfaces to control pitch, yaw, and roll by using computer simulation.
	14.03 Demonstrate an understanding of rocketry design and systems.
	14.04 Develop and construct models to test flight characteristics of powered aircraft.
	14.05 Explain the application of Newton's laws and Bernoulli's Principle to flight and rocketry.
16.0	Demonstrate an understanding of power systems including, internal combustion engines, jet engines, rocket engines, solar cells and nuclear power used in aviation/aerospace applications. The student will be able to:
	16.01 Classify the basic types of engines used for aircraft propulsion.
	16.02 Describe the change from linear motion to rotary motion in a reciprocating engine.
	16.03 Describe the interrelationship between elements of an aircraft engine.
	16.04 Describe the operation of aircraft turbine and ramjet engines.
	16.05 Explain chemical propulsion systems.
	16.06 Explain advanced propulsion systems including heavy lift launch systems, electrical propulsion, and nuclear propulsion.
	16.07 Design and construct a system of solar cells to generate electrical power.

CTE Standards and Benchmarks	
17.0	Demonstrate knowledge of robotics as it relates to the aviation/aerospace industry. The student will be able to:
17.01	Assess suitability of different types of robots.
17.02	Research how robotics technology is used in the exploration of space, space colonization or interplanetary space travel.
19.0	Demonstrate an understanding of career opportunities and requirements in the field of aerospace technologies. The student will be able to:
19.01	Discuss individual interests related to a career in Aerospace Technologies.
19.02	Explore career opportunities related to Aerospace Technologies.
19.03	Explore secondary education opportunities related to Aerospace Technologies.
19.04	Conduct a job search.
19.05	Complete a job application form correctly.
20.0	Demonstrate problem solving using troubleshooting, research and development, invention and innovation, and experimentation. The student will be able to:
20.01	Employ research and development as a specific problem solving approach to prepare devices and systems for the marketplace.
20.02	Conduct research needed to solve technological problems.
20.03	Utilize a multidisciplinary approach to solving technological problems.
21.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
21.01	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
21.02	Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
21.03	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
21.04	Operate systems so that they function in the way they were designed.
21.05	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
22.0	Demonstrate the abilities to assess the impact of products and systems. The student will be able to:
22.01	Collect information and evaluate its quality.

CTE Standards and Benchmarks	
	22.02 Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.
	22.03 Apply assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
23.0	Demonstrate an understanding of the development of aviation and space transportation. The student will be able to:
	23.01 Describe the effect of air power on the outcome of world conflict by using one the major wars/conflicts of the 20th/21st century (WWI, WWII, Vietnam, Desert Storm, Afghanistan, etc.)
	23.02 Describe the role of aviation research and development.
	23.03 Describe the role of NASA in the development of aeronautics and space exploration.
	23.04 Describe the expanding role UAS's are playing in the commercial, recreational, and military fields.
24.0	Assess the impact of various aviation organizations on aerospace activities. The student will be able to:
	24.01 Assess the impact of various governmental organizations on aerospace activities
	24.02 Assess the impact various non-governmental organizations on aerospace activities
25.0	Assess the aviation/aerospace environments' effects on flying and spaceflight. The student will be able to:
	25.01 Identify atmospheric regions and elements.
	25.02 Differentiate elements of the atmosphere and outer space to include space debris, radiation, solar flares, etc.
	25.03 Explain the role of space weather forecasting has as it relates to the aerospace environment.
26.0	Demonstrate an understanding of electrical, mechanical, fluid, and pneumatic systems that could be used in aerospace environments.--The student will be able to:
	26.01 Describe an electrical circuit.
	26.02 Describe basic parts and function of hydraulic and pneumatic systems.
	26.03 Describe common uses of mechanical systems in aerospace vehicles.
27.0	Demonstrate knowledge and understanding of processing skills on materials and composites as they relate to aviation/aerospace technologies. The student will be able to:
	27.01 Critique traditional vs. composite materials and their effect on aerospace vehicle design.
	27.02 Predict the use of composite materials in the future of aerospace vehicle designs.

CTE Standards and Benchmarks	
28.0	Describe and demonstrate principles of navigation. The student will be able to:
28.01	Describe navigation principles as they relate to aeronautical travel.
28.02	Demonstrate and ability to read and use an aeronautical navigational chart.
28.03	Examine navigational technologies and systems as they relate to aeronautical systems.
28.04	Complete a flight plan for a fixed wing aircraft, from destination to destination.
28.05	Demonstrate an understanding and application of mathematical concepts as they relate to determining space flight mechanics.
28.06	Define and describe a variety of orbital patterns.
29.0	Demonstrate an understanding of the effects of flight as it relates to physiology. The student will be able to:
29.01	Evaluate products and fixtures used in aerospace environments and assess their suitability for human use.
29.02	Describe the type of and effects of spatial disorientation on the ability to fly.
29.03	Describe the symptoms and effects of hypoxia on the ability to fly.

Florida Department of Education
Student Performance Standards

Course Title: **Aerospace Technologies III**
Course Number: **8601780**
Course Credit: **1**

Course Description:

This program provides students with an advanced understanding of the knowledge, human relations, and technological skills found today in Aerospace Technologies.

Lab Statement:

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error, and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences and flight simulation.

CTE Standards and Benchmarks	
08.0	Demonstrate an understanding of and be able to select and use information and communication technologies. The student will be able to:
08.01	Discuss the impact of advanced sensors and sensor integration in aerospace vehicles.
08.02	Critique use of automation in aerospace vehicles.
10.0	Demonstrate safe and appropriate use of tools and machines in aviation/aerospace technologies. The student will be able to:
10.01	Select appropriate tools, procedures, and/or equipment.
10.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
10.03	Maintain and troubleshoot equipment used in a variety of technological systems.
10.04	Follow laboratory safety rules and procedures.
10.05	Demonstrate good housekeeping at workstation within total laboratory.
10.06	Identify color-coding safety standards.

CTE Standards and Benchmarks
10.07 Explain fire prevention and safety precautions and practices for extinguishing fires.
10.08 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
13.0 Describe the aviation/aerospace environment. The student will be able to:
13.01 Compare atmospheric regions and elements.
13.02 Predict the effect of space weather on space exploration.
14.0 Describe and demonstrate an understanding of the principles of flight. The student will be able to:
14.01 Define terminology associated with flight and flight principles.
14.02 Assess the structural components of aircraft.
14.03 Demonstrate an understanding of aircraft lift and the use of control surfaces to control pitch, yaw, and roll by using computer flight simulation.
14.04 Demonstrate an understanding of rocketry design and systems.
19.0 Demonstrate an understanding of career opportunities and requirements in the field of aerospace technologies. The student will be able to:
19.01 Discuss individual interests related to a career in Aerospace Technologies.
19.02 Explore career opportunities related to Aerospace Technologies.
19.03 Explore secondary education opportunities related to Aerospace Technologies.
19.04 Conduct a job search.
19.05 Complete a job application form correctly.
19.06 Demonstrate competence in job interview techniques.
19.07 Create a professional resume and letter of introduction.
21.0 Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
21.01 Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
21.02 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
21.03 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.

CTE Standards and Benchmarks	
	21.04 Operate systems so that they function in the way they were designed.
	21.05 Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
27.0	Demonstrate knowledge and understanding of processing skills on materials and composites as they relate to aviation/aerospace technologies. The student will be able to:
	27.01 Investigate modern aerospace processing skills on materials and composites.
	27.02 Interpret and draw orthographic projections.
28.0	Describe and demonstrate principles of navigation. The student will be able to:
	28.01 Describe navigation principles as they relate to aeronautical travel.
	28.02 Demonstrate the ability to read and use an aeronautical navigational chart.
	28.03 Examine advanced navigational technologies and systems as they relate to aeronautical systems. (e.g., ILS, GPS)
	28.04 Define and describe a variety of orbital patterns.
30.0	Demonstrate the abilities to apply the design process. The student will be able to:
	30.01 Interpret the design problem to solve and decide whether or not to address it.
	30.02 Evaluate criteria and constraints and determine how these will affect the design process.
	30.03 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
	30.04 Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
	30.05 Produce a product or system using a design process.
	30.06 Evaluate final solutions and communicate observations, processes, and results of the entire design process.
31.0	Describe various factors critical to aircraft performance. The student will be able to:
	31.01 Describe aircraft weight and balance terms and factors.
	31.02 Calculate an aircraft’s center of gravity (CG).
	31.03 Describe how runway length affects aircraft performance.
	31.04 Describe how aircraft performance is affected by changing atmospheric conditions (wind, temperature, pressure altitude, humidity, etc.).

CTE Standards and Benchmarks	
	31.05 Describe the weather requirements and basic rules for flight under Visual Flight Rules (VFR) and Instrument Flight Rules IFR).
	31.06 Describe the major Airspace lasses and the rules for flight within each type of Airspace Class.
	31.07 Discuss engine and fuel issues/conditions relative to aircraft performance.
	31.08 Explain the role of instrumentation relative to aircraft performance.
	31.09 Describe how aircraft design impacts aircraft performance.
	31.10 Describe how meteorological conditions affect aircraft performance.
	31.11 Explain how the type of aircraft (e.g., fixed wing, rotary wing, commercial, military, utility, etc.) impacts aircraft performance.
32.0	Demonstrate an understanding of electrical, mechanical, fluid, and pneumatic systems that could be used on/in aviation/aerospace environments. The student will be able to:
	32.01 Demonstrate the concepts of force, work, rate, resistance, energy and power through the use of various mechanical sub systems, include: gears, belts, valves, chains, pulleys, screws, cams, linkages, rods, and sprockets or mechanical trainers.
	32.02 Demonstrate the concepts of force, work rate, resistance, and power through the use of various fluid subsystems, including: fluid manometers, hydraulic lifts, pipes, valves, tanks, air gauges of hydraulic trainers, and pneumatic trainers.
	32.03 Demonstrate the concepts of force, work, rate, resistance, energy, and power through the use of various electrical sub system, including: conductors, control elements, electrical loads, voltage sources, current sources, circuits, components, and measurement equipment, or electrical/electronic trainers.
33.0	Demonstrate technical knowledge of computer control as it is related to aviation/aerospace projects. The student will be able to:
	33.01 Demonstrate the application of a computer and software program to develop a plan for an aerospace vehicle.
	33.02 Demonstrate an ability to use software programs to control flight operations and/or testing procedures.
34.0	Explore the role of civilian spacecraft in the exploration and colonization of space. The student will be able to:
	34.01 Develop a plan for scientific research to be performed on a space station facility.
	34.02 Develop a plan for flight crew training for a manned space flight.
	34.03 Research, develop, plan, and build model structures of space colonization structures.
	34.04 Develop plans, models and a visual presentation of a manned space flight to a distant planet in the solar system.
	34.05 Examine methods of sending and receiving messages and controlling telemetry from space.
35.0	Perform advanced study and technical skills related to aerospace technologies. The student will be able to:

CTE Standards and Benchmarks
35.01 Identify an aerospace problem or product for improvement using the design methodology.
35.02 Develop a written plan of work for the design team to carry out the project.
35.03 Show evidence of technical study in support of the project.
35.04 Perform mathematical or computational skills related to the aerospace project.
35.05 Complete the project as planned.
35.06 Deliver a professional quality presentation of the design process and solution.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Technology Studies**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8600100
CIP Number	0821010100
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program provides a student with a foundation in the role of technology in everyday life along with a broad range of technology skills that make them aware of technology around them. Students completing the program will become technologically literate by learning the concepts and role that engineering, design, invention, and innovation have in creating technology systems that help make life easier and better. The key component of the program is that students become knowledgeable about technology, and use hands-on lessons to apply and transfer this knowledge to common problems.

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 credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8600510	Technology Studies I	ENG 7G TEC ED 1 @2 ENG&TEC ED1@2	1 credit	2	CT
8600610	Technology Studies II		1 credit	2	CT
8601710	Technology Studies III		1 credit	2	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

National Standards

Industry or National Standards have been crosswalked with the corresponding standards and/or benchmarks. Industry or National Standards for the Technology Studies program can be found using the following link: https://www.iteea.org/stel.aspx

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 the characteristics and scope of technology.
02.0 Demonstrate an understanding of the core concepts of technology.
03.0 Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study.
04.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
05.0 Demonstrate an understanding of the effects of technology on the environment.
06.0 Demonstrate an understanding of the role of society in the development and use of technology.
07.0 Demonstrate an understanding of the influence of technology on history.
08.0 Demonstrate an understanding of the attributes of design.
09.0 Demonstrate an understanding of engineering design.
10.0 Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
11.0 Demonstrate the abilities to apply the design process.
12.0 Demonstrate the abilities to use and maintain technological products and systems.
13.0 Demonstrate the abilities to assess the impact of products and systems.
14.0 Demonstrate an understanding of and be able to select and use medical technologies.
15.0 Demonstrate an understanding of and be able to select and use agricultural and related biotechnologies.
16.0 Demonstrate an understanding of and be able to select and use energy and power technologies.
17.0 Demonstrate an understanding of and be able to select and use information and communication technologies.
18.0 Demonstrate an understanding of and be able to select and use transportation technologies.
19.0 Demonstrate an understanding of and be able to select and use manufacturing technologies.
20.0 Demonstrate an understanding of and be able to select and use construction technologies.
21.0 Demonstrate the ability to work safely with a variety of technologies.
22.0 Demonstrate interpersonal skills as they relate to the workplace.
23.0 Identify and apply methods of information acquisition and utilizations.
24.0 Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities.
25.0 Demonstrate and apply design/problem-solving processes.
26.0 Express an understanding of technological systems and their complex interrelationships.
27.0 Demonstrate the ability to properly identify, organize, plan, and allocate resources.
28.0 Discuss individual interests and aptitudes as they relate to a career.
29.0 Demonstrate employability skills.
30.0 Demonstrate an understanding of entrepreneurship.
31.0 Make an informed and meaningful career choice.
32.0 Identify evolving technologies in our technological world.
33.0 Demonstrate knowledge of the basic principles of technology, the basic elements of all systems, and the components of each basic element.
34.0 Demonstrate knowledge and perform special skills unique to the physical technologies.
35.0 Demonstrate knowledge and perform special skills unique to the information/communication technologies.

36.0 Demonstrate knowledge and perform special skills unique to the biotechnologies.
37.0 Demonstrate knowledge and application of robotics technology.
38.0 Demonstrate knowledge and application of programmable controller technology.
39.0 Demonstrate knowledge and application of computer numerical control technology.
40.0 Demonstrate knowledge and application of computer-aided drafting technology.
41.0 Demonstrate knowledge and application of laser technology.
42.0 Demonstrate knowledge and application of mechanical systems.
43.0 Demonstrate knowledge and application of fluid systems.
44.0 Demonstrate knowledge and application of electrical systems.
45.0 Demonstrate the use of fiber optics.
46.0 Demonstrate the use of a computer to integrate and control a system composed of mechanical, fluid and electrical systems.
47.0 Conduct a research and experimentation project on a technological material or process.

Florida Department of Education
Student Performance Standards

Course Title: **Technology Studies I**
Course Number: **8600510**
Course Credit: **1**

Course Description:

This course provides students with an introduction to the knowledge, human relations, and technological skills found today in technical professions.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Discuss the nature and development of technological knowledge and processes.
01.02	Explain the rapid increase in the rate of technological development and diffusion.
01.03	Recognize specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Identify systems thinking logic and creativity with appropriate compromises in complex real-life problems.
02.02	Define technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.
02.03	Identify the stability of a technological system and its influence by all of the components in the system, especially those in the feedback loop.
02.04	Identify resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.
02.05	Identify the criteria and constraints of a product or system and then determine how they affect the final design and development.
02.06	List strategies for optimizing a technological process or methodology of designing or making a product, dependent on criteria and constraints.
02.07	Identify new technologies that create new processes.
02.08	Define a management system as the process of planning, organizing, and controlling work.
02.09	Outline complex systems that have many layers of controls and feedback loops to provide information.
03.0	Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study. The student will be able to:

CTE Standards and Benchmarks	
03.01	Identify technology transfer occurring when a new user applies an existing innovation developed for one purpose in a different function.
03.02	Identify technological innovation resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
03.03	Outline the process of patenting to protect a technological idea.
03.04	Identify technological progresses that promote the advancement of science and mathematics.
04.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
04.01	Identify changes caused by the use of technology ranging from gradual to rapid and from subtle to obvious.
04.02	Classify the use of technology involving weighing the trade-offs between the positive and the negative effects.
04.03	Identify ethical considerations important in the development, selection, and use of technologies.
04.04	List the cultural, social, economic, and political changes caused by the transfer of a technology from one society to another.
04.05	Discuss current technological developments that are/were driven by profit motive and the market.
05.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
05.01	Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
07.0	Demonstrate an understanding of the influence of technology on history. The student will be able to:
07.01	Research how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
07.02	Define the history of technology as a powerful force in reshaping the social, cultural, political, and economic landscape.
07.03	Discuss that early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.
07.04	Define the Iron Age as the use of iron and steel as the primary materials for tools.
07.05	Define the Middle Ages and its development of many technological devices that produced long-lasting effects on technology and society.
07.06	Define the Renaissance, a time of rebirth of the arts and humanities, as an important development in the history of technology.
07.07	Define the Industrial Revolution and the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.
07.08	Define the Information Age and its placement of emphasis on the processing and exchange of information.

CTE Standards and Benchmarks	
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
08.01	Recognize the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
08.02	Restate design problems that are seldom presented in a clearly defined form.
08.03	Check and critique a design continually, and improve and revise the idea of the design as needed.
08.04	List competing requirements of a design, such as criteria, constraints, and efficiency.
09.0	Demonstrate an understanding of engineering design. The student will be able to:
09.01	Identify design principles used to evaluate existing designs, to collect data, and to guide the design process.
09.02	Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the Engineering Design process.
09.03	Construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.
09.04	Identify factors taken into account in the process of engineering.
10.0	Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. The student will be able to:
10.01	Define research and development as a specific problem solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.
10.02	Identify research needed to solve technological problems.
10.03	Differentiate between technological and non-technological problems, and identify which problems can be solved using technology.
10.04	Utilize a multidisciplinary approach to solving technological problems.
11.0	Demonstrate the abilities to apply the design process. The student will be able to:
11.01	Identify the design problem to solve and decide whether or not to address it.
11.02	List criteria and constraints and determine how these will affect the design process.
11.03	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
11.04	Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.

CTE Standards and Benchmarks	
11.05	Develop a product or system using a design process.
11.06	Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
12.01	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
12.02	Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
12.03	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
12.04	Operate systems so that they function in the way they were designed.
12.05	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
13.0	Demonstrate the abilities to assess the impact of products and systems. The student will be able to:
13.01	Collect information and evaluate its quality.
13.02	Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.
13.03	Define assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
13.04	Identify forecasting techniques to evaluate the results of altering natural systems.
17.0	Demonstrate an understanding of and be able to select and use information and communication technologies. The student will be able to:
17.01	Discuss information and communication technologies including the inputs, processes, and outputs associated with sending and receiving information.
17.02	Classify information and communication systems that allow information to be transferred as human to human, human to machine, machine to human, or machine to machine.
17.03	Use information and communication systems to inform, persuade, entertain, control, manage, and educate.
17.04	Identify components of a communications system, including source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.
17.05	Identify many ways to communicate information, such as graphic and electronic means.
17.06	Communicate technological knowledge and processes using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.

CTE Standards and Benchmarks	
	17.07 Discuss the usage and protocols of using social media.
	17.08 Discuss how knowledge management is used to help companies analyze market trends.
18.0	Demonstrate an understanding of and be able to select and use transportation technologies. The student will be able to:
	18.01 Analyze the vital role played by transportation in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.
	18.02 Define intermodalism as the use of different modes of transportation, such as highways, railways, and waterways as part of an interconnected system that can move people and goods easily from one mode to another.
	18.03 Discuss how transportation services and methods have led to a population that is regularly on the move.
	18.04 Identify processes and innovative techniques involved in the design of intelligent and non-intelligent transportation systems.
20.0	Demonstrate an understanding of and be able to select and use construction technologies. The student will be able to:
	20.01 Define infrastructure as the underlying base or basic framework of a system.
	20.02 Identify a variety of processes and procedures used in constructing structures.
	20.03 Identify requirements involved in the design of structures.
	20.04 Recommend maintenance, alterations, or renovations to improve a structure or alter its intended use.
	20.05 Identify prefabricated materials used in some structures.
21.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
	21.01 Select appropriate tools, procedures, and/or equipment needed to produce a product.
	21.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
	21.03 Demonstrate knowledge required to maintain and troubleshoot equipment used in a variety of technological systems.
	21.04 Follow laboratory safety rules and procedures.
	21.05 Demonstrate good housekeeping at work station within total laboratory.
	21.06 Identify color-coding safety standards.
	21.07 Explain fire prevention and safety precautions and practices for extinguishing fires.

CTE Standards and Benchmarks	
	21.08 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
22.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
	22.01 Perform roles in a student personnel system or in career technical student organization (CTSO).
	22.02 Participate as a member of a team.
	22.03 Teach others new skills.
	22.04 Identify skills needed to serve clients/customers.
	22.05 Demonstrate leadership skills.
	22.06 Describe strategies necessary for negotiating agreements.
	22.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	22.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	22.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	22.10 Form an understanding and appreciation for the roles and work of co-workers.
23.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	23.01 Define terms related to computers.
	23.02 Identify and describe methods of information acquisition and evaluation.
	23.03 Discuss advantages and disadvantages in the application of technologies.
	23.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	23.05 Comprehend and communicate information relevant to emerging technologies.
	23.06 Demonstrate the use of computers to process information.
24.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	24.01 Identify and explain the main and subordinate ideas in a written work.
	24.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.

CTE Standards and Benchmarks	
24.03	Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
24.04	Distinguish fact from opinion.
24.05	Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
24.06	Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
24.07	Improve one's own writing by restructuring, correcting errors, and rewriting.
24.08	Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.
24.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
24.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
24.11	Compose unified and coherent correspondence, directions, descriptions, explanations and reports.
24.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
24.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
24.14	Use the mathematics of:
	• integers, fractions, and decimals;
	• ratios, proportions, and percentages;
	• roots and powers;
	• algebra;
24.15	Draw, read, and analyze graphs, charts, and tables.
24.16	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and field work.
24.17	Organize and communicate the results obtained by observation and experimentation.
25.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
25.01	Describe and explain steps in the design/problem-solving process.

CTE Standards and Benchmarks	
	25.02 Propose solutions to given problems.
	25.03 Design and implement the optimal solution to a given problem.
	25.04 Document each step of the design/problem-solving process.
	25.05 Demonstrate "brainstorming" as a process to solve problems.
	25.06 Define "critical thinking" and its value in the problem-solving process.
26.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:
	26.01 Demonstrate knowledge of how social, organizational, and technological systems work.
	26.02 Explore methods used to monitor and correct performance of technological systems.
	26.03 Design and implement an optimal solution to a given problem.
	26.04 Outline major historical technological developments or events.
	26.05 Identify recent advances in technology.
	26.06 Explain problem-solving roles of technology.
	26.07 Forecast a technological development or event.
	26.08 Define technology.
27.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
	27.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
	27.02 Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
	27.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
	27.04 Display knowledge of the efficient use of human resources.
28.0	Discuss individual interests and aptitudes as they relate to a career. The student will be able to:
	28.01 Describe individual strengths and weaknesses.
	28.02 Discuss individual interests related to a career.

CTE Standards and Benchmarks	
	28.03 Identify careers within specific areas of technology.
	28.04 Explore careers within specific areas of interest.
29.0	Demonstrate employability skills. The student will be able to:
	29.01 Research careers that have been identified as having attributes of science, technology, engineering, and mathematics.
31.0	Make an informed and meaningful career choice. The student will be able to:
	31.01 Make a tentative occupational choice based on the information learned and interest developed in this course.
	31.02 Review tentative occupational choices based on the information learned and interest developed in this course.
32.0	Identify evolving technologies in our technological world. The student will be able to:
	32.01 List five technologies that did not exist five years ago.
	32.02 Use the problem-solving process to generate three potential improvements to a recent or evolving technology.
33.0	Demonstrate knowledge of the basic principles of technology, the basic elements of all systems, and the components of each basic element. The student will be able to:
	33.01 Define the six basic principles of technology: force, work, rate, resistance, energy, and power.
	33.02 Name and define the three basic elements of all systems.
	33.03 Name components of the three basic elements of a system.
34.0	Demonstrate knowledge and perform special skills unique to the physical technologies. The student will be able to:
	34.01 Define the function of construction technology, energy and power technology, manufacturing technology, and transportation technology.
	34.02 Describe three careers for each of the physical technologies identified in 37.01.
	34.03 Identify and demonstrate the tools, processes, and materials used in construction technology.
	34.04 Identify and demonstrate the equipment, processes, and materials used in energy and power technology for converting and transmitting power.
	34.05 Identify and demonstrate the tools, processes, and materials used in manufacturing technology to perform computer-aided manufacturing.
	34.06 Identify and demonstrate various ways that people and goods are transported.

CTE Standards and Benchmarks	
	34.07 Demonstrate problem-solving skills relative to the physical technologies utilizing the techniques learned in this course.
35.0	Demonstrate knowledge and perform special skills unique to the information/communication technologies. The student will be able to:
	35.01 Define the function of information processing technology, graphic communication technology, and electronic communication technology.
	35.02 Describe three careers for each of the communications technologies identified in 38.01.
	35.03 Identify and demonstrate the tools, processes and materials used in the information/communication technologies.
	35.04 Compare and contrast different processes of communication technologies.
	35.05 Demonstrate modern communication systems using sound and speech, symbols and codes, printed words, drawing and pictures.
	35.06 Identify the function of information processing technology, graphic communication technology, and electronic communication technology.
	35.07 Identify several telecommunication services.
	35.08 Demonstrate problem-solving skills relative to the information communication technologies utilizing the techniques learned in this course.
40.0	Demonstrate knowledge and application of computer-aided drafting technology. The student will be able to:
	40.01 Compare and contrast computer-aided drafting with non-computer aided drafting in terms of speed consistency, neatness, and accuracy.
	40.02 Demonstrate the application of a computer and software program in doing several computer-aided drawings.
	40.03 Identify computer-aided drafting hardware.
	40.04 Demonstrate program-solving skills relative to computer-aided drafting utilizing the techniques learned in this course.

Florida Department of Education
Student Performance Standards

Course Title: **Technology Studies II**
Course Number: **8600610**
Course Credit: **1**

Course Description:

This program provides students with an intermediate understanding of the knowledge, human relations, and technological skills found today in technical professions.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Illustrate the nature and development of technological knowledge and processes.
01.02	Graph the rapid increase in the rate of technological development and diffusion.
01.03	Conduct specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Apply systems thinking logic and creativity with appropriate compromises in complex real-life problems.
02.02	Discuss technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.
02.03	Assess the stability of a technological system and its influence by all of the components in the system, especially those in the feedback loop.
02.04	Select resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.
02.05	Identify the criteria and constraints of a product or system and then determine how they affect the final design and development.
02.06	Implement strategies for optimizing a technological process or methodology of designing or making a product, dependent on criteria and constraints.
02.07	Identify new technologies that create new processes.
02.08	Describe a quality control process to ensure that a product, service or system meets established criteria.
02.09	Organize a management system as the process of planning, organizing, and controlling work.

CTE Standards and Benchmarks	
	02.10 Outline complex systems that have many layers of controls and feedback loops to provide information.
03.0	Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study. The student will be able to:
	03.01 Discuss technology transfer occurring when a new user applies an existing innovation developed for one purpose in a different function.
	03.02 Explain technological innovation resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
	03.03 Report the process of patenting to protect a technological idea.
	03.04 Discuss technological progresses that promote the advancement of science and mathematics.
04.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
	04.01 Discuss changes caused by the use of technology ranging from gradual to rapid and from subtle to obvious.
	04.02 Compare the use of technology involving weighing the trade-offs between the positive and the negative effects.
	04.03 Discuss ethical considerations important in the development, selection, and use of technologies.
	04.04 Debate the cultural, social, economic, and political changes caused by the transfer of a technology from one society to another.
	04.05 Evaluate current technological developments that are/were driven by profit motive and the market.
05.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
	05.01 List trade-offs of developing technologies to reduce the use of resources.
	05.02 Use technology to monitor the environment and provide information as a basis for decision-making.
	05.03 Discuss decisions about the implementation of technologies involving the weighing of trade-offs between predicted positive and negative effects on the environment.
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
	08.01 Implement the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
	08.02 Translate design problems that are seldom presented in a clearly defined form.
	08.03 Evaluate a design continually, and improve and revise the idea of the design as needed.

CTE Standards and Benchmarks	
	08.04 Analyze competing requirements of a design, such as criteria, constraints, and efficiency.
10.0	Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. The student will be able to:
	10.01 Employ research and development as a specific problem solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.
	10.02 Conduct research needed to solve technological problems.
	10.03 Differentiate between technological and non-technological problems, and identify which problems can be solved using technology.
	10.04 Utilize a multidisciplinary approach to solving technological problems.
11.0	Demonstrate the abilities to apply the design process. The student will be able to:
	11.01 Interpret the design problem to solve and decide whether or not to address it.
	11.02 Evaluate criteria and constraints and determine how these will affect the design process.
	11.03 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
	11.04 Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
	11.05 Produce a product or system using a design process.
	11.06 Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
	12.01 Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
	12.02 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
	12.03 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
	12.04 Operate systems so that they function in the way they were designed.
	12.05 Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
13.0	Demonstrate the abilities to assess the impact of products and systems. The student will be able to:
	13.01 Collect information and evaluate its quality.

CTE Standards and Benchmarks	
	13.02 Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.
	13.03 Apply assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
	13.04 Design forecasting techniques to evaluate the results of altering natural systems.
16.0	Demonstrate an understanding of and be able to select and use energy and power technologies. The student will be able to:
	16.01 Discuss how energy cannot be created nor destroyed; however, it can be converted from one form to another.
	16.02 Categorize types of energy into major forms: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.
	16.03 Explain impossibility of building an engine to perform work that does not exhaust thermal energy to the surroundings.
	16.04 Classify energy resources as renewable or nonrenewable.
	16.05 Construct a power system having a source of energy, a process, and loads.
19.0	Demonstrate an understanding of and be able to select and use manufacturing technologies. The student will be able to:
	19.01 Service products to keep them in good operating condition.
	19.02 Classify materials based on their qualities as natural, synthetic, or mixed.
	19.03 Classify goods as durable goods designed to operate for a long period of time, or non-durable goods designed to operate for a short period of time.
	19.04 Identify and classify manufacturing systems into types, such as customized production, batch production, and continuous production.
	19.05 Discuss the interchangeability of parts to increase the effectiveness of manufacturing processes.
	19.06 Identify chemical technologies providing a means for humans to alter or modify materials and to produce chemical products.
	19.07 Employ marketing techniques involving establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it.
21.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
	21.01 Select appropriate tools, procedures, and/or equipment needed to produce a product.
	21.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
	21.03 Demonstrate knowledge required to maintain and troubleshoot equipment used in a variety of technological systems.

CTE Standards and Benchmarks	
	21.04 Follow laboratory safety rules and procedures.
	21.05 Demonstrate good housekeeping at work station within total laboratory.
	21.06 Identify color-coding safety standards.
	21.07 Explain fire prevention and safety precautions and practices for extinguishing fires.
	21.08 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
22.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
	22.01 Perform roles in a student personnel system or in career technical student organization (CTSO).
	22.02 Participate as a member of a team.
	22.03 Teach others new skills.
	22.04 Identify skills needed to serve clients/customers.
	22.05 Demonstrate leadership skills.
	22.06 Describe strategies necessary for negotiating agreements.
	22.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	22.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	22.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	22.10 Form an understanding and appreciation for the roles and work of co-workers.
23.0	Identify and apply methods of information acquisition and utilizations. The student will be able to:
	23.01 Define terms related to computers.
	23.02 Identify and describe methods of information acquisition and evaluation.
	23.03 Discuss advantages and disadvantages in the application of technologies.
	23.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	23.05 Comprehend and communicate information relevant to emerging technologies.

CTE Standards and Benchmarks	
	23.06 Demonstrate the use of computers to process information.
24.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	24.01 Identify and explain the main and subordinate ideas in a written work.
	24.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	24.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	24.04 Distinguish fact from opinion.
	24.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	24.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	24.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	24.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.
	24.09 Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
	24.10 Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
	24.11 Compose unified and coherent correspondence, directions, descriptions, explanations and reports.
	24.12 Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
	24.13 Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
	24.14 Use the mathematics of:
	• integers, fractions, and decimals;
	• ratios, proportions, and percentages;
	• roots and powers;
	• algebra;
	• geometry;

CTE Standards and Benchmarks	
24.15	Make estimates and approximations, and judge the reasonableness of a result.
24.16	Draw, read, and analyze graphs, charts, and tables.
24.17	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and field work.
24.18	Organize and communicate the results obtained by observation and experimentation.
24.19	Apply the basic principles of biology, physics, and chemistry (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
24.20	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
25.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
25.01	Describe and explain steps in the design/problem-solving process.
25.02	Propose solutions to given problems.
25.03	Design and implement the optimal solution to a given problem.
25.04	Document each step of the design/problem-solving process.
25.05	Demonstrate "brainstorming" as a process to solve problems.
25.06	Define "critical thinking" and its value in the problem-solving process.
26.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:
26.01	Explore methods used to monitor and correct performance of technological systems.
26.02	Design and implement an optimal solution to a given problem.
26.03	Explain problem-solving roles of technology.
26.04	Forecast a technological development or event.
27.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
27.01	Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
27.02	Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.

CTE Standards and Benchmarks
27.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
27.04 Display knowledge of the efficient use of human resources.
28.0 Discuss individual interests and aptitudes as they relate to a career. The student will be able to:
28.01 Describe individual strengths and weaknesses.
28.02 Discuss individual interests related to a career.
28.03 Identify careers within specific areas of technology.
28.04 Explore careers within specific areas of interest.
29.0 Demonstrate employability skills. The student will be able to:
29.01 Research careers that have been identified as having attributes of science, technology, engineering, and mathematics.
29.02 Secure information about a career.
29.03 Identify documents that may be required when applying for a job interview.
29.04 Complete a job application form correctly.
29.05 Demonstrate competence in job interview techniques.
29.06 Prepare a resume for a job.
31.0 Make an informed and meaningful career choice. The student will be able to:
31.01 Make a tentative occupational choice based on the information learned and interest developed in this course.
31.02 Review tentative occupational choices based on the information learned and interest developed in this course.
33.0 Demonstrate knowledge of the basic principles of technology, the basic elements of all systems, and the components of each basic element. The student will be able to:
33.01 Name the six basic parts of the energy system.
33.02 State the function of each of the basic parts of the energy system.
36.0 Demonstrate knowledge and perform special skills unique to the biotechnologies. The student will be able to:
36.01 Define the function of biotechnology, medical technology, food production technology, and agriculture technology.

CTE Standards and Benchmarks	
	36.02 Describe three careers for each of the technology areas in 39.01.
	36.03 Explain the three areas into which modern biotechnology is divided.
	36.04 Contrast the seven resources for biotechnology with other technologies.
	36.05 Identify several impacts of biotechnology on society and the environment.
	36.06 Identify the role of biotechnology in agriculture, food production, and medicine.
	36.07 Identify and describe the processes used in biotechnology and the related areas of produce outputs.
	36.08 Identify several outputs of biotechnology and their related biotechnologies.
	36.09 Demonstrate problem-solving skills relative to biotechnology, or a related biotechnology utilizing the techniques learned in this course.
37.0	Demonstrate knowledge and application of robotics technology. The student will be able to:
	37.01 Identify three types of robots.
	37.02 State the function of effectors, sensors, controllers, and auxiliary parts in a robotics system.
	37.03 Operate a robot using a teach pendant.
	37.04 Program a robot using a computer to perform a specific task.
	37.05 Explain three impacts of robotics on society.
	37.06 Demonstrate problem-solving skills relative to robotics utilizing the techniques learned in this course.
38.0	Demonstrate knowledge and application of programmable controller technology. The student will be able to:
	38.01 State the function of the component parts of a programmable controller.
	38.02 List several advantages of using programmable controllers.
	38.03 Demonstrate logical continuity and branching functions with a programmable controller.
39.0	Demonstrate knowledge and application of computer numerical control technology. The student will be able to:
	39.01 Demonstrate the technique of computer numerical control to perform and engraving and a milling activity.

CTE Standards and Benchmarks	
	39.02 Demonstrate problem-solving skills relative to computer numerical control utilizing the techniques learned in this course.
40.0	Demonstrate knowledge and application of computer-aided drafting technology. The student will be able to:
	40.01 Compare and contrast computer-aided drafting with non-computer aided drafting in terms of speed consistency, neatness, and accuracy.
	40.02 Demonstrate the application of a computer and software program in doing several computer-aided drawings.
	40.03 Identify computer-aided drafting hardware.
	40.04 Demonstrate program-solving skills relative to computer-aided drafting utilizing the techniques learned in this course.
41.0	Demonstrate knowledge and application of laser technology. The student will be able to:
	41.01 Describe five applications of lasers.
	41.02 Perform laser experiments demonstrating knowledge of:
	41.03 Characteristics of laser light.
	41.04 Characteristics of light waves.
	41.05 List the safety precautions that one observes when working with a laser.
	41.06 Assemble, operate and identify the parts of a laser optics system.
	41.07 Demonstrate the use of a laser to do measurements, transmit data, and monitor.

Florida Department of Education
Student Performance Standards

Course Title: **Technology Studies III**
Course Number: **8601710**
Course Credit: **1**

Course Description:

This program provides students with an advanced understanding of the knowledge, human relations, and technological skills found today in technical professions.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Critique the nature and development of technological knowledge and processes.
01.02	Synthesize a future technological development.
01.03	Differentiate specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Apply systems thinking logic and creativity with appropriate compromises in complex real-life problems.
02.02	Assess technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.
02.03	Assess the stability of a technological system and its influence by all of the components in the system, especially those in the feedback loop.
02.04	Compare resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.
02.05	Identify the criteria and constraints of a product or system and then determine how they affect the final design and development.
02.06	Propose strategies for optimizing a technological process or methodology of designing or making a product, dependent on criteria and constraints.
02.07	Discuss new technologies that create new processes.
02.08	Recommend a quality control process to ensure that a product, service or system meets established criteria.
02.09	Develop a management system as the process of planning, organizing, and controlling work.

CTE Standards and Benchmarks	
	02.10 Develop complex systems that have many layers of controls and feedback loops to provide information.
03.0	Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study. The student will be able to:
	03.01 Create technology transfer occurring when a new user applies an existing innovation developed for one purpose in a different function.
	03.02 Examine technological innovation resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
	03.03 Report the process of patenting to protect a technological idea.
	03.04 Investigate technological progresses that promote the advancement of science and mathematics.
05.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
	05.01 Compare and contrast the alignment of technological processes with natural processes to maximize performance and reduce negative impacts on the environment.
	05.02 Assess technologies devised to reduce the negative consequences of other technologies.
	05.03 Make decisions about the implementation of technologies involving the weighing of trade-offs between predicted positive and negative effects on the environment.
06.0	Demonstrate an understanding of the role of society in the development and use of technology. The student will be able to:
	06.01 Report how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
	06.02 Consider societal opinions and demands, as well as corporate cultures to use as a basis for deciding whether or not to develop a technology.
	06.03 Evaluate a number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads as contributors to shaping the design of and demand for various technologies.
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
	08.01 Implement the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
	08.02 Translate design problems that are seldom presented in a clearly defined form.
	08.03 Evaluate a design continually, and improve and revise the idea of the design as needed.
	08.04 Analyze competing requirements of a design, such as criteria, constraints, and efficiency.

CTE Standards and Benchmarks	
10.0	Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. The student will be able to:
10.01	Employ research and development as a specific problem solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.
10.02	Conduct research needed to solve technological problems.
10.03	Differentiate between technological and non-technological problems, and identify which problems can be solved using technology.
10.04	Utilize a multidisciplinary approach to solving technological problems.
11.0	Demonstrate the abilities to apply the design process. The student will be able to:
11.01	Interpret the design problem to solve and decide whether or not to address it.
11.02	Evaluate criteria and constraints and determine how these will affect the design process.
11.03	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
11.04	Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
11.05	Produce a product or system using a design process.
11.06	Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
12.01	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
12.02	Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
12.03	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
12.04	Operate systems so that they function in the way they were designed.
12.05	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
13.0	Demonstrate the abilities to assess the impact of products and systems. The student will be able to:
13.01	Collect information and evaluate its quality.
13.02	Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.

CTE Standards and Benchmarks	
	13.03 Apply assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
	13.04 Design forecasting techniques to evaluate the results of altering natural systems.
14.0	Demonstrate an understanding of and be able to select and use medical technologies. The student will be able to:
	14.01 Classify medical technologies including prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained.
	14.02 Discuss telemedicine and its convergence of technological advances in a number of fields, including medicine, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology.
	14.03 Explain how the sciences of biochemistry and molecular biology have made it possible to manipulate the genetic information found in living creatures.
15.0	Demonstrate an understanding of and be able to select and use agricultural and related biotechnologies. The student will be able to:
	15.01 Discuss agriculture, including a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical, and other useful products.
	15.02 Identify biotechnology applications in such areas as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.
	15.03 Define conservation as the process of controlling soil erosion, reducing sediment in waterways, and improving water quality.
	15.04 Apply engineering design processes to management of agricultural systems requiring knowledge of artificial ecosystems and the effects of technological development on flora and fauna.
21.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
	21.01 Select appropriate tools, procedures, and/or equipment needed to produce a product.
	21.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
	21.03 Demonstrate knowledge required to maintain and troubleshoot equipment used in a variety of technological systems.
	21.04 Follow laboratory safety rules and procedures.
	21.05 Demonstrate good housekeeping at work station within total laboratory.
	21.06 Identify color-coding safety standards.
	21.07 Explain fire prevention and safety precautions and practices for extinguishing fires.
	21.08 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
22.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:

CTE Standards and Benchmarks	
	22.01 Perform roles in a student personnel system or in career technical student organization (CTSO).
	22.02 Participate as a member of a team.
	22.03 Teach others new skills.
	22.04 Identify skills needed to serve clients/customers.
	22.05 Demonstrate leadership skills.
	22.06 Describe strategies necessary for negotiating agreements.
	22.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	22.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	22.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	22.10 Form an understanding and appreciation for the roles and work of co-workers.
24.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	24.01 Identify and explain the main and subordinate ideas in a written work.
	24.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	24.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	24.04 Distinguish fact from opinion.
	24.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	24.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	24.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	24.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.
	24.09 Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
	24.10 Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.

CTE Standards and Benchmarks	
24.11	Compose unified and coherent correspondence, directions, descriptions, explanations and reports.
24.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
24.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
24.14	Use the mathematics of:
	• geometry;
24.15	Make estimates and approximations, and judge the reasonableness of a result.
24.16	Use elementary concepts of probability and statistics.
24.17	Draw, read, and analyze graphs, charts, and tables.
24.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and field work.
24.19	Organize and communicate the results obtained by observation and experimentation.
24.20	Apply the basic principles of biology, physics, and chemistry (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
24.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
25.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
25.01	Describe and explain steps in the design/problem-solving process.
25.02	Propose solutions to given problems.
25.03	Design and implement the optimal solution to a given problem.
25.04	Document each step of the design/problem-solving process.
25.05	Demonstrate "brainstorming" as a process to solve problems.
25.06	Define "critical thinking" and its value in the problem-solving process.
26.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:
26.01	Design and implement an optimal solution to a given problem.

CTE Standards and Benchmarks
26.02 Forecast a technological development or event.
27.0 Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
27.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
27.02 Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
27.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
27.04 Display knowledge of the efficient use of human resources.
28.0 Discuss individual interests and aptitudes as they relate to a career. The student will be able to:
28.01 Identify careers within specific areas of technology.
28.02 Explore careers within specific areas of interest.
29.0 Demonstrate employability skills. The student will be able to:
29.01 Research careers that have been identified as having attributes of science, technology, engineering, and mathematics.
29.02 Secure information about a career.
29.03 Identify documents that may be required when applying for a job interview.
29.04 Complete a job application form correctly.
29.05 Demonstrate competence in job interview techniques.
29.06 Prepare a resume for a job.
30.0 Demonstrate an understanding of entrepreneurship. The student will be able to:
30.01 Define entrepreneurship.
30.02 Describe the importance of entrepreneurship to the American economy.
30.03 List the advantages and disadvantages of business ownership.
30.04 Identify the risks involved in ownership of a business.
30.05 Identify the necessary personal characteristics of a successful entrepreneur.

CTE Standards and Benchmarks	
	30.06 Identify the business skills needed to operate a small business efficiently and effectively.
31.0	Make an informed and meaningful career choice. The student will be able to:
	31.01 Make a tentative occupational choice based on the information learned and interest developed in this course.
	31.02 Review tentative occupational choices based on the information learned and interest developed in this course.
42.0	Demonstrate knowledge and application of mechanical systems. The student will be able to:
	42.01 Define the concepts of force, work, rate, resistance, energy and power as they relate to mechanical systems.
	42.02 Diagram a mechanical system incorporating input, monitoring, controlling, output, and feedback.
	42.03 Report on the six simple machines.
	42.04 Identify various parts of a mechanical system.
	42.05 Assemble and operate the six simple machines.
	42.06 Use the problem-solving model - perform activities using combinations of the six simple machines to meet the described design criteria.
	42.07 Demonstrate the use of a computer to control a mechanical system.
43.0	Demonstrate knowledge and application of fluid systems. The student will be able to:
	43.01 Define the concepts of force, work rate, resistance, energy and power as they relate to fluid systems.
	43.02 Diagram a fluid system incorporating input, monitoring, controlling, output, and feedback.
	43.03 Diagram a fluid power system incorporating input, monitoring, controlling, output, and feedback.
	43.04 Use the problem-solving model - perform activities using fluid power components to meet the described design criteria.
	43.05 Assemble, operate, and identify the parts of a fluid power system.
	43.06 Report on the applications of fluid power used in technology.
	43.07 Demonstrate the use of a computer to control a fluid power system.
44.0	Demonstrate knowledge and application of electrical systems. The student will be able to:
	44.01 Define the concepts of force, work, rate resistance, energy, and power as they relate to electrical systems.

CTE Standards and Benchmarks	
	44.02 Diagram an electrical system incorporating input, monitoring, controlling, output and feedback components.
	44.03 Explain what a system and sub-system is.
	44.04 Describe types of electrical outputs of heat, light, temperature, sound, magnetism, and electrical voltage.
	44.05 Describe types of electrical inputs of light, temperature, sound, magnetism, moisture, movement, pressure, and voltage.
	44.06 Use the problem-solving model - perform activities using electrical system components to meet the describe design criteria.
	44.07 Demonstrate the use of a computer to control an electrical system.
45.0	Demonstrate the use of fiber optics. The student will be able to:
	45.01 Report on the applications of fiber optics in technology.
	45.02 Use the problem-solving model - perform activities using fiber optics to meet the described design criteria.
	45.03 Assemble, operate, and identify the parts of a fiber optics system.
46.0	Demonstrate the use of a computer to integrate and control a system composed of mechanical, fluid and electrical systems. The student will be able to:
	46.01 Diagram an integrated system incorporating input, monitoring, controlling, output and feedback components.
	46.02 Use the problem-solving model - perform activities using integrated systems to meet the described design criteria.
	46.03 Assemble, operate, and identify the parts of integrated systems.
	46.04 Demonstrate the use of a computer to control an integrated system composed of mechanical, fluid and electrical components.
47.0	Conduct a research and experimentation project on a technological material or process. The student will be able to:
	47.01 Identify a problem.
	47.02 State a need to research the problem.
	47.03 Form a hypothesis about the problem.
	47.04 Plan the procedures for researching the problem.
	47.05 Conduct the research following the planned procedures.
	47.06 Present the research findings in a seminar.

CTE Standards and Benchmarks
47.07 State conclusions based on the research findings.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Electronics Technology**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8600900
CIP Number	0821010400
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of electronics technology. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

The content includes, but is not limited to, the theory, use, and technical application of electronics technology. The content and activities will also include the study of entrepreneurship, safety, and leadership 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 three credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8600910	Electronics Technology I	ELECTRICAL @7 7G ELECTRONIC @7 7G ENG 7G TEC ED 1 @2 ENG&TEC ED1@2 TEC ELEC @7 7G	1 credit	3	CT
8600920	Electronics Technology II		1 credit	3	CT
8600930	Electronics Technology III		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 the characteristics and scope of technology.
02.0 Demonstrate an understanding of the core concepts of technology.
03.0 Demonstrate an understanding of the relationships among technologies and the connections between technology and other fields of study.
04.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
05.0 Demonstrate an understanding of the effects of technology on the environment.
06.0 Demonstrate an understanding of the role of society in the development and use of technology.
07.0 Demonstrate an understanding of the influence of technology on history.
08.0 Demonstrate an understanding of the attributes of design.
09.0 Demonstrate an understanding of engineering design.
10.0 Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
11.0 Demonstrate the abilities to apply the design process.
12.0 Demonstrate the abilities to use and maintain technological products and systems.
13.0 Demonstrate the abilities to assess the impact of products and systems.
14.0 Demonstrate an understanding of and be able to select and use information and communication technologies.
15.0 Demonstrate safe and appropriate use of tools, machines, and materials in electronics technology.
16.0 Demonstrate an understanding of electronic circuit symbols, diagrams, and color codes.
17.0 Describe the structure of matter related to electronics.
18.0 Describe, construct, conduct, and analyze experiments with basic Direct Current (DC) circuits.
19.0 Describe, construct, conduct, and analyze experiments with magnets.
20.0 Describe, construct, conduct, and analyze circuits with motors.
21.0 Describe, construct, analyze, and perform math calculations and experiments with Ohms law.
22.0 Describe, construct, analyze and perform math calculations on series circuits.
23.0 Describe, construct, analyze and perform math calculations on parallel circuits.
24.0 Describe, construct, analyze and perform math calculations on series-parallel circuits.
25.0 Describe, construct, analyze and perform math calculations and circuits with Watts law.
26.0 Set up and operate multimeters in DC and AC circuits.
27.0 Identify, measure, perform math calculations and describe the function of transformers and inductors in electronic circuits.
28.0 Describe, construct, analyze and experiment with capacitive circuits.
29.0 Demonstrate the use of electronic equipment.
30.0 Demonstrate proper electronic assembly methods.
31.0 Demonstrate an understanding of basic electrical circuits and electronic systems.
32.0 Describe, experiment, and construct circuits with integrated circuits.
33.0 Describe, construct, and experiment with circuits using semiconductors.
34.0 Describe, construct, and experiment with circuits using Digital logic IC’s.
35.0 Describe, construct, conduct, and analyze experiments with basic Alternating Current (AC) circuits.

36.0 Describe, construct, analyze and experiment with circuits containing relays.
37.0 Describe, construct, experiment and build circuits using microcontrollers.
38.0 Describe, construct and experiment with circuits containing sensors and transducers.
39.0 Describe, construct and experiment with circuits containing Servos.
40.0 Demonstrate knowledge of robotics.
41.0 Perform advanced study and skills related to electronics.
42.0 Demonstrate an understanding of the principles and applications of microcomputer systems.
43.0 Describe, identify, and correct problems in electronic circuits.
44.0 Demonstrate technical knowledge and skills about electronic networks and systems.
45.0 Conduct a research and experimentation project on an electronic system or process.
46.0 Demonstrate an understanding of career opportunities and requirements in the field of electronics technology.

Florida Department of Education
Student Performance Standards

Course Title: **Electronics Technology I**
Course Number: **8600910**
Course Credit: **1**

Course Description:

This course provides students with an introduction to the knowledge, human relations, and technical skills of electronics technology.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Discuss the nature and development of technological knowledge and processes.
01.02	Explain the rapid increase in the rate of technological development and diffusion.
01.03	Recognize specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Identify systems thinking logic and creativity with appropriate compromises in complex real-life problems.
02.02	Define technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.
02.03	Identify resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.
02.04	Identify the criteria and constraints of a product or system and determine how they affect the final design and development.
02.05	Apply quality control as a planned process to ensure that a product, service, or system meets established criteria.
02.06	Define a management system as the process of planning, organizing, and controlling work.
03.0	Demonstrate an understanding of the relationships among technologies and the connections between technology and other fields of study. The student will be able to:
03.01	Identify technology transfer occurring when a new user applies an existing innovation developed for one purpose in a different function.
03.02	Compare technological innovations resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
03.03	Outline the process of patenting to protect a technological idea.

CTE Standards and Benchmarks	
	03.04 Identify technological progresses that promote the advancement of science and mathematics.
	03.05 Discuss and describe copyright and trademarks and how they are used to protect intellectual property.
	03.06 Discuss how artistic and engineering design may infringe on patents and trademarks.
04.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
	04.01 Identify and compare changes in society caused by the use of technology.
	04.02 Describe how the use of technology involving weighing the trade-offs between the positive and the negative effects.
	04.03 Discuss and reflect on the historical and cultural events involving the evolution of electronics technology.
05.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
	05.01 Compare trade-offs of developing technologies to reduce the use of resources.
	05.02 Assess technologies devised to reduce the negative consequences of other technologies.
	05.03 Make decisions about the implementation of technologies involving the weighing of trade-offs between predicted positive and negative effects on the environment.
06.0	Demonstrate an understanding of the role of society in the development and use of technology. The student will be able to:
	06.01 Investigate how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
	06.02 Collect societal opinions and demands, as well as corporate cultures to use as a basis for deciding whether or not to develop a technology.
	06.03 Identify a number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads as contributors to shaping the design of and demand for various technologies.
07.0	Demonstrate an understanding of the influence of technology on history. The student will be able to:
	07.01 Describe how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
	07.02 Describe how technology has been a powerful force in reshaping social, cultural, political, and economic landscapes throughout history.
	07.03 Investigate how technology has created and transformed jobs and careers.
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
	08.01 Recognize the design process; including defining a problem, brainstorming, researching and generating ideas.

CTE Standards and Benchmarks	
	08.02 Identify specifications, criteria, and design constraints.
	08.03 Investigate the use of unique tools, materials and technologies to create the design or invention.
	08.04 Through collaborative brainstorming investigate a possible invention to solve the design solution.
	08.05 Create collaborative sketches or artistic renderings of the invention.
	08.06 Select an approach and develop a design proposal.
	08.07 Prepare drawings using CAD or 3-D illustration software.
	08.08 Create a model or prototype.
	08.09 Test and evaluate the design, revise and complete an updated design.
	08.10 Communicate the process, the multiple design revisions and results of the design or invention.
	08.11 Prepare a presentation design process and proposed solution using presentation, CAD, or modeling software.
	08.12 Describe why design problems that are seldom presented in a clearly defined form.
	08.13 Explain why a design must be continually checked and critiqued.
	08.14 Give examples of competing requirements of a design, such as criteria, constraints, and efficiency.
09.0	Demonstrate an understanding of engineering design. The student will be able to:
	09.01 Identify design principles used to evaluate existing designs, to collect data, and to guide the design process.
	09.02 Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the engineering design process.
	09.03 Identify factors taken into account in the process of engineering.
	09.04 Solve product design related problems through abstract and divergent thinking.
	09.05 Use the principles of the design process to create or redesign a product or system.
10.0	Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. The student will be able to:
	10.01 Define research and development as a specific problem solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.

CTE Standards and Benchmarks	
	10.02 Describe why research needed to solve technological problems
	10.03 Explain why some problems have technological solutions while others have non-technological solutions.
	10.04 Explain why a multidisciplinary approach to solving technological problems.
11.0	Demonstrate the abilities to apply the design process. The student will be able to:
	11.01 Identify the design problem to solve and decide whether or not to address it.
	11.02 List criteria and constraints and determine how these will affect the design process.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
	12.01 Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
	12.02 Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
13.0	Demonstrate the abilities to assess the impact of products and systems. The student will be able to:
	13.01 Collect information and evaluate its quality.
	13.02 Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.
14.0	Demonstrate an understanding of and be able to select and use information and communication technologies. The student will be able to:
	14.01 Classify information and communication systems that allow information to be transferred as human to human, human to machine, machine to human, or machine to machine.
	14.02 Use information and communication systems to inform, persuade, entertain, control, manage, and educate.
	14.03 Use presentation or modeling software to communicate a new design.
15.0	Demonstrate safe and appropriate use of tools, machines, and materials in electronics technology. The student will be able to:
	15.01 Select appropriate tools, procedures, and/or equipment.
	15.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
	15.03 Follow laboratory safety rules and procedures.
	15.04 Demonstrate good housekeeping at workstation within total laboratory.

CTE Standards and Benchmarks	
	15.05 Identify color-coding safety standards.
	15.06 Explain fire prevention and safety precautions and practices for extinguishing fires.
	15.07 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
	15.08 Identify the factors that determine the severity of electrical shock.
	15.09 Identify lifesaving safety equipment such as ground fault circuit interrupters (GFCI), proper grounding.
	15.10 Identify protective equipment such as circuit breakers, fuses, surge protection, and uninterruptable power supplies.
	15.11 Compare the characteristics and applications of different types of batteries. (Lithium, NiCad, Alkaline, etc.)
	15.12 Explain ways in which batteries are rated and tested.
16.0	Demonstrate an understanding of electronic circuit symbols, diagrams, and color codes. The student will be able to:
	16.01 Identify schematic symbols.
	16.02 Identify wiring and block diagrams.
	16.03 Create schematic diagrams.
	16.04 Identify resistors by their color code.
	16.05 Categorize the different types of resistors.
	16.06 Explain resistor uses and ratings.
	16.07 Explain how resistors are constructed.
	16.08 Identify the factors that contribute to the resistance value of a conductor.
17.0	Describe the structure of matter related to electronics. The student will be able to:
	17.01 Describe the composition of elements, mixtures, and compounds according to the electron theory.
	17.02 List the atomic sub-particles.
	17.03 Diagram and show the relationship between electrons, protons, and neutrons.
	17.04 State the law of electrical charges.

CTE Standards and Benchmarks	
	17.05 Describe the classification and characteristics of materials as they apply to conductor, insulators, and semiconductors.
	17.06 Define electrical quantities (voltage, current, resistance, etc.).
	17.07 Define units of measure including milli, micro, mega, and kilo.
	17.08 Describe and perform mathematical calculations using metric prefixes (milli, micro, mega, kilo, etc.).
18.0	Describe, construct, conduct, and analyze experiments with basic Direct Current (DC) circuits. The student will be able to:
	18.01 Define the elements of a complete circuit.
	18.02 Define the characteristics of voltage, current, and resistance.
	18.03 Perform mathematical calculations related to basic DC circuits.
19.0	Describe, construct, conduct, and analyze experiments with magnets. The student will be able:
	19.01 Describe magnetic poles, fields, and flux lines.
	19.02 Define Gauss, Gilbert and Oested.
	19.03 Describe permanent and temporary magnets providing example applications of each.
	19.04 Describe how voltage and current affect an electromagnet's strength.
	19.05 Construct simple circuits using solenoids and relays.
20.0	Describe, construct, conduct, and analyze circuits with motors. The student will be able:
	20.01 Explain basic motor operating principles.
	20.02 Describe the construction, and operating characteristics of DC motors.
	20.03 Describe the construction, and operating characteristics of AC motors.
	20.04 Explain the relationship between motor power, speed, and torque.
21.0	Describe, construct, analyze, and perform math calculations and experiments with Ohms law. The student will be able to:
	21.01 Describe and identify metric prefixes (milli, micro, mega, kilo)
	21.02 Use prefixes to convert quantities.

CTE Standards and Benchmarks
21.03 State Ohms law and define the relationship between voltage, current and resistance.
21.04 Use ohms law to perform math calculations for unknown quantities of voltage, current and resistance.
22.0 Describe, construct, analyze and perform math calculations on series circuits. The student will be able to:
22.01 Describe and identify the elements of a series circuit.
22.02 Describe the characteristics of current in a series circuit.
22.03 Apply and solve for Kirchhoff's voltage law in a series circuit.
22.04 Solve for total resistance in a series circuit.
22.05 Setup and test series circuits.
23.0 Describe, construct, analyze and perform math calculations on parallel circuits. The student will be able to:
23.01 Describe and identify the elements of a parallel circuit.
23.02 Describe the characteristics of voltage in a parallel circuit.
23.03 Apply and solve for Kirchhoff's current law in a parallel circuit.
23.04 Solve for total resistance in a parallel circuit
23.05 Setup and test parallel circuits
24.0 Describe, construct, analyze and perform math calculations on series-parallel circuits. The student will be able to:
24.01 Describe and identify the elements of a series-parallel circuit.
24.02 Describe the characteristics of voltage, and current in a parallel circuit.
24.03 Solve for total resistance in a parallel circuit
24.04 Setup and test parallel circuits
25.0 Describe, construct, analyze and perform math calculations and circuits with Watts law. The student will be able to:
25.01 Define electrical power.
25.02 Calculate the power dissipation of a circuit using Watts law.

CTE Standards and Benchmarks	
	25.03 Perform math calculations for residential power usage in kilowatts.
26.0	Set up and operate multimeters in DC and AC circuits. The student will be able to:
	26.01 Set up and operate power supplies in DC circuits.
	26.02 Describe magnetism, the law of magnetic poles, and the behavior of flux lines.
	26.03 Demonstrate electromagnetism.
	26.04 Construct simple circuits using a relay.
27.0	Identify, measure, perform math calculations and describe the function of transformers and inductors in electronic circuits. The student will be able to:
	27.01 Explain the theory of operation and application of inductance in inductors and transformers.
	27.02 Explain what an inductor is and what its purpose is.
	27.03 Construct circuits using transformers and inductors.
	27.04 Explain inductive reactance.
28.0	Describe, construct, analyze and experiment with capacitive circuits. The student will be able to:
	28.01 Explain how a capacitor stores electrical energy.
	28.02 Explain how a capacitor charges and discharges.
	28.03 Explain how a capacitor is constructed.
29.0	Demonstrate the use of electronic equipment. The student will be able to:
	29.01 Use a VOM to obtain accurate measurements.
	29.02 Apply safety rules in the use of electronic instruments and demonstrate proper care and maintenance for the equipment during storage and use.
	29.03 Use voltmeters to obtain accurate measurements in series, parallel and series-parallel circuits.
	29.04 Use ammeters to obtain accurate measurements in series, parallel and series-parallel circuits.
	29.05 Use ohmmeters to obtain accurate measurements in series, parallel and series-parallel circuits.

CTE Standards and Benchmarks
29.06 Use testers to determine the condition of electronic components.
30.0 Demonstrate proper electronic assembly methods. The student will be able to:
30.01 Identify common electrical and electronics hand tools.
30.02 Demonstrate electronic component assembly.
31.0 Demonstrate an understanding of basic electrical circuits and electronic systems. The student will be able to:
31.01 Define electronic systems.
31.02 Describe the importance of electronic systems in today's technology world.
31.03 Define electronics input, process and output of electronic systems.
31.04 Conduct electronic experiments using input, process and output systems.
31.05 Describe, design and conduct experiments with electronic systems.
32.0 Describe, experiment, and construct circuits with integrated circuits. The student will be able to:
32.01 Explain what integrated circuits (IC's) are and how they are manufactured.
32.02 Explain the advantages of integrated circuits as compared to discrete component circuits.
32.03 Construct electronic circuits that contain ICs.
32.04 Describe the basic types of integrated circuit design, along with their pin numbering systems and dimensions.
33.0 Describe, construct, and experiment with circuits using semiconductors. The student will be able to:
33.01 Describe the general theory and application of semiconductor devices.
33.02 Construct transistor circuits that act as switches
33.03 Construct transistor circuits that act as amplifiers
34.0 Describe, construct, and experiment with circuits using Digital logic IC’s. The student will be able to:
34.01 Describe the basic digital gates
34.02 Describe and apply the binary numbering system

CTE Standards and Benchmarks
34.03 Convert binary numbers to decimal numbers and decimal numbers to binary numbers.

Florida Department of Education
Student Performance Standards

Course Title: **Electronics Technology II**
Course Number: **8600920**
Course Credit: **1**

Course Description:

This course provides students with an intermediate understanding of the knowledge, human relations, and technical skills of electronics technology.

CTE Standards and Benchmarks	
03.0	Demonstrate an understanding of the relationships among technologies and the connections between technology and other fields of study. The student will be able to:
03.01	Outline the process of patenting to protect a technological idea.
03.02	Identify technological progresses that promote the advancement of science and mathematics.
03.03	Discuss and describe copyright and trademarks and how they are used to protect intellectual property.
03.04	Discuss how artistic and engineering design may infringe on patents, and trademarks.
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
08.01	Recognize the design process; including defining a problem, brainstorming, researching and generating ideas.
08.02	Identify specifications, criteria and design constraints.
08.03	Through collaborative brainstorming explore possibly design solution.
08.04	Select an approach and develop a design proposal.
08.05	Create a model or prototype.
08.06	Test and evaluating the design, refine the design then create a revision.
08.07	Communicate the process and results of the design.
08.08	Describe why design problems that are seldom presented in a clearly defined form.
08.09	Explain why a design must be continually checked and critiqued.

CTE Standards and Benchmarks	
	08.10 Give examples of competing requirements of a design, such as criteria, constraints, and efficiency.
09.0	Demonstrate an understanding of engineering design. The student will be able to:
	09.01 Construct a prototype or working model used to test a design concept by making actual observations and necessary adjustments.
	09.02 Identify factors taken into account in the process of engineering.
	09.03 Solve product design related problems through abstract and divergent thinking.
	09.04 Using the principles of the design process to create or redesign a product or system.
11.0	Demonstrate the abilities to apply the design process. The student will be able to:
	11.01 Collaborate with a team to create models and sketches of the proposed design.
	11.02 Demonstrate flexibility and the ability to adapt throughout the process of innovation.
	11.03 Through collaborative problem solving produce a design that is technically accurate, artistic and aesthetically pleasing.
	11.04 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
	11.05 Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
	11.06 Develop a product or system using a design process.
	11.07 Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
	12.01 Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
	12.02 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
	12.03 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
	12.04 Operate systems so that they function in the way they were designed.
13.0	Demonstrate the abilities to assess the impact of products and systems. The student will be able to:
	13.01 Define assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.

CTE Standards and Benchmarks
13.02 Identify forecasting techniques to evaluate the results of altering natural systems.
13.03 Analyze the social, environmental and economic impacts of the product design
13.04 Research ideas to develop and market the product, design, or new technology.
15.0 Demonstrate safe and appropriate use of tools, machines, and materials in electronics technology. The student will be able to:
15.01 Select appropriate tools, procedures, and/or equipment.
15.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
15.03 Follow laboratory safety rules and procedures.
15.04 Demonstrate good housekeeping at workstation within total laboratory.
15.05 Identify color-coding safety standards.
15.06 Explain fire prevention and safety precautions and practices for extinguishing fires.
15.07 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
17.0 Describe the structure of matter related to electronics. The student will be able to:
17.01 Describe the composition of element, mixtures, and compounds according to the electron theory.
17.02 List the atomic sub-particles.
17.03 Diagram and show the relationship between electrons, protons, and neutrons.
17.04 State the law of electrical charges.
17.05 Describe the classification and characteristics of materials as they apply to conductors, insulators, and semiconductors.
18.0 Describe, construct, conduct, and analyze experiments with basic Direct Current (DC) circuits. The student will be able to:
18.01 Define the elements of a complete circuit.
18.02 Define the characteristics of voltage, current and resistance.
18.03 Perform math calculations with basic DC circuits.
18.04 Compare AWG wire size and diameter of conductors.

CTE Standards and Benchmarks	
27.0	Identify, measure, perform math calculations and describe the function of transformers and inductors in electronic circuits. The student will be able to:
	27.01 Explain the theory of operation and application of inductance in inductors and transformers.
	27.02 Explain what an inductor is and what its purpose is.
	27.03 Construct circuits using transformers and inductors.
	27.04 Explain inductive reactance.
	27.05 List the factors that affect inductance.
28.0	Describe, construct, analyze and experiment with capacitive circuits. The student will be able to:
	28.01 Explain how a capacitor stores electrical energy.
	28.02 Explain how a capacitor charges and discharges.
	28.03 Explain how a capacitor is constructed.
	28.04 Explain capacitive reactance.
	28.05 List the factors that affect capacitance.
	28.06 Explain RC time constraints and the effect on circuits.
29.0	Demonstrate the use of electronic equipment. The student will be able to:
	29.01 Use a VOM to obtain accurate measurements.
	29.02 Apply safety rules in the use of electronic instruments and demonstrate proper care and maintenance for the equipment during storage and use.
	29.03 Use voltmeters to obtain accurate measurements in series, parallel, and series-parallel circuits.
	29.04 Use ammeters to obtain accurate measurements in series, parallel and series-parallel circuits.
	29.05 Use ohmmeters to obtain accurate measurements in series, parallel and series-parallel circuits.
	29.06 Set up and use an oscilloscope to observe waveforms and to determine the voltage of the signal presented.
	29.07 Use testers to determine the condition of electronic components.

CTE Standards and Benchmarks	
30.0	Demonstrate proper electronic assembly methods. The student will be able to:
30.01	Exhibit safe soldering techniques.
30.02	Identify proper soldering practices.
30.03	Demonstrate proper soldering applications.
30.04	Identify common electrical and electronics hand tools.
30.05	Demonstrate electronic component assembly.
30.06	Apply electrical tape to a spliced and soldered wire connection.
30.07	Solder and de-solder components and wires.
31.0	Demonstrate an understanding of basic electrical circuits and electronic systems. The student will be able to:
31.01	Define electronic systems.
31.02	Describe the importance of electronic systems in today's technology world.
31.03	Define electronic input, process and output of electronic systems.
31.04	Conduct electronic experiments using input, process and output systems.
31.05	Describe, design and conduct experiments with electronic systems.
31.06	Define and give an example of a super conductor.
32.0	Describe, experiment and construct circuits with integrated circuits. The student will be able to:
32.01	Explain what integrated circuits (IC's) are and how they are manufactured.
32.02	Explain the advantages of integrated circuits as compared to discrete component circuits.
32.03	Construct, test, and troubleshoot electronic circuits that contain ICs.
32.04	Describe the basic types of integrated circuit design, along with their pin numbering systems and dimensions.
32.05	Explain handling precautions for Integrated circuits.
32.06	Compare the operation of digital and analog integrated circuits (I.C.’s).

CTE Standards and Benchmarks	
	32.07 Discuss the operation of the 555 timer and its application.
33.0	Describe, construct, and experiment with circuits using semiconductors. The student will be able to:
	33.01 Describe the general theory and application of semiconductor devices.
	33.02 Explain the difference between N-type and P-type material.
	33.03 Explain the precautions necessary when working with solid state devices.
	33.04 Demonstrate the proper procedures for the installation of solid state components using thermal release devices (heat sinks).
	33.05 Construct and experiment with semiconductor devices.
	33.06 Construct and test circuits which contain solid state components such as FET'S, SCR's, UJT's, tunnel diodes, Zener diodes, light emitting diodes, etc.
	33.07 Construct transistor circuits that act as switches.
	33.08 Construct transistor circuits that act as amplifiers.
	33.09 Explain how diodes are used a rectifiers.
34.0	Describe, construct, and experiment with circuits using Digital logic IC's. The student will be able to:
	34.01 Describe the basic digital gates
	34.02 Describe and apply the binary numbering system
	34.03 Convert binary numbers to decimal numbers and decimal numbers to binary numbers.
	34.04 Describe most significant bit, and least significant bit.
	34.05 Draw logic symbols and construct truth tables
	34.06 Explain the basic operating principles of comparators, adders, and flip flops.
35.0	Describe, construct, conduct, and analyze experiments with basic Alternating Current (AC) circuits. The student will be able to:
	35.01 Compare and contrast AC and DC current.
	35.02 Define the characteristics of voltage, current and resistance in AC circuits.
	35.03 Perform math calculations with basic AC circuits.

Florida Department of Education
Student Performance Standards

Course Title: **Electronics Technology III**
Course Number: **8600930**
Course Credit: **1**

Course Description:

This course provides students with an advanced understanding of the knowledge, human relations, and technical skills of electronics technology.

CTE Standards and Benchmarks	
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
08.01	Recognize the design process; including defining a problem, brainstorming, researching and generating ideas.
08.02	Identify specifications, criteria and design constraints.
08.03	Through collaborative brainstorming explore possibly design solution.
08.04	Select an approach and develop a design proposal.
08.05	Create a model or prototype.
08.06	Test and evaluating the design, refine the design then create a revision.
08.07	Communicate the process and results of the design.
08.08	Describe why design problems that are seldom presented in a clearly defined form.
08.09	Explain why a design must be continually checked and critiqued.
08.10	Give examples of competing requirements of a design, such as criteria, constraints, and efficiency.
09.0	Demonstrate an understanding of engineering design. The student will be able to:
09.01	Identify design principles used to evaluate existing designs, to collect data, and to guide the design process.
09.02	Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the engineering design process.
09.03	Construct a prototype or working model used to test a design concept by making actual observations and necessary adjustments.

CTE Standards and Benchmarks	
	09.04 Identify factors taken into account in the process of engineering.
	09.05 Solve product design related problems through abstract and divergent thinking.
	09.06 Use the principles of the design process to create or redesign a product or system.
10.0	Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. The student will be able to:
	10.01 Define research and development as a specific problem solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.
	10.02 Describe why research needed to solve technological problems.
	10.03 Utilize a multidisciplinary approach to solving technological problems.
11.0	Demonstrate the abilities to apply the design process. The student will be able to:
	11.01 Collaborate with a team to create models and sketches of the proposed design.
	11.02 Demonstrate flexibility and the ability to adapt throughout the process of innovation.
	11.03 Through collaborative problem solving produce a design that is technically accurate, artistic and aesthetically pleasing.
	11.04 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
	11.05 Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
	11.06 Develop a product or system using a design process.
	11.07 Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
	12.01 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
	12.02 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
14.0	Demonstrate an understanding of and be able to select and use information and communication technologies. The student will be able to:
	14.01 Use presentation or modeling software to communicate a new design.
15.0	Demonstrate safe and appropriate use of tools, machines, and materials in electronics technology. The student will be able to:

CTE Standards and Benchmarks	
	15.01 Select appropriate tools, procedures, and/or equipment.
	15.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
	15.03 Follow laboratory safety rules and procedures.
	15.04 Demonstrate good housekeeping at workstation within total laboratory.
	15.05 Identify color-coding safety standards.
	15.06 Explain fire prevention and safety precautions and practices for extinguishing fires.
	15.07 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
27.0	Identify, measure, perform math calculations and describe the function of transformers and inductors in electronic circuits. The student will be able to:
	27.01 Explain inductive reactance.
	27.02 List the factors that affect inductance
	27.03 Calculate inductive reactance
	27.04 Explain the factors that determine impedance
	27.05 Compare real, reactive, and apparent power
	27.06 Perform math calculations to calculate turns ratio, voltage, and current in a transformer.
	27.07 Troubleshoot transformers using an ohm and voltmeter
	27.08 Describe transformer efficiency and types of losses.
28.0	Describe, construct, analyze and experiment with capacitive circuits. The student will be able to:
	28.01 Explain capacitive reactance.
	28.02 List the factors that affect capacitance.
	28.03 Explain RC time constants and the effect on circuits.
	28.04 Perform math calculations to calculate capacitive reactance
	28.05 Perform math calculations to calculate capacitance in series and parallel.

CTE Standards and Benchmarks	
29.0	Demonstrate the use of electronic equipment. The student will be able to:
29.01	Use a VOM to obtain accurate measurements.
29.02	Apply safety rules in the use of electronic instruments and demonstrate proper care and maintenance for the equipment during storage and use.
29.03	Use voltmeters to obtain accurate measurements in series, parallel, and series-parallel circuits.
29.04	Use ammeters to obtain accurate measurements in series, parallel and series-parallel circuits.
29.05	Use ohmmeters to obtain accurate measurements in series, parallel and series-parallel circuits.
29.06	Set up and use an oscilloscope to observe waveforms and to determine the voltage of the signal presented.
29.07	Use signal generators to produce waveforms of selected frequencies and shapes.
29.08	Use testers to determine the condition of electronic components.
30.0	Demonstrate proper electronic assembly methods. The student will be able to:
30.01	Exhibit safe soldering techniques.
30.02	Identify proper soldering practices.
30.03	Demonstrate proper soldering applications.
30.04	Identify common electrical and electronics hand tools.
30.05	Demonstrate electronic component assembly.
30.06	Apply electrical tape to a spliced and soldered wire connection.
30.07	Solder and de-solder components and wires.
30.08	Describe the two methods of making a printed circuit board.
31.0	Demonstrate an understanding of basic electrical circuits and electronic systems. The student will be able to:
31.01	Identify problems and demonstrate appropriate solutions when dealing with series, series-parallel, parallel, voltage dividers, and network circuits.
31.02	Define electronic systems.

CTE Standards and Benchmarks	
	31.03 Describe the importance of electronic systems in today's technology world.
	31.04 Define electronics input, process and output of electronic systems.
	31.05 Conduct electronic experiments using input, process and output systems.
	31.06 Describe, design and conduct experiments with electronic systems.
32.0	Describe, experiment and construct circuits with integrated circuits. The student will be able to:
	32.01 Explain what integrated circuits (IC's) are and how they are manufactured.
	32.02 Explain the advantages of integrated circuits as compared to discrete component circuits.
	32.03 Construct test and troubleshoot electronic circuits that contain ICs.
	32.04 Describe the basic types of integrated circuit design, along with their pin numbering systems and dimensions.
	32.05 Explain handling precautions for Integrated circuits.
	32.06 Compare the operation of digital and analog integrated circuits (I.C.'s).
	32.07 Discuss the operation of the 555 timer and its application.
	32.08 Discuss the characteristics of operational amplifiers and their applications.
34.0	Describe, construct, and experiment with circuits using Digital logic IC's. The student will be able to:
	34.01 Describe most significant bit, and least significant bit.
	34.02 Draw logic symbols and construct truth tables
	34.03 Explain the basic operating principles of comparators, adders, and flip flops
	34.04 Explain encoders, decoders, sequential logic and binary counters.
	34.05 Construct circuits using and demonstrating digital gate, sequential logic and binary counters.
	34.06 Explain the operating principles of comparators, address, flip flops, multiplexers, de-multiplexers, encoders, and decoders.
35.0	Describe, construct, conduct, and analyze experiments with basic Alternating Current (AC) circuits. The student will be able to:
	35.01 Compare and contrast AC and DC current.

CTE Standards and Benchmarks	
	35.02 Define the characteristics of voltage, current and resistance in AC circuits.
	35.03 Perform math calculations with basic AC circuits.
36.0	Describe, construct, analyze and experiment with circuits containing relays. The student will be able to:
	36.01 Describe the characteristics of electronic relays and their uses.
	36.02 Compare electromagnetic and solid-state relays.
	36.03 Explain how relays are rated.
	36.04 Describe the operation of ON-delay, and Off-delay timer relays.
37.0	Describe, construct, experiment and build circuits using microcontrollers. The student will be able to:
	37.01 Identify and explain the purpose of each of the major parts of a microprocessor (basic, stamp, and adrino).
	37.02 Identify types of computer input and output devices.
	37.03 Construct control circuits containing microcontroller.
38.0	Describe, construct and experiment with circuits containing sensors and transducers. The student will be able to:
	38.01 Define what a sensor is.
	38.02 Define what a transducer is.
	38.03 Explain the principle if operation for light sensors, thermistors, hall effect sensors, capacitive and ultrasonic sensors.
	38.04 Explain the different type of contact, and non-contact sensors.
	38.05 Describe the characteristics it photocells, IR and Proximity sensors
	38.06 Construct sensor experiments detecting distance and proximity.
	38.07 Construct experiments using sensors to detecting range.
	38.08 Perform light detecting experiments with sensors.
	38.09 Create navigation experiments with sensors.
39.0	Describe, construct and experiment with circuits containing Servos. The student will be able to:

CTE Standards and Benchmarks	
	39.01 Explain the parts and basic operation of servos.
	39.02 Describe how torque is controlled in servo motors.
	39.03 Describe the difference between standard and continuous servos.
	39.04 Create circuits containing servos.
40.0	Demonstrate knowledge of robotics. The student will be able to:
	40.01 Identify different types of robots.
	40.02 State the function of effectors, sensors, controllers, and auxiliary parts in robotics system.
	40.03 Program a robot using a computer to perform a specific task.
	40.04 Explain how robotics technology is used in the electronics industry.
	40.05 Demonstrate problem-solving skills using robotics technology as it applies to electronics manufacturing.
	40.06 Forecast how robotics technology will be used in the future for domestic home use and in industry.
41.0	Perform advanced study and skills related to electronics. The student will be able to:
	41.01 Select an individual or group project in cooperation with the teacher.
	41.02 Develop a written plan of work to carry out the project.
	41.03 Show evidence of technical study in support of the project.
	41.04 Perform skills related to the project.
	41.05 Complete the project as planned.
42.0	Demonstrate an understanding of the principles and applications of microcomputer systems. The student will be able to:
	42.01 Define microcomputer systems.
	42.02 Describe the importance of microcomputer systems in today's technology world.
	42.03 Describe microcomputer applications in today's technology world.
	42.04 Define microcomputer interfacing.

CTE Standards and Benchmarks
42.05 Conduct microcomputer systems experiments.
42.06 Conduct microcomputer systems interfacing, sensing and control applications.
43.0 Describe, identify, and correct problems in electronic circuits. The student will be able to:
43.01 Identify problems when dealing with power supplies, oscillators, and amplifiers.
43.02 Demonstrate solutions to problems with power supplies, oscillators, and amplifiers.
44.0 Demonstrate technical knowledge and skills about electronic networks and systems. The student will be able to:
44.01 Define and describe telecommunications.
44.02 Conduct telecommunications experiments including receivers, transmitters, wirelines and antennas, telephones and fiber optics.
44.03 Describe the technology and organization of electronic guidance systems.
44.04 Perform technical skills in building, assembling, servicing, or operating one of the above systems.
44.05 Define and describe logic control.
44.06 Conduct a logic control experiment.
44.07 Define and describe digital communications.
44.08 Conduct a digital communications experiment.
44.09 Define and describe industrial controls.
44.10 Conduct an industrial controls experiment.
45.0 Conduct a research and experimentation project on an electronic system or process. The student will be able to:
45.01 Identify a problem.
45.02 State a need to research the problem.
45.03 Form a hypothesis about the problem.
45.04 Plan the procedures for researching the problem.
45.05 Conduct the research following the planned procedures.

CTE Standards and Benchmarks	
	45.06 Present the research findings in a seminar.
	45.07 State conclusions based on the research findings.
46.0	Demonstrate an understanding of career opportunities and requirements in the field of electronics technology. The student will be able to:
	46.01 Discuss individual interests related to a career in electronics technology.
	46.02 Explore career opportunities related to a career in electronics technology.
	46.03 Explore secondary education opportunities related to electronics technology.
	46.04 Conduct a job search.
	46.05 Complete a job application form correctly.
	46.06 Demonstrate competence in job interview techniques.
	46.07 Create a professional resume and letter of introduction.
	46.08 Solicit awards, letters of recommendation and recognition.
	46.09 Organize work samples in a professional, presentable format.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated, or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Communications Technology**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8601000
CIP Number	0821010600
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of communications technology. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry. Communications Technology represents the current and expanding digital technology.

The content includes, but is not limited to a study of the processes, uses, and technical skills found in visual technologies (both conventional and digital procedures), multimedia production, computer animation and graphics, web page design, electronic media, and other new and emerging technologies.

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 credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8601010	Communications Technology I	COMM ART @7 7G GRAPH ARTS @4 PRINTING @7 7G TEC ED 1 @2 ENG&TEC ED1@2	1 credit	3	CT
8601020	Communications Technology II		1 credit	3	CT
8601030	Communications Technology III		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 the role and its relationships that technology provides across various fields of study.
02.0 Demonstrate an understanding of the characteristics, scope, and influence of technology.
03.0 Demonstrate an understanding of the elements of design and the principles of composition and how it correlates to the design process.
04.0 Understand, select, and use information and communication technologies.
05.0 Demonstrate safe and appropriate use of tools, machines, and materials in communications technology.
06.0 Produce a visual representation of the project scope in forms of layouts, designs, blueprint and mock-ups/prototypes across various platforms that are associated with digital publishing.
07.0 Express technical knowledge and understanding of major printing processes.
08.0 Identify and demonstrate proficiency with common computer peripherals, including connections to standard input and output devices.
09.0 Demonstrate knowledge of computer file management.
10.0 Demonstrate proficiency using the Internet to locate information.
11.0 Demonstrate an understanding of Internet safety and ethics.
12.0 Develop and apply word processing and document manipulation skills.
13.0 Demonstrate an understanding of color theory and its role in communications design.
14.0 Demonstrate an understanding of the Elements of Art and the Principles of Design.
15.0 Demonstrate an understanding of typography.
16.0 Demonstrate basic proficiency and understanding of the differences between a moment in time, artwork and visual communications in the studies of photography.
17.0 Demonstrate proficiency in using a software application for digital imaging.
18.0 Develop an awareness of emerging technologies associated with communication design.
19.0 Demonstrate proficiency in using presentation software.
20.0 Demonstrate an understanding and application of the various approaches used in problem solving.
21.0 Demonstrate abilities to apply the design process.
22.0 Demonstrate technical knowledge and skills in the area of design process.
23.0 Demonstrate technical knowledge and skills in finishing, binding, and packaging.
24.0 Define, design, and complete digital publishing projects.
25.0 Demonstrate proficiency in using digital photography.
26.0 Demonstrate proficiency creating and manipulating digital images using software applications.
27.0 Use computer networks, internet and online resources to facilitate collaborative communication.
28.0 Compare and contrast various forms of digital media delivery systems.
29.0 Plan, organize, and carry out collaborative communication projects.
30.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
31.0 Demonstrate the abilities to use and maintain technological products and systems.
32.0 Demonstrate proficiency in the design of communication solutions involving motion or special effects.
33.0 Demonstrate proficiency in producing a communications product for delivery using mobile communication devices.
34.0 Demonstrate technical knowledge and skills in digital and electronic communication.

35.0 Demonstrate an understanding of how market research and audience data gathering methods are used to assess the impact of the product.
36.0 Demonstrate an understanding of career opportunities and requirements in the field of communications technology.
37.0 Demonstrate an understanding of the use of emerging technologies in communication and advertising.
38.0 Demonstrate advanced layout, mock-up, prototype, layout, project design associated with digital publishing.
39.0 Demonstrate advanced proficiency creating and manipulating digital images using software applications.
40.0 Organize and carry out project plans for creating various communications products.

Florida Department of Education
Student Performance Standards

Course Title: **Communications Technology I**
Course Number: **8601010**
Course Credit: **1**

Course Description:

This course provides students with instruction in the characteristics and evolution of technology, underlying principles of design, and fundamental knowledge and skills in the use of software used in communications design. Included in the content is the use of essential application software. The ultimate output of this course is a design portfolio created by the student. Each item or product included in the portfolio should include a narrative description and an explanation of the technical approach or techniques used to create the item. Consideration should be given to having students present the portfolio using presentation software.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the role and relationships that technology provides across various fields of study. The student will be able to:
01.01	Identify technology beyond its intended purpose.
01.02	Identify technological innovation resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across disciplines.
01.03	Identify the various types of intellectual properties and outline the procedures for patenting to protect a technological idea.
02.0	Demonstrate an understanding of the characteristics, scope, and influence of technology. The student will be able to:
02.01	Describe how technology is used to influence society's cultural, political, personal and economic aspects.
02.02	Describe the major technological developments that characterized the Industrial Revolution and their impact on society.
02.03	Describe the major technological developments that characterized the Information Age and their impact on society.
02.04	Conduct specific, goal-directed research related to inventions and innovations throughout history.
03.0	Demonstrate understanding of the elements of design and the principles of composition and how it correlates to the design process. The student will be able to:
03.01	Research and describe the implication of audience, purpose/message, intention, and timeframe constraints of a project.
03.02	Research historical applications and perspectives related to the project.
03.03	Identify the difference between being creative and creativity.

CTE Standards and Benchmarks	
	03.04 Describe the sequence and associated activities involved in applying the design process starting with the problem, need/scope.
	03.05 Explain the relationship between design criteria and design constraints.
	03.06 Explain the forms of analysis used in evaluating potential solutions, particularly those forms associated with design principles, estimation, economics, and worst case scenario.
	03.07 Brainstorm potential solutions to a communication design problem.
	03.08 Evaluate proposed solutions to communications design problem selecting optimal solution.
	03.09 Produce thumbnail sketches/rough design and final designs.
	03.10 Evaluate solution to ensure the sustainability and effectiveness of a communications design (e.g., visual appeal, audience, media, and market research).
04.0	Understand, select, and use information and communication technologies. The student will be able to:
	04.01 Describe and give examples of human to human, human to machine, machine to human, and machine to machine communications.
	04.02 Select and use information and communication systems to inform, persuade, entertain, control, manage, and educate.
	04.03 Compare and contrast the means of communicating visual messages (i.e., graphically, electronically) and associated forms (e.g., digital, analog, and multimedia).
	04.04 Compare and contrast the forms for communicating technological information (e.g., symbols, icons, graphic, measurement, et al).
05.0	Demonstrate safe and appropriate use of tools, machines, and materials in communications technology. The student will be able to:
	05.01 Select appropriate tools, procedures, and/or equipment.
	05.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
	05.03 Follow laboratory safety rules and procedures.
	05.04 Demonstrate good housekeeping at workstation within total laboratory.
	05.05 Identify American National Standards Institute (ANSI) color-coding safety standards.
	05.06 Explain fire prevention and safety precautions and appropriate practices for extinguishing fires.
	05.07 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
06.0	Produce a visual representation of the project scope in forms of layouts, designs, blueprint and mock-ups/prototypes across various platforms that are associated with digital publishing. The student will be able to:

CTE Standards and Benchmarks	
	06.01 Demonstrate an understanding of the elements and principles of design (e.g., line, shape, balance).
	06.02 Develop a concessive plan of the project scope, demonstrating the processes needed to accomplish the end goal (e.g., audience, purpose, time limitations).
	06.03 Describe the processes and implications of content preparation and editing/proofreading.
	06.04 Develop and apply specifications for specific projects.
	06.05 Demonstrate basic technical skills using a digital publishing application (e.g., InDesign, Scribus, and Microsoft Publisher).
	06.06 Understand the differences between manual paste-up and electronic page layout.
	06.07 Identify distinct components in a layout (e.g., headlines, subheads, body copy).
	06.08 Demonstrate proper use of typography (Visual hierarchy, proximity, alignment, contrast, and repetition).
	06.09 Compare and contrast methods of measurement used in desktop publishing (e.g., in, cm, mm, points, picas)
	06.10 Produce a variety of designs using digital publishing applications (flyers, postcards, brochures, business cards, and letter head).
	06.11 Incorporate clip art/images, borders, and other special effects into a layout.
	06.12 Understand and comply with the legalities of using preexisting images (copyright/trademark).
	06.13 Create a portfolio to showcase projects.
07.0	Express technical knowledge and understanding of major printing processes. The student will be able to:
	07.01 Explain and demonstrate pre-press operations.
	07.02 Demonstrate an understanding of printing processes (i.e., letterpress, gravure, screen, lithographic).
	07.03 Demonstrate an understanding of digital printing processes (e.g., dye sublimation, direct print, and laser jet).
	07.04 Demonstrate an understanding of the lithographic offset press process.
	07.05 Explain the difference between printing and duplicating processes.
	07.06 Explain and apply the different types of file formats used for the various printing methods.
08.0	Identify and demonstrate proficiency with common computer peripherals, including connections to standard input and output devices. The student will be able to:

CTE Standards and Benchmarks	
08.01	Identify the internal components of a computer (e.g., power supply, hard drive, mother board, I/O cards/ports, cabling, etc.).
08.02	Identify and demonstrate the types and functions of common and special input devices (e.g., mouse, keyboard, camera, microphone, scanner, cell phone, digital cameras, mobile devices, GPS devices).
08.03	Describe the types and purposes of various computer connection ports (e.g., USB, firewire, parallel, serial, and Ethernet).
08.04	Identify and connect an output device (e.g., printer, monitor, projector, et al) and verify proper operation.
08.05	Identify various storage devices (e.g., flash drive, iPod, phone, external hard drive, etc.).
09.0	Demonstrate knowledge of computer file management. The student will be able to:
09.01	Describe and use conventional file naming conventions.
09.02	Demonstrate proficiency with file management tasks (e.g., folder creation, file creation, backup, copy, delete, open, save).
09.03	Be able to identify file types by extension and association (e.g., .doc, .txt, .psd, .ai, .png, jpeg, and etc.).
10.0	Demonstrate proficiency using the Internet to locate information. The student will be able to:
10.01	Identify and use web terminology.
10.02	Define Universal Resource Locators (URLs) and associated protocols (e.g., http, ftp, telnet, mailto).
10.03	Compare and contrast the types of Internet domains (e.g., .com, .org, .edu, .gov, .net, and mil).
10.04	Demonstrate proficiency using search engines, including Boolean search techniques.
10.05	Apply the rules for properly citing works or other information obtained from the Internet.
10.06	Identify and apply Copyright Fair Use guidelines.
10.07	Evaluate online information for credibility and quality using basic guidelines and indicators (e.g., authority, affiliation, purpose, etc.).
11.0	Demonstrate an understanding of Internet safety and ethics. The student will be able to:
11.01	Describe cyber-bullying and its impact on perpetrators and victims.
11.02	Differentiate between viruses and malware, specifically their sources, ploys, and impact on personal privacy and computer operation, and ways to avoid infection.
11.03	Describe risks associated with social networking sites and ways to mitigate these risks.

CTE Standards and Benchmarks	
	11.04 Adhere to cyber safety practices with regard to conducting Internet searches, email, chat rooms, and other social network websites.
	11.05 Adhere to Acceptable Use Policies when accessing the Internet.
12.0	Develop and apply word processing and document manipulation skills. The student will be able to:
	12.01 Apply and adjust page layouts (work with text; tables, pages, special features) to demonstrate graphic capabilities of software application.
	12.02 Create projects that contain a title page, text, and graphic images.
13.0	Demonstrate an understanding of color theory and its role in communications design. The student will be able to:
	13.01 Describe the spectral colors in the visible light spectrum.
	13.02 Describe the difference between additive and subtractive color mixing.
	13.03 Compare and contrast the RGB and CYMK color modes used in communication design.
	13.04 Demonstrate knowledge in terms relating to color such as chroma, lightness, saturation, hue, intensity, luminance/value, shade, tint, etc.
	13.05 Demonstrate an understanding relating to the meanings of color (the psychology of color & the application of color in design).
	13.06 Demonstrate the application of color theory to design practices.
14.0	Demonstrate an understanding of the Elements of Art and the Principles of Design. The student will be able to:
	14.01 Describe the Elements of Art (e.g., line, shape, form, mass etc.).
	14.02 Describe the Principles of Design (e.g., balance, unity, contrast, rhythm, proportion, emphasis, movement, scaling).
	14.03 Apply the Elements of Art and Principles of Design to enhance the message of the image/text and layout.
15.0	Demonstrate an understanding of typography. The student will be able to:
	15.01 Describe character and line spacing (e.g., leading, kerning, tracking, baseline shift, ligature, line spacing).
	15.02 Identify characteristics and psychology of type, type families, type series, and type styles.
	15.03 Demonstrate an understanding of the history of typography
	15.04 Describe the principles of typographic design as they relate to communication design.

CTE Standards and Benchmarks	
	15.05 Compare and contrast the techniques for typographic communication relative to their appropriateness and effectiveness.
	15.06 Demonstrate proficiency in incorporating typographic techniques into a communication design.
	15.07 Identify and apply the various fonts as a form of controlling audience visual impact.
16.0	Demonstrate basic proficiency and understanding of the differences between a moment in time, artwork and visual communications in the studies of photography. The student will be able to:
	16.01 Demonstrate typical features and operation of a digital camera. (modes)
	16.02 Apply the concepts of Element of Art and the Principles of Design in visual communications.
	16.03 Apply effective design principles in digital photography compositions.(rule of thirds)
	16.04 Demonstrate an understanding between the various types of photography as it relates to its usage in the field of visual communications (e.g., photojournalism, quote, and slogan).
17.0	Demonstrate proficiency in using a software application for digital imaging. The student will be able to:
	17.01 Differentiate between the various file formats (e.g., bitmap, raster, vector, GIF, and PNG).
	17.02 Demonstrate a basic knowledge of the tools and techniques for using vector software application (e.g., Illustrator, Inkscape, and Corel Draw).
	17.03 Create and edit various illustrations using vector software (e.g., line art, drawing basics, transforming/applying effects to objects, painting, type and type effects, and working with layers).
	17.04 Demonstrate a basic knowledge of the tools and techniques for using a vector/raster software application (e.g., Photoshop, GIMP).
	17.05 Create and edit images/photographs using digital imaging software (e.g., layers, images adjusting, adjustment layers, filters, and masking).
	17.06 Demonstrate skill in image manipulation, color correction, and special effects to creatively convey a message using vector/raster software applications.
	17.07 Demonstrate skill in scanning, cropping, and importing photographs.
	17.08 Compare and contrast image formats (e.g., TIF, BMP, EPS, PNG, PDF, JPEG, GIF, Raw).
	17.09 Demonstrate an understanding of image resolution and compression factors such as transmission speed, color reduction, and delivery media parameters.
	17.10 Incorporate scanned or digitally taken photographs into documents comprising a visual communication design (e.g., poster, brochure, card, advertisement, and web).
18.0	Develop an awareness of emerging technologies associated with communication design. The student will be able to:

CTE Standards and Benchmarks	
18.01	Compare and contrast emerging technologies relative to their role in communication design (e.g., wireless, Clouds, wireless web, cell phones, portables, handhelds, kiosks).
18.02	Describe social media as an emerging communications technology.
18.03	Describe the emerging or evolving nature of software applications used in interactive design (e.g., Adobe InDesign, Creative Cloud Suite).
18.04	Explain how the use of advanced image sensing devices have altered the manner in which communication takes place, especially those employing Quick Response (QR) codes or other form of two-dimensional bar coding technologies.
19.0	Demonstrate proficiency in using presentation software. The student will be able to:
19.01	Create a slide presentation that includes pictures, text, video, digital images and audios.
19.02	Adjust presentation formats.

Florida Department of Education
Student Performance Standards

Course Title: **Communications Technology II**
Course Number: **8601020**
Course Credit: **1**

Course Description:

In this course, students learn more about the nature of design and development techniques for communication purposes. Students are also provided with instruction in a variety of technologies commonly used to communicate concepts and designs. Students are expected to continue collating their portfolio using exemplars of their work. As with previous portfolio pieces, each exemplar should include a narrative description of the item with an explanation of any special techniques used to create the item.

CTE Standards and Benchmarks	
05.0	Demonstrate safe and appropriate use of tools, machines, and materials in communications technology. The student will be able to:
05.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
05.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to manufacture a product.
05.03	Follow laboratory safety rules and procedures.
05.04	Demonstrate good housekeeping at workstation within total laboratory.
05.05	Identify color-coding safety standards.
05.06	Explain fire prevention and safety precautions and appropriate practices for extinguishing fires.
05.07	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
20.0	Demonstrate an understanding and application of the various approaches used in problem solving. The student will be able to:
20.01	Research a problem and determine the most appropriate problem-solving method to employ functional, economic, and ethical viability of a project.
20.02	Utilize a multiple approaches to solving technological problems.
21.0	Demonstrate abilities to apply the design process. The student will be able to:
21.01	Determine whether a communications design problem is worthy of being resolved or addressed.
21.02	Identify the criteria and constraints associated with a communications design problem and select the most appropriate solution based

CTE Standards and Benchmarks	
	on these factors.
21.03	Evaluate the quality, efficiency, and productivity of an existing or proposed design and refine the design accordingly.
21.04	Evaluate an existing design using conceptual, physical, and mathematical models and note aspects for improvement. Does it meet criteria and constraints?
21.05	Select an appropriate brainstorming process (e.g., concept mapping, graphic organizers and explain its role in the design process.
21.06	Design and develop communications design solution using the design process.
21.07	Apply and evaluate the design process pertaining to a design solution.
22.0	Demonstrate technical knowledge and skills in the area of design process. The student will be able to:
22.01	Demonstrate how to represent concept.
22.02	Determine the most effective software applications for the design problem.
22.03	Use communication, analysis, and design skills to define project specifications that will meet client needs/desires, including purpose, mood and audience.
22.04	Complete projects according to plan using the most effective design.
22.05	Define, design, and complete digital projects and account for time and resources.
22.06	Create a portfolio to showcase projects.
23.0	Demonstrate technical knowledge and skills in finishing, binding, and packaging. The student will be able to:
23.01	Describe standard binding, finishing and packaging processes.
23.02	Describe the processes of imposition, pagination, scoring, folding, gathering, and collating.
23.03	Demonstrate proper packaging for a printed project (packaging, mounting, and framing).
24.0	Define, design, and complete digital publishing projects. The student will be able to:
24.01	Demonstrate increased proficiency using tools and techniques in digital publishing software applications (layout of a document, working with text, managing graphics, understanding color and transparency, basic output).
24.02	Use communication, analysis, and design skills to define project specifications that will meet client needs/desires.
24.03	Develop a client brief which includes all project scope and time constraints which result in the development of a final project.

CTE Standards and Benchmarks	
	24.04 Develop an awareness of the history of digital photography.
	24.05 Complete the project according to plan.
	24.06 Create a portfolio to showcase the project.
25.0	Demonstrate proficiency in using digital photography. The student will be able to:
	25.01 Demonstrate proficiency in adjusting the hardware features of a basic digital SLR camera, including manual settings, shutter speed, f-stops, et al.
	25.02 Demonstrate an understanding of lighting in photographic composition.
	25.03 Use imaging techniques (e.g., High Dynamic Range (HDR), panoramic, long exposure, stop motion, time lapse) to achieve different artistic effects.
	25.04 Demonstrate knowledge of photography by creating various projects
	25.05 Demonstrate effective presentation (mounting, display, etc.) of a thematic photograph or video portfolio of different types of photos.
	25.06 Develop an awareness of the history of photography.
26.0	Demonstrate proficiency creating and manipulating digital images using software applications. The student will be able to:
	26.01 Demonstrate proficiency using tools and techniques in raster-based software applications (e.g., layers, adjusting images, filters, special effects, selections, masks, channels).
	26.02 Demonstrate proficiency using tools and techniques in vector-based software applications (line art, drawing, transforming/applying effects to objects, painting, type and type effects, working with layers).
27.0	Use computer networks, internet and online resources to facilitate collaborative communication. The student will be able to
	27.01 Demonstrate how to connect to an online collaborative resource.
	27.02 Discuss the ethics and copyright legalities of downloading or sharing music or videos from online collaborative environments (e.g., Google Docs).
	27.03 Describe risks associated with using social networking sites for collaboration and ways to mitigate these risks.
	27.04 Adhere to cyber safety practices with regard to conducting Internet searches, email, chat rooms, and other social network websites.
	27.05 Use various web tools associated with online collaboration, including those used downloading files, transfer of files, telnet, FTP, PDF, plug-ins, and data compression.
	27.06 Describe how communication is supported by interactive web applications, including real-time sharing of photos and video clips, messaging, chatting and collaborating.

CTE Standards and Benchmarks	
	27.07 Describe appropriate use of social networking sites and applications, blogs and collaborative tools for information, images, etc.
28.0	Compare and contrast various forms of digital media delivery systems. The student will be able to:
	28.01 Explain the benefits and constraints of fixed versus streaming digital media.
	28.02 Describe the variations in design considerations between mass display and on-demand display of digital media.
	28.03 Discuss the variations in design considerations related to digital signage.
	28.04 Describe the implications to the design of digital images and/or graphics based on projected mobile and WiFi delivery media.
29.0	Plan, organize, and carry out collaborative communication projects. The student will be able to:
	29.01 Apply the design process to determine the scope of a project.
	29.02 Organize the team according to individual strengths.
	29.03 Assign specific tasks within a team.
	29.04 Determine project priorities and timeline.
	29.05 Identify required resources.
	29.06 Plan research, design, development, and evaluation activities as required.
	29.07 Carry out the project plan to successful completion.
	29.08 Create a presentation to articulate the problem, the solution, the process chosen, conclusions, and lessons learned (self-reflection).

Florida Department of Education
Student Performance Standards

Course Title: **Communications Technology III**
Course Number: **8601030**
Course Credit: **1**

Course Description:

In addition to exploring the implications of applying technologies, this course provides students with instruction in advanced techniques relative to both static and animated communication designs. In addition to learning more advanced techniques and emerging technologies, students will have an opportunity to research a project, design an appropriate solution, and present their results. The ultimate output of this course is the student's presentation of a completed portfolio illustrating their best exemplars. The portfolio should include a narrative description of the scenario, the approach to data collection, resulting renderings, and an interpretation of each chart/graph. Research references should be cited appropriately. Given the advanced nature of this course, students should be encouraged to produce the portfolio using presentation software suitable for dissemination via the Internet.

CTE Standards and Benchmarks	
05.0	Demonstrate safe and appropriate use of tools, machines, and materials in communications technology. The student will be able to:
05.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
05.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to manufacture a product.
05.03	Follow laboratory safety rules and procedures.
05.04	Demonstrate good housekeeping at workstation within total laboratory.
05.05	Identify color-coding safety standards.
05.06	Explain fire prevention and safety precautions and appropriate practices for extinguishing fires.
05.07	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
30.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
30.01	Identify changes caused by the use of technology ranging from gradual to rapid and from subtle to obvious.
30.02	Classify the use of technology involving weighing the trade-offs between the positive and negative effects.
31.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:

CTE Standards and Benchmarks	
31.01	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
31.02	Diagnose a system that is malfunctioning and use tools, materials, machines, or knowledge to repair it.
31.03	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
31.04	Operate systems so that they function in the way they were designed.
31.05	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
32.0	Demonstrate proficiency in the design of communication solutions involving motion or special effects. The student will be able to:
32.01	Demonstrate an understanding of kinetic typography.
32.02	Design a communication solution that employs animation or motion (e.g., graphics, text, video) to achieve or enhance the intended message.
32.03	Demonstrate proficiency in the use of digital and editing software to create a product featuring special visual effects.
32.04	Design and create an interactive communication product featuring the use of rich media.
32.05	Describe the design constraints associated with optics and devices (e.g., tablet, kiosk, smart phone) used in delivering communication products.
33.0	Demonstrate proficiency in producing communications product for delivery using mobile communication devices. The student will be able to:
33.01	Design and create a communication product suitable for delivery via multiple media (e.g., smart phones, tablets, and laptop).
33.02	Discuss the design implications of products intended for delivery via Bluetooth enabled devices.
33.03	Compare and contrast the security and privacy issues associated with different delivery media, particularly those involving social media.
34.0	Demonstrate technical knowledge and skills in digital and electronic communication. The student will be able to:
34.01	Demonstrate effective use of the internet to locate and evaluate information.
34.02	Distribute information electronically.
34.03	Identify effective design methods for presenting information digitally.
34.04	Demonstrate ability to select appropriate media topics, equipment, and materials for an electronic media product.
34.05	Produce an electronic media project.

CTE Standards and Benchmarks	
35.0	Demonstrate an understanding of how market research and audience data gathering methods are used to assess the impact of the product. The student will be able to:
35.01	Collect information from various sources and evaluate its quality and legitimacy.
35.02	Evaluate data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and environment.
35.03	Use assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
36.0	Demonstrate an understanding of career opportunities and requirements in the field of communications technology. The student will be able to:
36.01	Discuss individual interests related to a career in communications technology.
36.02	Explore career opportunities related to a career in communications technology.
36.03	Explore secondary education opportunities related to communications technology.
36.04	Conduct a job search.
36.05	Complete a job application form correctly.
36.06	Demonstrate competence in job interview techniques.
36.07	Create a professional resume and letter of introduction.
36.08	Solicit awards, letters of recommendation and recognition.
36.09	Organize work samples in a professional, presentable format. (portfolio)
37.0	Demonstrate an understanding of the use of emerging technologies in communication and advertising. The student will be able to:
37.01	Demonstrate an understanding of the principles of optics and how they relate to communications technology.
37.02	Discuss modern trends in digital signage and imprinted advertising specialties.
37.03	Explain the various technologies associated with these industries.
37.04	Compare and contrast imprinted and dye sublimation transfer processes.
38.0	Demonstrate advanced layout, mock-up, prototype, layout, project design associated with digital publishing. The student will be able to:
38.01	Demonstrate advanced proficiency in the use of tools and technical skills using digital publishing applications (layout of a document, working with text, managing graphics, understanding color, building interactive documents and preparing documents for final output)

CTE Standards and Benchmarks	
39.0	Demonstrate advanced proficiency creating and manipulating digital images using software applications. The student will be able to:
39.01	Demonstrate advanced proficiency using tools and techniques in raster-based software applications (layers, adjusting images, adjustments, filters, special effects, selections, masks, channels).
39.02	Demonstrate advanced proficiency using tools and techniques in vector-based software applications (line art, drawing, transforming/applying effects to objects, painting, type and type effects, working with layers).
25.0	Demonstrate proficiency in using digital photography. The student will be able to:
25.01	Demonstrate advanced knowledge of photography by creating various projects based on themes.
25.02	Demonstrate the ability to plan, schedule, and conduct a photoshoot, producing a final project across various disciplines of media communication.
40.0	Organize and carry out project plans for creating various communications products. The student will be able to:
40.01	Apply the design process to determine the goal, scope, criteria, constraints, and timeline of the project.
40.02	Work as part of the project team, supporting project focus, direction, and progress.
40.03	Identify required resources.
40.04	Plan research, design, development, and evaluation activities as required.
40.05	Carry out the project plan to successful completion.
40.06	Create a presentation to articulate the problem, the solution, the process chosen, conclusions, and lessons learned. (self-reflections)

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Special Notes

It is recommended, though not required, that the optimal class size enrollment not exceed a 1:1 student/computer ratio.
Recommended minimum equipment:

- Presentation equipment
- Digital cameras
- Functional scanner(s) (e.g., flatbed, integrated within printer, etc.)
- Functional color printer(s)
- Up-to-date applicable software version (i.e., upgrades, updates, patches, etc.)

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Materials and Processes Technology**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8601100
CIP Number	0821010700
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of the technology of materials and processes. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

The content includes, but is not limited to, a study of the pre-processing, processing, and post-processing of wood, metal, plastic, composites, and other materials. The content and activities will also include the study of entrepreneurship, safety, and leadership 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 three credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8601110	Materials and Processes Technology I	CAB WOODWK @7 7G ENG 7G TEC ED 1 @2 ENG&TEC ED1@2 WOODWORKIN @4	1 credit	2	CT
8601120	Materials and Processes Technology II		1 credit	2	CT
8601130	Materials and Processes Technology III		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 the characteristics and scope of technology.
02.0 Demonstrate an understanding of the core concepts of technology.
03.0 Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study.
04.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
05.0 Demonstrate an understanding of the effects of technology on the environment.
06.0 Demonstrate an understanding of the role of society in the development and use of technology.
07.0 Demonstrate an understanding of the influence of technology on history.
08.0 Demonstrate an understanding of the attributes of design.
09.0 Demonstrate an understanding of engineering design.
10.0 Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
11.0 Demonstrate the abilities to apply the design process.
12.0 Demonstrate the abilities to use and maintain technological products and systems.
13.0 Demonstrate the ability to assess the impact of products and systems.
14.0 Demonstrate an understanding of and be able to select and use manufacturing technologies.
15.0 Demonstrate safe and appropriate use of tools, machines, and materials in materials and processes technology.
16.0 Demonstrate the ability to properly identify, organize, plan, and allocate resources.
17.0 Demonstrate an understanding of entrepreneurship.
18.0 Demonstrate technical knowledge and skills associated with pre-processing activities and practices of industrial materials.
19.0 Demonstrate technical knowledge and skills associated with processing activities and practices of industrial materials.
20.0 Demonstrate technical knowledge and skills associated with post-processing activities and practices of industrial materials.
21.0 Perform advanced study and technical skills related to industrial materials and processes.
22.0 Demonstrate understanding of career opportunities and requirements in the field of materials and processes technology.

Florida Department of Education
Student Performance Standards

Course Title: **Materials and Processes Technology I**
Course Number: **8601110**
Course Credit: **1**

Course Description:

This course provides students with an introduction to the knowledge, human relations, and technical skills of industrial materials and processes technology.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Discuss the nature and development of technological knowledge and processes.
01.02	Explain the rapid increase in the rate of technological development and diffusion.
01.03	Recognize specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Identify systems thinking logic and creativity with appropriate compromises in complex real-life problems.
02.02	Define technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.
02.03	Formulate why the stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.
02.04	Identify resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.
02.05	Identify the criteria and constraints of a product or system and determine how they affect the final design and development.
02.06	List strategies for optimizing a technological process or methodology of designing or making a product, dependent on criteria and constraints.
02.07	Identify new technologies that create new processes.
02.08	Research quality control as a planned process to ensure that a product, service, or system meets established criteria.
02.09	Define a management system as the process of planning, organizing, and controlling work.

CTE Standards and Benchmarks	
	02.10 Outline complex systems have many layers of controls and feedback loops to provide information.
03.0	Demonstrate an understanding of the relationships among technologies and the connections between technology and other fields of study. The student will be able to:
	03.01 Identify technology transfer occurring when a new user applies an existing innovation developed for one purpose in a different function.
	03.02 Identify technological innovation resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
	03.03 Outline the process of patenting to protect a technological idea.
	03.04 Identify technological progresses that promote the advancement of science and mathematics.
04.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
	04.01 Identify changes caused by the use of technology ranging from gradual to rapid and from subtle to obvious.
	04.02 Classify the use of technology involving weighing the trade-offs between the positive and the negative effects.
	04.03 Identify ethical considerations important in the development, selection, and use of technologies.
	04.04 List the cultural, social, economic, and political changes caused by the transfer of a technology from one society to another.
	04.05 Discuss current technological developments that are/were driven by profit motives and the market.
05.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
	05.01 Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
	05.02 List trade-offs of developing technologies to reduce the use of resources.
	05.03 Identify technology to monitor the environment and provide information as a basis for decision-making.
	05.04 Compare and contrast the alignment of technological processes with natural processes to maximize performance and reduce negative impacts on the environment.
	05.05 Identify technologies devised to reduce the negative consequences of other technologies.
	05.06 Discuss the implementation of technologies involving the weighing of trade-offs between predicted positive and negative effects on the environment.
14.0	Demonstrate an understanding of and be able to select and use manufacturing technologies. The student will be able to:
	14.01 Service products to keep them in good operating condition.

CTE Standards and Benchmarks	
14.02	Classify materials based on their qualities as natural, synthetic, or mixed.
14.03	Classify goods as durable goods designed to operator for a long period of time, or non-durable goods designed to operate for a short period of time.
14.04	Identify and classify manufacturing systems into types, such as customized production, batch production, and continuous production.
14.05	Discuss the interchangeability of parts to increase the effectiveness of manufacturing processes.
14.06	Identify chemical technologies providing a means for humans to alter or modify materials and to produce chemical products.
14.07	Employ marketing techniques involving establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it.
15.0	Demonstrate safe and appropriate use of tools, machines, and materials in materials and processes technology. The student will be able to:
15.01	Select appropriate tools, procedures, and/or equipment.
15.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
15.03	Follow laboratory safety rules and procedures.
15.04	Demonstrate good housekeeping at workstation within total laboratory.
15.05	Identify color-coding safety standards.
15.06	Explain fire prevention and safety precautions and practices for extinguishing fires.
15.07	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
16.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
16.01	Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
16.02	Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
16.03	Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
16.04	Display an understanding of the efficient use of human resources.
17.0	Demonstrate an understanding of entrepreneurship. The student will be able to:
17.01	Define entrepreneurship.

CTE Standards and Benchmarks
17.02 Describe the importance of entrepreneurship to the American economy.
17.03 List the advantages and disadvantages of business ownership.
17.04 Identify the risks involved in ownership of a business.
17.05 Identify the necessary personal characteristics of a successful entrepreneur.
17.06 Identify the business skills needed to operate a small business efficiently and effectively.

Florida Department of Education
Student Performance Standards

Course Title: **Materials and Processes Technology II**
Course Number: **8601120**
Course Credit: **1**

Course Description:

This course provides students with an intermediate understanding of the knowledge, human relations, and technical skills of industrial materials and processes technology.

CTE Standards and Benchmarks	
06.0	Demonstrate an understanding of the role of society in the development and use of technology. The student will be able to:
06.01	Investigate how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
06.02	Collect societal opinions and demands, as well as corporate cultures to use as a basis for deciding whether or not to develop a technology.
06.03	Identify a number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads as contributors to shaping the design of and demand for various technologies.
07.0	Demonstrate an understanding of the influence of technology on history. The student will be able to:
07.01	Develop a logical argument as to why technological development has been evolutionary, the result of a series of refinements to a basic invention.
07.02	Research how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
07.03	Define the history of technology as a powerful force in reshaping the social, cultural, political, and economic landscape.
07.04	Discuss that early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.
07.05	Define the Iron Age as the use of iron and steel as the primary materials for tools.
07.06	Define the Middle Ages and its development of many technological devices that produced long-lasting effects on technology and society.
07.07	Define the Renaissance, a time of rebirth of the arts and humanities, as an important development in the history of technology.
07.08	Define the Industrial Revolution and the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.
07.09	Define the Information Age and its placement of emphasis on the processing and exchange of information.

CTE Standards and Benchmarks	
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
08.01	Apply the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
08.02	Restate design problems that are seldom presented in a clearly defined form.
08.03	Check and critique a design continually and improve and revise the idea of the design as needed.
08.04	List competing requirements of a design, such as criteria, constraints, and efficiency.
09.0	Demonstrate an understanding of engineering design. The student will be able to:
09.01	Identify design principles used to evaluate existing designs, to collect data, and to guide the design process.
09.02	Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the Engineering Design process.
09.03	Construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.
09.04	Evaluate factors taken into account in the process of engineering.
18.0	Demonstrate technical knowledge and skills associated with pre-processing activities and practices of industrial materials. The student will be able to:
18.01	Define and describe the term “pre-processing” as it relates to industrial materials.
18.02	Describe the technical processes of extracting materials from natural resources.
18.03	Locate and order industrial materials.
18.04	Arrange for the appropriate transportation of industrial materials.
18.05	Store and protect industrial materials properly.
18.06	Follow proper precautions in the receiving, unpacking, and handling of industrial materials.
19.0	Demonstrate technical knowledge and skills associated with processing activities and practices of industrial materials. The student will be able to:
19.01	Define and describe “processing” as it relates to industrial materials.
19.02	Demonstrate technical processing using a variety of composite and synthetic industrial materials.

CTE Standards and Benchmarks	
	19.03 Demonstrate understanding of both manual and automated processes.
	19.04 Apply the technical processes of separating and forming a variety of industrial materials.
	19.05 Apply the technical processes of conditioning a variety of industrial materials.
	19.06 Apply the technical processes of combining in the fabrication and finishing of a product.
20.0	Demonstrate technical knowledge and skills associated with post-processing activities and practices of industrial materials. The student will be able to:
	20.01 Define and describe “post-processing” as it relates to industrial materials.
	20.02 Identify processes for distributing products made of industrial materials.
	20.03 Describe processes for installing products made of industrial materials.
	20.04 Describe processes for maintaining products made of industrial materials.
	20.05 Describe processes for altering products made of industrial materials.
	20.06 Describe processes for servicing products made of industrial materials.

Florida Department of Education
Student Performance Standards

Course Title: **Materials and Processes Technology III**
Course Number: **8601130**
Course Credit: **1**

Course Description:

This course provides students with an advanced understanding of the knowledge, human relations, and technical skills of industrial materials and processes technology.

CTE Standards and Benchmarks	
10.0	Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. The student will be able to:
10.01	Employ research and development as a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.
10.02	Conduct research needed to solve technological problems.
10.03	Differentiate between technological and non-technological problems and identify which problems can be solved using technology.
10.04	Utilize a multidisciplinary approach to solving technological problems.
11.0	Demonstrate abilities to apply the design process. The student will be able to:
11.01	Interpret the design problem to solve and decide whether or not to address it.
11.02	List criteria and constraints and determine how these will affect the design process.
11.03	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
11.04	Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
11.05	Develop and produce a product or system using a design process.
11.06	Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
12.01	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.

CTE Standards and Benchmarks	
	12.02 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
	12.03 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
	12.04 Operate systems so that they function in the way they were designed.
	12.05 Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
13.0	Demonstrate the ability to assess the impact of products and systems. The student will be able to:
	13.01 Collect information and evaluate its quality.
	13.02 Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and environment.
	13.03 Apply assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
	13.04 Design forecasting techniques to evaluate the results of altering natural systems.
21.0	Perform advanced study and technical skills related to industrial materials and processes. The student will be able to:
	21.01 Identify and research a design problem related to materials and processes.
	21.02 Produce a detailed design and plan for the production of the solution.
	21.03 Complete the advanced design project as planned.
	21.04 Deliver a professional quality presentation of the design process and solution.
22.0	Demonstrate understanding of career opportunities and requirements in the field of materials and processes technology. The student will be able to:
	22.01 Discuss individual interests related to a career in materials and processes.
	22.02 Explore career opportunities related to materials and processes.
	22.03 Explore secondary education opportunities related to materials and processes.
	22.04 Conduct a job search.
	22.05 Complete a job application form correctly.
	22.06 Demonstrate competence in job interview techniques.
	22.07 Create a professional resume and letter of introduction.

CTE Standards and Benchmarks
22.08 Solicit awards, letters of recommendation and recognition.
22.09 Organize work samples in a professional, presentable format.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition atSALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Transportation Technology**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8601200
CIP Number	0821010500
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of transportation technology. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

The content includes, but is not limited to, a study of power systems and the kinds and sources of energy. The content and activities will also include the study of entrepreneurship, safety, and leadership 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 three credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8601210	Transportation Technology I	AIR MECH @7 7G AUTO IND @7 %7 %G AUTO MECH @7 7G DIESEL MEC @7 7G ENG 7G GASENG RPR @7 7G TEC ED 1 @2 ENG&TEC ED1@2 TRANSPORT 7G	1 credit	2	CT
8601220	Transportation Technology II		1 credit	2	CT
8601230	Transportation Technology III		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 the characteristics and scope of technology.
02.0 Demonstrate an understanding of the core concepts of technology.
03.0 Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study.
04.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
05.0 Demonstrate an understanding of the effects of technology on the environment.
06.0 Demonstrate an understanding of the role of society in the development and use of technology.
07.0 Demonstrate an understanding of the influence of technology on history.
08.0 Demonstrate an understanding of the attributes of design.
09.0 Demonstrate an understanding of engineering design.
10.0 Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
11.0 Demonstrate the abilities to apply the design process.
12.0 Demonstrate the abilities to use and maintain technological products and systems.
13.0 Demonstrate the ability to assess the impact of products and systems.
14.0 Demonstrate an understanding of and be able to select and use energy and power technologies.
15.0 Demonstrate an understanding of and be able to select and use transportation technologies.
16.0 Demonstrate safe and appropriate use of tools, machines, and materials in transportation technology.
17.0 Demonstrate technical knowledge and skills about steam-powered vehicles.
18.0 Demonstrate technical knowledge and skills about diesel engine power technology.
19.0 Demonstrate technical knowledge and skills about internal combustion power technology.
20.0 Demonstrate technical knowledge and skills about hydraulic and pneumatic power technology.
21.0 Demonstrate technical knowledge and skills about electric-powered vehicles.
22.0 Demonstrate technical knowledge and skills about jet engine power technology.
23.0 Demonstrate technical knowledge and skills about rocket engine power technology.
24.0 Demonstrate technical knowledge and skills about solar cells and fuel cells.
25.0 Demonstrate technical knowledge and skills about human-powered vehicles.
26.0 Perform advanced-study and technical skills related to energy and power technology.
27.0 Demonstrate technical knowledge and skills about powered transportation systems.
28.0 Conduct a research and experimentation project on an energy and power system.
29.0 Demonstrate an understanding of career opportunities and requirements in the field of transportation technology.

Florida Department of Education
Student Performance Standards

Course Title: **Transportation Technology I**
Course Number: **8601210**
Course Credit: **1**

Course Description:

This course provides students with an introduction to the knowledge, human relations, and technical skills of transportation technology.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Discuss the nature and development of technological knowledge and processes.
01.02	Explain the rapid increase in the rate of technological development and diffusion.
01.03	Recognize specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Identify systems thinking logic and creativity with appropriate compromises in complex real-life problems.
02.02	Define technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.
02.03	Formulate why the stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.
02.04	Identify resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.
02.05	Identify the criteria and constraints of a product or system and determine how they affect the final design and development.
02.06	List strategies for optimizing a technological process or methodology of designing or making a product, dependent on criteria and constraints.
02.07	Identify new technologies that create new processes.
02.08	Research quality control as a planned process to ensure that a product, service, or system meets established criteria.
02.09	Define a management system as the process of planning, organizing, and controlling work.
02.10	Outline complex systems have many layers of controls and feedback loops to provide information.

CTE Standards and Benchmarks	
03.0	Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study. The student will be able to:
03.01	Identify technology transfer occurring when a new user applies an existing innovation developed for one purpose in a different function.
03.02	Identify technological innovation resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
03.03	Outline the process of patenting to protect a technological idea.
03.04	Identify technological progresses that promote the advancement of science and mathematics.
04.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
04.01	Identify changes caused by the use of technology ranging from gradual to rapid and from subtle to obvious.
04.02	Classify the use of technology involving weighing the trade-offs between the positive and the negative effects.
04.03	Identify ethical considerations important in the development, selection, and use of technologies.
04.04	List the cultural, social, economic, and political changes caused by the transfer of a technology from one society to another.
04.05	Discuss current technological developments that are/were driven by profit motives and the market.
05.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
05.01	Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
05.02	List trade-offs of developing technologies to reduce the use of resources.
05.03	Identify technology to monitor the environment and provide information as a basis for decision-making.
05.04	Compare and contrast the alignment of technological processes with natural processes to maximize performance and reduce negative impacts on the environment.
05.05	Identify technologies devised to reduce the negative consequences of other technologies.
05.06	Discuss the implementation of technologies involving the weighing of trade-offs between predicted positive and negative effects on the environment.
14.0	Demonstrate an understanding of and be able to select and use energy and power technologies. The student will be able to:
14.01	Explain why energy cannot be created nor destroyed; however, it can be converted from one form to another.
14.02	List and group major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.

CTE Standards and Benchmarks	
	14.03 Explain impossibility of building an engine to perform work that does not exhaust thermal energy to the surroundings.
	14.04 Classify energy resources such as renewable or nonrenewable.
	14.05 Construct a power system having a source of energy, a process, and loads.
15.0	Demonstrate an understanding of and be able to select and use transportation technologies. The student will be able to:
	15.01 Analyze the vital role played by transportation in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.
	15.02 Define intermodalism as the use of different modes of transportation, such as highways, railways, and waterways as part of an interconnected system that can move people and goods easily from one mode to another.
	15.03 Discuss how transportation services and methods have led to a population that is regularly on the move.
	15.04 Identify processes and innovative techniques involved in the design of intelligent and non-intelligent transportation systems.
16.0	Demonstrate safe and appropriate use of tools, machines, and materials in transportation technology. The student will be able to:
	16.01 Select appropriate tools, procedures, and/or equipment.
	16.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
	16.03 Follow laboratory safety rules and procedures.
	16.04 Demonstrate good housekeeping at workstation within total laboratory.
	16.05 Identify color-coding safety standards.
	16.06 Explain fire prevention and safety precautions and practices for extinguishing fires.
	16.07 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.

Florida Department of Education
Student Performance Standards

Course Title: **Transportation Technology II**
Course Number: **8601220**
Course Credit: **1**

Course Description:

This course provides students with an intermediate understanding of the knowledge, human relations, and technical skills of transportation technology.

CTE Standards and Benchmarks	
06.0	Demonstrate an understanding of the role of society in the development and use of technology. The student will be able to:
06.01	Investigate how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
06.02	Collect societal opinions and demands, as well as corporate cultures to use as a basis for deciding whether or not to develop a technology.
06.03	Identify a number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads as contributors to shaping the design of and demand for various technologies.
07.0	Demonstrate an understanding of the influence of technology on history. The student will be able to:
07.01	Develop a logical argument as to why technological development has been evolutionary, the result of a series of refinements to a basic invention.
07.02	Research how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
07.03	Define the history of technology as a powerful force in reshaping the social, cultural, political, and economic landscape.
07.04	Discuss that early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.
07.05	Define the Iron Age as the use of iron and steel as the primary materials for tools.
07.06	Define the Middle Ages and its development of many technological devices that produced long-lasting effects on technology and society.
07.07	Define the Renaissance, a time of rebirth of the arts and humanities, as an important development in the history of technology.
07.08	Define the Industrial Revolution and the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.
07.09	Define the Information Age and its placement of emphasis on the processing and exchange of information.

CTE Standards and Benchmarks	
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
08.01	Apply the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
08.02	Restate design problems that are seldom presented in a clearly defined form.
08.03	Check and critique a design continually and improve and revise the idea of the design as needed.
08.04	List competing requirements of a design, such as criteria, constraints, and efficiency.
09.0	Demonstrate an understanding of engineering design. The student will be able to:
09.01	Identify design principles used to evaluate existing designs, to collect data, and to guide the design process.
09.02	Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the Engineering Design process.
09.03	Construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.
09.04	Evaluate factors taken into account in the process of engineering.
17.0	Demonstrate technical knowledge and skills about steam-powered vehicles. The student will be able to:
17.01	Identify and define the key terms, categories, and parts of steam-powered engine.
17.02	Describe the operating theory and principles of steam engines and steam turbines.
17.03	Explain the uses and applications of steam power engines and systems.
17.04	Describe energy and fuel sources for steam power operations.
17.05	Perform technical skills in the construction of a small-scale model of a steam-powered engine or vehicle.
18.0	Demonstrate technical knowledge and skills about diesel engine power technology. The student will be able to:
18.01	Identify and define key terms, categories, and parts of diesel engine power technology.
18.02	Describe the operating theory and principles of diesel engine power technology.
18.03	Explain the uses and applications of diesel engines.

CTE Standards and Benchmarks	
	18.04 Identify industries that produce and use diesel engines.
	18.05 Describe energy and fuel sources for diesel engines.
	18.06 Perform technical skills in the construction of a small-scale model of a diesel engine.
19.0	Demonstrate technical knowledge and skills about internal combustion power technology. The student will be able to:
	19.01 Identify and define the key terms, categories, and parts of gasoline engine internal combustion technology.
	19.02 Describe the operating theory and principles of internal combustion gasoline engines.
	19.03 Explain the uses and applications of internal combustion gasoline engines.
	19.04 Identify industries that produce and use internal combustion gasoline engines.
	19.05 Describe energy and fuel sources for internal combustion gasoline engines.
	19.06 Perform technical skills in the construction of a small-scale model of a gasoline engine.
20.0	Demonstrate technical knowledge and skills about hydraulic and pneumatic power technology. The student will be able to:
	20.01 Identify and define key terms, categories, and parts of hydraulic and pneumatic power technology.
	20.02 Describe the operating theory and principles of hydraulic and pneumatic power technology.
	20.03 Explain the uses and applications of hydraulic and pneumatic power systems.
	20.04 Identify industries that produce and use hydraulic and pneumatic power systems.
	20.05 Describe the energy sources for hydraulic and pneumatic power systems.
	20.06 Perform technical skills in the construction of a small-scale model of a hydraulic and pneumatic power system.
21.0	Demonstrate technical knowledge and skills about electric-powered vehicles. The student will be able to:
	21.01 Identify and define the key terms, categories, and parts of an electric-powered vehicle.
	21.02 Describe the operating theory and principles of electric-powered vehicle systems.
	21.03 Explain the uses and applications of electric-powered vehicles.
	21.04 Describe energy and fuel sources for electric-powered vehicles.

CTE Standards and Benchmarks
21.05 Perform technical skills in the construction of a small-scale model of an electric-powered vehicle.
22.0 Demonstrate technical knowledge and skills about jet engine power technology. The student will be able to:
22.01 Identify and define key terms, categories, and parts of jet engine power technology.
22.02 Describe the operating theory and principles of jet engine power technology.
22.03 Explain the uses and applications of jet engines.
22.04 Identify industries that produce and use jet engines.
22.05 Describe energy and fuel sources for jet engines.
22.06 Perform technical skills in the construction of a small-scale model of a jet engine.
23.0 Demonstrate technical knowledge and skills about rocket engine power technology. The student will be able to:
23.01 Identify and define key terms, categories, and parts of rocket engine power technology.
23.02 Describe the operating theory and principles of rocket engine power technology.
23.03 Explain the uses and applications of rocket engines.
23.04 Identify industries that produce and use rocket engines.
23.05 Describe energy and fuel sources for rocket engines.
23.06 Perform technical skills in the construction of a small-scale model of a rocket engine.

Florida Department of Education
Student Performance Standards

Course Title: **Transportation Technology III**
Course Number: **8601230**
Course Credit: **1**

Course Description:

This course provides students with an advanced understanding of the knowledge, human relations, and technical skills of transportation technology.

CTE Standards and Benchmarks	
10.0	Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. The student will be able to:
10.01	Employ research and development as a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.
10.02	Conduct research needed to solve technological problems.
10.03	Differentiate between technological and non-technological problems and identify which problems can be solved using technology.
10.04	Utilize a multidisciplinary approach to solving technological problems.
11.0	Demonstrate the abilities to apply the design process. The student will be able to:
11.01	Interpret the design problem to solve and decide whether or not to address it.
11.02	List criteria and constraints and determine how these will affect the design process.
11.03	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
11.04	Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
11.05	Develop a product or system using a design process.
11.06	Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
12.01	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
12.02	Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.

CTE Standards and Benchmarks	
12.03	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
12.04	Operate systems so that they function in the way they were designed.
12.05	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
13.0	Demonstrate the ability to assess the impact of products and systems. The student will be able to:
13.01	Collect information and evaluate its quality.
13.02	Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.
13.03	Apply assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
13.04	Design forecasting techniques to evaluate the results of altering natural systems.
24.0	Demonstrate technical knowledge and skills about solar cells and fuel cells. The student will be able to:
24.01	Identify and define key terms, categories, and parts of solar cell and fuel cell power technology.
24.02	Describe the operating theory and principles of solar cell and fuel cell power technology.
24.03	Explain the uses and applications of solar cell and fuel cell power technology.
24.04	Identify the industries that produce and use solar cell and fuel cell power systems.
24.05	Describe the energy and fuel sources for solar cell and fuel cell power systems.
24.06	Perform technical skills in building, assembling, maintaining, or operating solar cell or fuel cell systems.
25.0	Demonstrate technical knowledge and skills about human-powered vehicles. The student will be able to:
25.01	Identify and define the key terms, categories, and parts of human-powered vehicles.
25.02	Describe the operating theory and principles of human-powered systems.
25.03	Explain the uses and applications of human-powered vehicles.
25.04	Perform technical skills in building, assembling, maintaining, or operating a simulated or real human-powered vehicle.
26.0	Perform advanced-study and technical skills related to energy and power technology. The student will be able to:

CTE Standards and Benchmarks	
	26.01 Select an individual or group project in cooperation with the teacher.
	26.02 Develop a written plan of work to carry out the project.
	26.03 Show evidence of technical study in support of the project.
	26.04 Perform skills related to the project.
	26.05 Complete the project as planned.
27.0	Demonstrate technical knowledge and skills about powered transportation systems. The student will be able to:
	27.01 Identify and define key terms, categories, and parts of land, water, air, and space transportation systems.
	27.02 Describe the theories and operating principles of land, water, air, and space transportation.
	27.03 Explain the uses and applications of land, water, air and space transportation vehicles.
	27.04 Identify industries that produce and use land, water, air, and space transportation vehicles.
	27.05 Describe the energy and power systems used in land, water, air, and space vehicles.
	27.06 Perform technical skills in the construction of a small-scale model of a complete transportation vehicle.
28.0	Conduct a research and experimentation project on an energy and power system. The student will be able to:
	28.01 Identify a problem.
	28.02 State a need to research the problem.
	28.03 Form a hypothesis about the problem.
	28.04 Plan the procedures for researching the problem.
	28.05 Conduct the research following the planned procedures.
	28.06 Present the research findings in a seminar.
29.0	Demonstrate an understanding of career opportunities and requirements in the field of transportation technology. The student will be able to:
	29.01 Discuss individual interests related to a career in transportation technology.
	29.02 Explore career opportunities related to a career in transportation technology.

CTE Standards and Benchmarks
29.03 Explore secondary education opportunities related to transportation technology.
29.04 Conduct a job search.
29.05 Complete a job application form correctly.
29.06 Demonstrate competence in job interview techniques.
29.07 Create a professional resume and letter of introduction.
29.08 Solicit awards, letters of recommendation and recognition.
29.09 Organize work samples in a professional, presentable format.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Power and Energy Technology**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8601300
CIP Number	0821010501
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of power and energy technology. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

The content includes, but is not limited to, a study of power systems and the kinds and sources of energy. The content and activities will also include the study of entrepreneurship, safety, and leadership 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 three credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8601310	Power and Energy Technology I	AIR MECH @7 7G AUTO IND @7 %7 %G AUTO MECH @7 7G DIESEL MEC @7 7G ENG 7G GASENG RPR @7 7G TEC ED 1 @2 ENG&TEC ED1@2 TEC MECH @7 7G TRANSPORT 7G	1 credit	2	CT
8601320	Power and Energy Technology II		1 credit	2	CT
8601330	Power and Energy Technology III		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 the characteristics and scope of technology.
02.0 Demonstrate an understanding of the core concepts of technology.
03.0 Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study.
04.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
05.0 Demonstrate an understanding of the effects of technology on the environment.
06.0 Demonstrate an understanding of the role of society in the development and use of technology.
07.0 Demonstrate an understanding of the influence of technology on history.
08.0 Demonstrate an understanding of the attributes of design.
09.0 Demonstrate an understanding of engineering design.
10.0 Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
11.0 Demonstrate the abilities to apply the design process.
12.0 Demonstrate the abilities to use and maintain technological products and systems.
13.0 Demonstrate the ability to assess the impact of products and systems.
14.0 Demonstrate an understanding of and be able to select and use energy and power technologies.
15.0 Demonstrate safe and appropriate use of tools, machines, and materials in power and energy technology.
16.0 Describe sources of energy.
17.0 Demonstrate technical knowledge and skills related to power and energy systems.
18.0 Demonstrate technical knowledge and skills about steam power technology.
19.0 Demonstrate technical knowledge and skills about hydraulic and pneumatic power technology.
20.0 Demonstrate technical knowledge and skills about electric power technology.
21.0 Demonstrate technical knowledge and skills about solar cells and fuel cells.
22.0 Demonstrate technical knowledge and skills about nuclear power technology.
23.0 Perform advanced-study and technical skills related to energy and power technology.
24.0 Measure and report the power and efficiency of power producing systems.
25.0 Conduct a research and experimentation project on an energy and power system.
26.0 Demonstrate an understanding of career opportunities and requirements in the field of power and energy technology.

Florida Department of Education
Student Performance Standards

Course Title: **Power and Energy Technology I**
Course Number: **8601310**
Course Credit: **1**

Course Description:

This course provides students with an introduction to the knowledge, human relations, and technical skills of energy and power technology.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Discuss the nature and development of technological knowledge and processes.
01.02	Explain the rapid increase in the rate of technological development and diffusion.
01.03	Recognize specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Identify systems thinking logic and creativity with appropriate compromises in complex real-life problems.
02.02	Define technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.
02.03	Formulate why the stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.
02.04	Identify resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.
02.05	Identify the criteria and constraints of a product or system and determine how they affect the final design and development.
02.06	List strategies for optimizing a technological process or methodology of designing or making a product, dependent on criteria and constraints.
02.07	Identify new technologies that create new processes.
02.08	Research quality control as a planned process to ensure that a product, service, or system meets established criteria.
02.09	Define a management system as the process of planning, organizing, and controlling work.
02.10	Outline complex systems have many layers of controls and feedback loops to provide information.

CTE Standards and Benchmarks	
03.0	Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study. The student will be able to:
03.01	Identify technology transfer occurring when a new user applies an existing innovation developed for one purpose in a different function.
03.02	Identify technological innovation resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
03.03	Outline the process of patenting to protect a technological idea.
03.04	Identify technological progresses that promote the advancement of science and mathematics.
04.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
04.01	Identify changes caused by the use of technology ranging from gradual to rapid and from subtle to obvious.
04.02	Classify the use of technology involving weighing the trade-offs between the positive and the negative effects.
04.03	Identify ethical considerations important in the development, selection, and use of technologies.
04.04	List the cultural, social, economic, and political changes caused by the transfer of a technology from one society to another.
04.05	Discuss current technological developments that are/were driven by profit motives and the market.
05.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
05.01	Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
05.02	List trade-offs of developing technologies to reduce the use of resources.
05.03	Identify technology to monitor the environment and provide information as a basis for decision-making.
05.04	Compare and contrast the alignment of technological processes with natural processes to maximize performance and reduce negative impacts on the environment.
05.05	Identify technologies devised to reduce the negative consequences of other technologies.
05.06	Discuss the implementation of technologies involving the weighing of trade-offs between predicted positive and negative effects on the environment.
14.0	Demonstrate an understanding of and be able to select and use energy and power technologies. The student will be able to:
14.01	Explain why energy cannot be created nor destroyed; however, it can be converted from one form to another.
14.02	List and group major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.

CTE Standards and Benchmarks
14.03 Explain impossibility of building an engine to perform work that does not exhaust thermal energy to the surroundings.
14.04 Classify energy resources such as renewable or nonrenewable.
14.05 Construct a power system having a source of energy, a process, and loads.
15.0 Demonstrate safe and appropriate use of tools, machines, and materials in power and energy technology. The student will be able to:
15.01 Select appropriate tools, procedures, and/or equipment needed to produce a product.
15.02 Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to manufacture a product.
15.03 Follow laboratory safety rules and procedures.
15.04 Demonstrate good housekeeping at workstation and within total laboratory.
15.05 Identify color-coding safety standards.
15.06 Explain fire prevention and safety precautions and practices for extinguishing fires.
15.07 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
16.0 Describe sources of energy. The student will be able to:
16.01 Describe sources of thermal energy.
16.02 Describe sources of radiant energy.
16.03 Describe sources of nuclear energy.
16.04 Describe sources of chemical energy.
16.05 Describe sources of electrical energy.
16.06 Describe sources of mechanical energy.
16.07 Describe sources of fluid energy.

Florida Department of Education
Student Performance Standards

Course Title: **Power and Energy Technology II**
Course Number: **8601320**
Course Credit: **1**

Course Description:

This course provides students with intermediate understanding of the knowledge, human relations, and technical skills of energy and power technology.

CTE Standards and Benchmarks	
06.0	Demonstrate an understanding of the role of society in the development and use of technology. The student will be able to:
06.01	Investigate how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
06.02	Collect societal opinions and demands, as well as corporate cultures to use as a basis for deciding whether or not to develop a technology.
06.03	Identify a number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads as contributors to shaping the design of and demand for various technologies.
07.0	Demonstrate an understanding of the influence of technology on history. The student will be able to:
07.01	Develop a logical argument as to why technological development has been evolutionary, the result of a series of refinements to a basic invention.
07.02	Research how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
07.03	Define the history of technology as a powerful force in reshaping the social, cultural, political, and economic landscape.
07.04	Discuss that early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.
07.05	Define the Iron Age as the use of iron and steel as the primary materials for tools.
07.06	Define the Middle Ages and its development of many technological devices that produced long-lasting effects on technology and society.
07.07	Define the Renaissance, a time of rebirth of the arts and humanities, as an important development in the history of technology.
07.08	Define the Industrial Revolution and the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.
07.09	Define the Information Age and its placement of emphasis on the processing and exchange of information.

CTE Standards and Benchmarks	
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
08.01	Apply the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
08.02	Restate design problems that are seldom presented in a clearly defined form.
08.03	Check and critique a design continually and improve and revise the idea of the design as needed.
08.04	List competing requirements of a design, such as criteria, constraints, and efficiency.
09.0	Demonstrate an understanding of engineering design. The student will be able to:
09.01	Identify design principles used to evaluate existing designs, to collect data, and to guide the design process.
09.02	Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the Engineering Design process.
09.03	Construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.
09.04	Evaluate factors taken into account in the process of engineering.
17.0	Demonstrate technical knowledge and skills related to power and energy systems. The student will be able to:
17.01	Identify and define key terms, categories, and parts of a steam power system.
17.02	Identify and define key terms, categories, and parts of a hydraulic or pneumatic system.
17.03	Identify and define key terms, categories, and parts of an electric power system.
17.04	Identify and define key terms, categories, and parts of a solar power system.
17.05	Identify and define key terms, categories, and parts of a nuclear power system.
17.06	Construct, test, and evaluate a variety of power systems.
18.0	Demonstrate technical knowledge and skills about steam power technology. The student will be able to:
18.01	Describe the operating theory and principles of steam power systems.
18.02	Explain the uses and applications of steam power systems.

CTE Standards and Benchmarks	
	18.03 Identify industries that produce and use steam power systems.
	18.04 Describe energy and fuel sources for steam power operations.
	18.05 Perform technical skills in designing, assembling, maintaining, or operating a steam power system.
19.0	Demonstrate technical knowledge and skills about hydraulic and pneumatic power technology. The student will be able to:
	19.01 Identify and define key terms, categories, and parts of hydraulic and pneumatic power technology.
	19.02 Describe the operating theory and principles of hydraulic and pneumatic power technology.
	19.03 Explain the uses and applications of hydraulic and pneumatic power systems.
	19.04 Identify industries that produce and use hydraulic and pneumatic power systems.
	19.05 Describe the energy sources for hydraulic and pneumatic power systems.
	19.06 Perform technical skills in building, assembling, maintaining, or operating hydraulic and pneumatic power systems.
20.0	Demonstrate technical knowledge and skills about electric power technology. The student will be able to:
	20.01 Describe the operating theory and principles of electric power systems.
	20.02 Explain the uses and applications of electric power systems.
	20.03 Identify industries that produce and use electric power systems.
	20.04 Describe energy and fuel sources for electric power systems.
	20.05 Perform technical skills in building, assembling, maintaining, or operating an electric power system.
21.0	Demonstrate technical knowledge and skills about solar cells and fuel cells. The student will be able to:
	21.01 Describe the operating theory and principles of solar cell and fuel cell power technology.
	21.02 Explain the uses and applications of solar cell and fuel cell power technology.
	21.03 Identify the industries that produce and use solar cell and fuel cell power systems.
	21.04 Describe the energy and fuel sources for solar cell and fuel cell power systems.
	21.05 Perform technical skills in building, assembling, maintaining, or operating solar cell or fuel cell systems.

CTE Standards and Benchmarks	
22.0	Demonstrate technical knowledge and skills about nuclear power technology. The student will be able to:
22.01	Describe the operating theory and principles of nuclear power systems.
22.02	Explain the uses and applications of nuclear power systems.
22.03	Identify industries that produce and use nuclear power systems.
22.04	Describe energy and fuel sources for nuclear power systems.

Florida Department of Education
Student Performance Standards

Course Title: **Power and Energy Technology III**
Course Number: **8601330**
Course Credit: **1**

Course Description:

This course provides students with advanced understanding of the knowledge, human relations, and technical skills of energy and power technology.

CTE Standards and Benchmarks	
10.0	Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. The student will be able to:
10.01	Employ research and development as a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.
10.02	Conduct research needed to solve technological problems.
10.03	Differentiate between technological and non-technological problems and identify which problems can be solved using technology.
10.04	Utilize a multidisciplinary approach to solving technological problems.
11.0	Demonstrate the abilities to apply the design process. The student will be able to:
11.01	Interpret the design problem to solve and decide whether or not to address it.
11.02	List criteria and constraints and determine how these will affect the design process.
11.03	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
11.04	Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
11.05	Develop a product or system using a design process.
11.06	Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
12.01	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.

CTE Standards and Benchmarks	
	12.02 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
	12.03 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
	12.04 Operate systems so that they function in the way they were designed.
	12.05 Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
13.0	Demonstrate the ability to assess the impact of products and systems. The student will be able to:
	13.01 Collect information and evaluate its quality.
	13.02 Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.
	13.03 Apply assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
	13.04 Design forecasting techniques to evaluate the results of altering natural systems.
23.0	Perform advanced-study and technical skills related to energy and power technology. The student will be able to:
	23.01 Select an individual or group project in cooperation with the teacher.
	23.02 Develop a written plan of work to carry out the project.
	23.03 Show evidence of technical study in support of the project.
	23.04 Perform skills related to the project.
	23.05 Complete the project as planned.
24.0	Measure and report the power and efficiency of power producing systems. The student will be able to:
	24.01 Measure the power and efficiency of a mechanical system.
	24.02 Measure the power and efficiency of a fluid system.
	24.03 Measure the power and efficiency of an electrical system.
	24.04 Measure the power and efficiency of a thermal system.
25.0	Conduct a research and experimentation project on an energy and power system.--The student will be able to:

CTE Standards and Benchmarks	
	25.01 Identify a problem.
	25.02 State a need to research the problem.
	25.03 Form a hypothesis about the problem.
	25.04 Plan the procedures for researching the problem.
	25.05 Conduct the research following the planned procedures.
	25.06 Present the research findings in a seminar.
26.0	Demonstrate an understanding of career opportunities and requirements in the field of power and energy technology. The student will be able to:
	26.01 Discuss individual interests related to a career in power and energy technology.
	26.02 Explore career opportunities related to a career in power and energy technology.
	26.03 Explore secondary education opportunities related to power and energy technology.
	26.04 Conduct a job search.
	26.05 Complete a job application form correctly.
	26.06 Demonstrate competence in job interview techniques.
	26.07 Create a professional resume and letter of introduction.
	26.08 Solicit awards, letters of recommendation and recognition.
	26.09 Organize work samples in a professional, presentable format.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular career and technical student organization 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated, or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Work-Based Experience**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8601800
CIP Number	08210199CP
Grade Level	9-12
Program Length	1 credit (Maximum of 3 credits)
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this course is to provide Engineering and Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated, Work-Based experience. The Engineering and Technology Education/Work-Based Experience is designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations.

This course is **not** intended to be used as a job preparatory, specific-skill development activity such as found in youth apprenticeship programs.

To enroll in the Engineering and Technology Education Work-Based Experience program, a student must have:

1. Completed one credit of an Engineering & Technology Education program consisting of 3 credits or more.
2. Be currently enrolled in or have completed an Engineering & Technology Education program.
3. Assigned a Work-Based Experience logically related to the Engineering & Technology Education program.

This Work-Based Experience course may be taken by a student for one or more semesters. A student may earn multiple credits in this course.

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

Program Structure

This program of instruction consists of one credit.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8601800	Work-Based Experience	*Since this program serves as a capstone experience for the student, the teacher certification must be appropriate to the student's Engineering & Technology program of study and the teacher certifications specified in the respective curriculum framework.*	1 credit*	2	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

** Note: Students may earn multiple credits (maximum of 3 credits) in this course.*

Pre-Placement Planning Conferences: The student, teacher, and the work-based experience site supervisor must participate in a pre-placement conference. It is also recommended that the parents/guardian of the student be included in the pre-placement planning conference. Pre-placement planning is essential to designing 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, training/learning activities and evaluation methods. The Student Learner learning agreement should be signed by the student, teacher-coordinator, parent/guardian, and the work-based learning site supervisor.

Site Criteria: The following criteria shall be met when choosing the Work-Based Experience site:

1. The work-based learning must allow experiences that utilize both skills and knowledge directly related to the student's career interests and the Technology Education program in which the student is enrolled or has completed.
2. The work-based experience must provide opportunities for rotation through a wide variety of increasingly responsible experiences beyond routine activities.
3. The work-based experience sponsors must provide skilled work-based experience site supervisors and/or mentors who are interested and willing to assist the student.
4. The work-based experience sponsors must provide a safe and ethically sound environment with up-to-date facilities and equipment. The work-based learning experience must adhere to all state and federal laws and rules regarding the employment of minors. The work-based experience must not displace a paid employee.
5. Timecards documenting the time spent at the work-based experience site must be maintained.
6. When offered for multiple credits, the student should have varied learning experiences in order to provide maximum work-based exposure.

Work Experience: This component shall provide a match between the student's career interests and a work-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 Engineering and Technology Education studies and career interests.

Experience Plan: A work-based experience plan must be developed and implemented for each student based on the curriculum frameworks of the Engineering and Technology Education program. The work-based experience plan must outline learning objectives, methods of learning, activities/responsibilities, time required, student performance standards, provision for supervision, and method(s) of student evaluation. The work-based learning experience plan must be signed by the student, teacher, parent and the work-based experience site supervisor.

Supervision/Site Visits: Teacher-coordinators of the Engineering and Technology Education/Work-Based Experience must monitor and support learning while students are at a work-based site. Teacher-coordinators must visit the work-based experience site as frequently as once every two weeks, but not less than once per month so that students may be observed in all facets of their work-based learning experiences. Students must also be evaluated a minimum of once per grading period by the teacher-coordinator with input from the work-based experience site supervisor. The evaluation should assess how well the student is progressing toward goals established by the student teacher-coordinator, and work-based experience site supervisor. Portfolio assessment, orchestrated by the teacher-coordinator, is a recommended method of student assessment. It is recommended that for every 20 students (or portion thereof) enrolled in Engineering and Technology Education/Work-Based Experience; the teacher-coordinator should be given one hour of coordination release time per day in order to visit students at the work-based learning sites.

Hazardous Occupations Placements: In order for a student learner to obtain a waiver for a specific allowable hazardous occupation the following Florida (Section 450.161, Florida Statutes) Child Labor Law must be followed.

1. The student learner is enrolled in a youth career training program under a recognized state or local educational authority.
2. Such student learner is employed under a written agreement which provides:
   (a) That the work of the student learner in the occupation declared particularly hazardous shall be incidental to the training.
   (b) That such work shall be intermittent and for short periods of time and under the direct and close supervision of a qualified and experienced person.
   (c) That safety instructions shall be given by the school correlated by the employer with on-the-job training.
   (d) That a schedule of organized and progressive work processes to be performed on the job shall have been prepared.

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 Gain practical exposure in broad occupational clusters.

Florida Department of Education
Student Performance Standards

Course Title: **Work-Based Experience**
Course Number: **8601800**
Course Credit: **1**

Course Description:

This course provides Engineering and Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated, Work-Based experience. This course is **not** intended to be used as a job preparatory, specific-skill development activity such as found in youth apprenticeship programs.

CTE Standards and Benchmarks	
01.0	Complete a skills inventory. The student will be able to:
01.01	Practice safety procedures at the work-based site as learned in the classroom setting.
01.02	Demonstrate an understanding of employer safety and general policies and procedures.
01.03	Maintain a daily log of activities documenting job tasks at the work-based site.
02.0	Demonstrate acceptable work values. The student will be able to:
02.01	Maintain a positive work relationship with peers and mentors.
02.02	Report on time and consistently each assigned day.
02.03	Notify instructor and mentor if unable to report to work-based site.
02.04	Demonstrate adaptive self-management skills.
03.0	Gain practical exposure in broad occupational clusters. The student will be able to:
03.01	Rotate through a wide variety of increasingly responsible experiences.
03.02	Participate as a team member with a skilled mentor.
03.03	Demonstrate an understanding and appreciation of related occupational groups.
03.04	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) is the co-curricular career and technical student organization 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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Advanced Technology Applications**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8601900
CIP Number	08210200CP
Grade Level	9-12
Program Length	1 credit (Maximum of 3 credits)
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this course is to serve as a capstone course to provide Engineering and Technology Education students with the opportunity, to develop a project from "vision" to "reality". Working in teams to design, engineer, manufacture, construct, test, redesign, test again, and then produce a finished "project". This would involve using ALL of the knowledge previously learned, not only in technology education, but across the curriculum.

To enroll in Advanced Technology Applications, a student must have:

1. Completed three credits of an Engineering & Technology Education program.
2. Received permission of the supervising Engineering & Technology Education Instructor and or Faculty Team.

This Advanced Technology Applications course may be taken by a student for one or more semesters. A student may earn multiple credits in this course (maximum of three).

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

Program Structure

This program of instruction consists of one credit.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8601900	Advanced Technology Applications	*Since this program serves as a capstone experience for the student, the teacher certification must be appropriate to the student's Engineering & Technology program of study and the teacher certifications specified in the respective curriculum framework.*	1 credit*	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

** Note: Students may earn multiple credits (maximum of 3 credits) in this course.*

The Advanced Technology Applications program MUST include the following components:

Pre-Project Planning Conference: The student, teacher, and 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 Advanced Technology Applications Project:

The project must allow experiences that utilize both skills and knowledge directly related to the student's career interests and the Engineering & Technology Education program in which the student is enrolled or has completed.

The project must provide opportunities for rotation through a wide variety of advanced applications in technology tasks.

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 manufactured or constructed

Each student must maintain a portfolio of the project to include:

(a) Bibliography of all research materials accessed.
(b) A written research paper describing the background information the project is to be based on.
(c) A Laboratory Report to include:
    1. A clear statement of the project
    2. A hypothesis or description of the area of investigation.
    3. A written procedure of each activity as it is accomplished.
    4. List of materials used in each activity.
    5. Data recovered in the form of a data table, charts graphs.
    6. Conclusion
    7. Bibliography
(d) Safety concerns and procedures to be followed.
(e) An abstract.

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 description of the experiment, process or activity
(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 Engineering & Technology Education studies and career interests.

Experience Plan: A project experience plan must be developed and implemented for each student based on the curriculum frameworks of the Engineering & Technology Education program. The project experience plan must outline learning objectives, methods of learning, activities/ responsibilities, time required, student performance standards, provision for supervision, and method(s) of student evaluation. The project learning experience plan must be signed by the student and teacher.

Supervision: Teacher-coordinators of the Advanced Technology 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 student 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 process in an appropriate and safe manner.
10.0 Demonstrate an understanding of the scientific process.
11.0 Demonstrate appropriate scientific content related to the project.
12.0 Demonstrate appropriate mathematics content related to the project.
13.0 Carry out a research assignment and document the results of research efforts.
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 education program previously completed, that this project is based upon.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Technology Applications**
Course Number: **8601900**
Course Credit: **1**

Course Description:

This is a project-based capstone course to provide Engineering and Technology Education students with the opportunity to develop a project from "vision" to "reality". Students work in teams to design, engineer, manufacture, construct, test, redesign, test again, and then produce a finished "project".

CTE Standards and Benchmarks	
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.
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.

CTE Standards and Benchmarks	
	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 logbook 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, 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.

CTE Standards and Benchmarks	
	07.04 Determine project priorities.
	07.05 Identify required resources.
	07.06 Plan research, development, design, construction and manufacturing 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 waste disposal.
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 scientific process. The student will be able to:
	10.01 State a problem clearly.
	10.02 Identify and write a hypothesis.
	10.03 Develop a materials list.
	10.04 Develop a step by step procedure.
	10.05 Follow a written procedure.

CTE Standards and Benchmarks	
	10.06 Record data.
	10.07 Make a conclusion based on results, observations and data.
	10.08 Document progress using a laboratory report.
	10.09 Write an abstract.
11.0	Demonstrate appropriate scientific content related to the project. The student will be able to:
	11.01 Document how all matter has observable, measurable properties.
	11.02 Apply the basic principles of atomic theory.
	11.03 Determine how energy may be changed in form with varying efficiency.
	11.04 Document the interaction of matter and energy.
	11.05 Document how types of motion may be described, measured, and predicted.
	11.06 Demonstrate how types of force that act on an object and the effect of that force can be described, measured, and predicted.
	11.07 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 the problem mathematical using length, time, weight/mass, temperature, money, perimeter, area, and volume, and estimates 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

CTE Standards and Benchmarks	
	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	Carry out a research assignment and document the results of research efforts. 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 a research experiment.
13.10	Complete a laboratory report on the experiment, documenting results, data and observations.
13.11	Prepare a display of the experiment to include a title, problem statement, hypothesis, material list, procedure, results and observations, data tables and or graphs and charts, illustrations of the procedure, models, mock ups, devices or fixtures required, conclusion safety statements and an abstract.

CTE Standards and Benchmarks	
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 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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Production Technology**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	8604000
CIP Number	0821011400
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of production technology and its effect upon our lives and the choosing of an occupation. The content and activities will also include the study of entrepreneurship, safety, and leadership skills. This program focuses on transferable skills and stresses understanding and demonstration of the technological tolls, machines, instruments, materials, processes and systems in business and industry.

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 credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8600540	Production Technology I	AUTO PROD 7G ENG 7G ENG TEC 7G TEC ED 1 @2 ENG&TEC ED1@2	1 credit	2	CT
8600640	Production Technology II		1 credit	2	CT
8601740	Production Technology III		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

In addition to the above courses, the Advanced Technology Applications (8601900) course is appropriate to be used for content area continuation in this program after all three credits of this program have been completed. The purpose of the Advanced Technology Applications course is to provide students with a capstone opportunity to develop a school-based project from "vision" to "reality," working in teams to design, engineer, manufacture, construct, test, redesign, test again; and then produce a finished "project". This would involve using ALL the knowledge previously learned, not only in Engineering & Technology Education but also across the curriculum. See the Advanced Technology Applications framework for more information.

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 the characteristics and scope of technology.
02.0 Demonstrate an understanding of the core concepts of technology.
03.0 Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study.
04.0 Demonstrate an understanding of the cultural, social, economic, and political effects of technology.
05.0 Demonstrate an understanding of the effects of technology on the environment.
06.0 Demonstrate an understanding of the role of society in the development and use of technology.
07.0 Demonstrate an understanding of the influence of technology on history.
08.0 Demonstrate an understanding of the attributes of design.
09.0 Demonstrate an understanding of engineering design.
10.0 Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
11.0 Demonstrate the abilities to apply the design process.
12.0 Demonstrate the abilities to use and maintain technological products and systems.
13.0 Demonstrate the ability to assess the impact of products and systems.
14.0 Demonstrate an understanding of and be able to select and use manufacturing technologies.
15.0 Demonstrate safe and appropriate use of tools and machines in production technology.
16.0 Demonstrate the ability to properly identify, organize, plan, and allocate resources.
17.0 Demonstrate an understanding of entrepreneurship.
18.0 Produce a custom product from industrial materials and composites using preprocessing, processing, and post-processing production technology skills.
19.0 Plan and participate in a mass production system for manufacturing a product.
20.0 Utilize modern production technology in the processes of separating, forming, combining, fabrication, and finishing of materials.
21.0 Perform advanced study and technical skills related to production technology.
22.0 Demonstrate an understanding of career opportunities and requirements in the field of production technology.

Florida Department of Education
Student Performance Standards

Course Title: **Production Technology I**
Course Number: **8600540**
Course Credit: **1**

Course Description:

This course provides students with an introduction to the knowledge, human relations, and technological skills found today in production technology.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the characteristics and scope of technology. The student will be able to:
01.01	Discuss the nature and development of technological knowledge and processes.
01.02	Explain the rapid increase in the rate of technological development and diffusion.
01.03	Recognize specific goal-directed research related to inventions and innovations.
02.0	Demonstrate an understanding of the core concepts of technology. The student will be able to:
02.01	Identify systems thinking logic and creativity with appropriate compromises in complex real-life problems.
02.02	Define technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.
02.03	Formulate why the stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.
02.04	Identify resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.
02.05	Identify the criteria and constraints of a product or system and determine how they affect the final design and development.
02.06	List strategies for optimizing a technological process or methodology of designing or making a product, dependent on criteria and constraints.
02.07	Identify new technologies that create new processes.
02.08	Research quality control as a planned process to ensure that a product, service, or system meets established criteria.
02.09	Define a management system as the process of planning, organizing, and controlling work.
02.10	Outline complex systems have many layers of controls and feedback loops to provide information.

CTE Standards and Benchmarks	
03.0	Demonstrate an understanding of the relationships among technologies and the connection between technology and other fields of study. The student will be able to:
03.01	Identify technology transfer occurring when a new user applies an existing innovation developed for one purpose in a different function.
03.02	Identify technological innovation resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
03.03	Outline the process of patenting to protect a technological idea.
03.04	Identify technological progresses that promote the advancement of science and mathematics.
04.0	Demonstrate an understanding of the cultural, social, economic, and political effects of technology. The student will be able to:
04.01	Identify changes caused by the use of technology ranging from gradual to rapid and from subtle to obvious.
04.02	Classify the use of technology involving weighing the trade-offs between the positive and the negative effects.
04.03	Identify ethical considerations important in the development, selection, and use of technologies.
04.04	List the cultural, social, economic, and political changes caused by the transfer of a technology from one society to another.
04.05	Discuss current technological developments that are/were driven by profit motives and the market.
05.0	Demonstrate an understanding of the effects of technology on the environment. The student will be able to:
05.01	Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
05.02	List trade-offs of developing technologies to reduce the use of resources.
05.03	Identify technology to monitor the environment and provide information as a basis for decision-making.
05.04	Compare and contrast the alignment of technological processes with natural processes to maximize performance and reduce negative impacts on the environment.
05.05	Identify technologies devised to reduce the negative consequences of other technologies.
05.06	Discuss the implementation of technologies involving the weighing of trade-offs between predicted positive and negative effects on the environment.
14.0	Demonstrate an understanding of and be able to select and use manufacturing technologies. The student will be able to:
14.01	Service products to keep them in good operating condition.
14.02	Classify materials based on their qualities as natural, synthetic, or mixed.

CTE Standards and Benchmarks	
14.03	Classify goods as durable goods designed to operate for a long period of time, or non-durable goods designed to operate for a short period of time.
14.04	Identify and classify manufacturing systems into types, such as customized production, batch production, and continuous production.
14.05	Discuss the interchangeability of parts to increase the effectiveness of manufacturing processes.
14.06	Identify chemical technologies providing a means for humans to alter or modify materials and to produce chemical products.
14.07	Employ marketing techniques involving establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it.
15.0	Demonstrate safe and appropriate use of tools and machines in production technology. The student will be able to:
15.01	Select appropriate tools, procedures, and/or equipment.
15.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.
15.03	Follow laboratory safety rules and procedures.
15.04	Demonstrate good housekeeping at workstation within total laboratory.
15.05	Identify color-coding safety standards.
15.06	Explain fire prevention and safety precautions and practices for extinguishing fires.
15.07	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
16.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
16.01	Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
16.02	Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
16.03	Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
16.04	Display an understanding of the efficient use of human resources.
17.0	Demonstrate an understanding of entrepreneurship. The student will be able to:
17.01	Define entrepreneurship.
17.02	Describe the importance of entrepreneurship to the American economy.

CTE Standards and Benchmarks
17.03 List the advantages and disadvantages of business ownership.
17.04 Identify the risks involved in ownership of a business.
17.05 Identify the necessary personal characteristics of a successful entrepreneur.
17.06 Identify the business skills needed to operate a small business efficiently and effectively.

Florida Department of Education
Student Performance Standards

Course Title: **Production Technology II**
Course Number: **8600640**
Course Credit: **1**

Course Description:

This program provides students with an intermediate understanding of the knowledge, human relations, and technological skills found today in production technology.

CTE Standards and Benchmarks	
06.0	Demonstrate an understanding of the role of society in the development and use of technology. The student will be able to:
06.01	Investigate how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
06.02	Collect societal opinions and demands, as well as corporate cultures to use as a basis for deciding whether or not to develop a technology.
06.03	Identify a number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads as contributors to shaping the design of and demand for various technologies.
07.0	Demonstrate an understanding of the influence of technology on history. The student will be able to:
07.01	Develop a logical argument as to why technological development has been evolutionary, the result of a series of refinements to a basic invention.
07.02	Research how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
07.03	Define the history of technology as a powerful force in reshaping the social, cultural, political, and economic landscape.
07.04	Discuss that early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.
07.05	Define the Iron Age as the use of iron and steel as the primary materials for tools.
07.06	Define the Middle Ages and its development of many technological devices that produced long-lasting effects on technology and society.
07.07	Define the Renaissance, a time of rebirth of the arts and humanities, as an important development in the history of technology.
07.08	Define the Industrial Revolution and the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.
07.09	Define the Information Age and its placement of emphasis on the processing and exchange of information.

CTE Standards and Benchmarks	
08.0	Demonstrate an understanding of the attributes of design. The student will be able to:
08.01	Apply the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
08.02	Restate design problems that are seldom presented in a clearly defined form.
08.03	Check and critique a design continually and improve and revise the idea of the design as needed.
08.04	List competing requirements of a design, such as criteria, constraints, and efficiency.
09.0	Demonstrate an understanding of engineering design. The student will be able to:
09.01	Identify design principles used to evaluate existing designs, to collect data, and to guide the design process.
09.02	Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the Engineering Design process.
09.03	Construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.
09.04	Evaluate factors taken into account in the process of engineering.
18.0	Produce a custom product from industrial materials and composites using preprocessing, processing, and post-processing production technology skills. The student will be able to:
18.01	Apply the technology processes of separating and forming materials.
18.02	Apply the technology processes of conditioning materials.
18.03	Apply the technology processes of combining in the fabrication and finishing of materials.
18.04	Produce a custom product.
19.0	Plan and participate in a mass production system for manufacturing a product. The student will be able to:
19.01	Design and develop jigs, fixtures, or a model system for product mass production.
19.02	Develop an organized plan of tools, materials, processes, and systems to efficiently mass-produce a product.
19.03	Apply pre-processing, processing, and post-processing techniques in the mass production of a product.
19.04	Participate in the organized mass production of a product.

CTE Standards and Benchmarks	
20.0	Utilize modern production technology in the processes of separating, forming, combining, fabrication, and finishing of materials. The student will be able to:
20.01	Design a program to be used in the separating forming and finishing of materials.
20.02	Develop and perform an operational program of forming materials.
20.03	Develop and perform an operational program of finishing materials.
20.04	Develop and perform an operational program that will use combination of modern production processes, equipment, and materials.

Florida Department of Education
Student Performance Standards

Course Title: **Production Technology III**
Course Number: **8601740**
Course Credit: **1**

Course Description:

This program provides students with an advanced understanding of the knowledge, human relations, and technological skills found today in production technology.

CTE Standards and Benchmarks	
10.0	Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. The student will be able to:
10.01	Employ research and development as a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.
10.02	Conduct research needed to solve technological problems.
10.03	Differentiate between technological and non-technological problems and identify which problems can be solved using technology.
10.04	Utilize a multidisciplinary approach to solving technological problems.
11.0	Demonstrate the abilities to apply the design process. The student will be able to:
11.01	Interpret the design problem to solve and decide whether or not to address it.
11.02	List criteria and constraints and determine how these will affect the design process.
11.03	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
11.04	Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
11.05	Develop a product or system using a design process.
11.06	Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
12.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
12.01	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.

CTE Standards and Benchmarks	
12.02	Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
12.03	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
12.04	Operate systems so that they function in the way they were designed.
12.05	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
13.0	Demonstrate the ability to assess the impact of products and systems. The student will be able to:
13.01	Collect information and evaluate its quality.
13.02	Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.
13.03	Apply assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.
13.04	Design forecasting techniques to evaluate the results of altering natural systems.
21.0	Perform advanced study and technical skills related to production technology. The student will be able to:
21.01	Identify and research a design problem related to production technology.
21.02	Produce a detailed design and plan for the production of the solution.
21.03	Complete the advanced design project as planned.
21.04	Deliver a professional quality presentation of the design process and solution.
22.0	Demonstrate an understanding of career opportunities and requirements in the field of production technology. The student will be able to:
22.01	Discuss individual interests related to a career in production technology.
22.02	Explore career opportunities related to production technology.
22.03	Explore secondary education opportunities related to production technology.
22.04	Conduct a job search.
22.05	Complete a job application form correctly.
22.06	Demonstrate competence in job interview techniques.

CTE Standards and Benchmarks
22.07 Create a professional resume and letter of introduction.
22.08 Solicit awards, letters of recommendation and recognition.
22.09 Organize work samples in a professional, presentable format.

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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English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Scientific Visualization**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	9400100
CIP Number	0507039918
Grade Level	9-12
Program Length	5 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This Engineering and Technology Education program focuses on the principles, concepts, and use of complex graphic and visualization tools as applied to the study of science and technology. Students use complex 2D graphics, 3D Animation, editing, and image analysis tools to better understand, illustrate, explain, and present technical, mathematical, and/or scientific concepts and principles. Emphasis is placed on the use of computer enhanced images to generate both conceptual and data-driven models, data-driven charts, and animations. Science, math, and visual design concepts are reinforced throughout each course.

The skills students acquire in this program can be applied to many different occupations, however, occupations that require scientific visualization skills do not typically include the term in the job title. For example, a person who designs educational web pages for a zoo or a museum is using scientific visualization to convey scientific ideas to the public. Also, a research chemist may use scientific visualization to design a better medical drug, or an engineer might use the same skills to design a faster race car. This course helps students gain experience using a multitude of computer graphic software, develop problem solving skills, become independent learners, and acquire the intellectual confidence necessary for success in their post-secondary educational pursuits.

The Scientific Visualization program is a sequence of four courses with provisions for an internship for students as a capstone experience. In addition to complex visualization tools, 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 of geospatial concepts, project management strategies, applications of geographic data elements and remotely sensed data, and visualizations of dynamic spatial data.

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 credits.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8207310	Digital Information Technology	DIT Teacher Certifications	1 credit	2	CT
9400110	Principles of Scientific Visualization	COMPU SCI 6 ENG 7G SCI VIZ 7G TEC ED 1 @2 ENG&TEC ED1@2	1 credit	3	CT
9400120	Data Modeling		1 credit	3	CT
9400130	Advanced Applications in Scientific Visualization		1 credit	3	CT
9400140	SciViz Internship		1 credit	2	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

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:

Digital Information Technology (8207310) is the first course in this program. Standards 01.0 – 15.0 are associated with this course.

01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
02.0 Develop an awareness of microcomputers.
03.0 Demonstrate an understanding of networks.
04.0 Use word processing applications to enhance the effectiveness of various types of documents and communication.
05.0 Use presentation applications to enhance communication skills.
06.0 Use spreadsheet applications to enhance communication skills.
07.0 Use database applications to store and organize data.
08.0 Use electronic mail to enhance communication skills.
09.0 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.
10.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
11.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
12.0 Develop awareness of computer languages, web-based and software applications, and emerging technologies.
13.0 Demonstrate an understanding of basic html by creating a simple web page.
14.0 Demonstrate comprehension and communication skills.
15.0 Use social media to enhance online communication and develop an awareness of a digital footprint.
16.0 Describe scientific and technical visualization.
17.0 Describe the historical significance of scientific and technical visualization.
18.0 Describe the technological advancements of scientific and technical visualization.
19.0 Recognize types of scientific and technical visualization and related careers.
20.0 Classify the categories of visualization tools, providing examples of each category.
21.0 Describe design fundamentals relative to visualization.
22.0 Interpret color and its applications.
23.0 Discuss vector and bitmap images.
24.0 Identify effective 2D presentation techniques.
25.0 Describe 2D software applications and their basic functions.
26.0 Demonstrate effective presentation techniques using appropriate design fundamentals.
27.0 Evaluate methods for displaying data using charts and graphs.
28.0 Describe the steps of a design brief.
29.0 Describe various organizational and diagramming tools. The student will be able to:
30.0 Interpret data for use in charts and graphs.
31.0 Apply data to make an appropriate graph.
32.0 Recognize digital image formats.

33.0 Summarize basic 3D modeling concepts.
34.0 Recognize basic rendering techniques.
35.0 Summarize basic animation techniques.
36.0 Produce a 3D model with animation and rendering.
37.0 Describe 3D modeling.
38.0 Apply basic 3D modeling concepts.
39.0 Render 3D objects to final form.
40.0 Animate 3D objects using dynamic data.
41.0 Render an animated 3D model.
42.0 Interpret different types of spatial data used in 3D visualization and analysis.
43.0 Customize the display of geospatial data.
44.0 Manage, query, and symbolize geospatial data.
45.0 Create, change, and manipulate remotely sensed image data.
46.0 Construct a 3D model of a physical environment.
47.0 Apply advanced tools of visualization.
48.0 Demonstrate advanced principles of visualization.
49.0 Demonstrate advanced visualization processes.
50.0 Demonstrate advanced scientific visualization.
51.0 Demonstrate preparedness for the future.

Florida Department of Education
Student Performance Standards

Course Title: Digital Information Technology
Course Number: 8207310
Course Credit: 1

Course Description:

This core course is designed to provide a basic overview of current business and information systems and trends, and to introduce students to fundamental skills required for today's business and academic environments. Emphasis is placed on developing fundamental computer skills. The intention of this course is to prepare students to be successful both personally and professionally in an information-based society. Digital Information Technology includes the exploration and use of: databases, the internet, spreadsheets, presentation applications, management of personal information and email, word processing and document manipulation, HTML, web page design, and the integration of these programs using software that meets industry standards.

Digital Information Technology (8207310) is part of several programs across various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 15.0) have been placed in a separate document. To access this document, visit: Digital Information Technology (8207310)

Florida Department of Education
Student Performance Standards

Course Title: **Principles of Scientific Visualization**
Course Number: **9400110**
Course Credit: **1**

Course Description:

This course provides students with instruction in the evolution and underlying principles of scientific visualization, including two-dimensional representation of scientific and other forms of data. Included in the content is the use of color and other graphical elements such as vector and bitmap images in different presentation techniques. Students will also learn about the use of charts and graphs in representing data and the software tools used to produce them. The ultimate output of this course is a design portfolio created by the student from a scenario. The portfolio should include a narrative description of the scenario, the approach to data collection, resulting charts and graphs, and an interpretation of each chart/graph. Research references should be cited appropriately. Consideration should be given to having students produce the portfolio using presentation software.

CTE Standards and Benchmarks	
16.0	Describe scientific and technical visualization. The student will be able to:
16.01	Define scientific and technical visualization and provide examples of each.
16.02	Explain the importance of scientific visualization and its applicability to various industries.
16.03	Provide examples of 2-D and 3D rendered visualizations.
17.0	Describe the historical significance of scientific and technical visualization. The student will be able to:
17.01	Describe the evolution of drawings from cave through perspective drawings to photography, television, and the Internet.
17.02	Define and describe the elements contained on various types of maps (e.g., road, topographic, aeronautical, weather, concept, and gene).
18.0	Describe the technological advancements of scientific and technical visualization. The student will be able to:
18.01	Describe x-ray crystallography and its importance to modern visualization.
18.02	Compare the differences between microscopes and the types of telescopes (radio and light) relative to their use in scientific visualization.
18.03	Describe how the advancement of computer technology has impacted scientific visualization.
18.04	Explain how DNA fingerprinting relates to scientific visualization.

CTE Standards and Benchmarks	
	18.05 Describe magnetic resonance imaging (MRI) and how it benefits from scientific visualization.
	18.06 Describe how geospatial information systems and remote sensing relate to scientific visualization.
	18.07 Define virtual reality and relate it to simulations and holograms.
19.0	Recognize types of scientific and technical visualization and related careers. The student will be able to:
	19.01 Describe careers related to scientific visualization that exist in various industries.
	19.02 Describe careers related to technical visualization that exist in various industries.
20.0	Classify the categories of visualization tools, providing examples of each category. The student will be able to:
	20.01 Describe basic computer hardware and software components and characteristics.
	20.02 Interpret the use and application of different types of software programs.
	20.03 Summarize the ethical use of electronic media.
	20.04 Demonstrate basic computer knowledge by writing a proposal for a 3-D animation project to include:
	• A chart or spreadsheet comparing three software applications in terms of hardware requirements and software cost.
	• List describing input and output devices chosen and rationale.
	• Written justification for the proposed solution (2-3 paragraphs).
21.0	Describe design fundamentals relative to visualization. The student will be able to:
	21.01 Define the three aspects of design.
	21.02 Describe the three principles of design (balance, rhythm, proportion).
	21.03 Describe the three methods of design (emphasis, unity, and repetition).
	21.04 Define and describe the six elements of design (lines, shapes, color, texture, space, and size)
22.0	Interpret color and its applications. The student will be able to:
	22.01 Describe the relationships between additive and subtractive color and their implications to absorbed, reflected, transmissive, transparent, and opaque colors.
	22.02 Describe how mood is communicated using color and give examples.

CTE Standards and Benchmarks	
	22.03 Describe the HSV (Hue, Saturation, Values) Model and its role in color mixing and harmony.
	22.04 Define and explain the use of complimentary color schemes.
	22.05 Describe and give examples of how visual communication uses images and text to convey information and persuade.
23.0	Discuss vector and bitmap images. The student will be able to:
	23.01 Define the characteristics of vector images.
	23.02 Describe the advantages of vector images over raster images.
	23.03 Describe the disadvantages of vector images compared to raster images.
	23.04 Compare and contrast line art, complex line art, high detail line art, and colored vector images.
	23.05 Identify the native file format for common software used to create vector images (Corel Draw, Adobe Illustrator, and Adobe Photoshop).
	23.06 Define the characteristics of raster (bitmap) images.
	23.07 Describe the advantages of raster images over vector images.
	23.08 Describe the disadvantages of vector images compared to raster images.
	23.09 Compare the three types of raster images.
	23.10 Explain how the color depth of a raster image pixel affects file size.
	23.11 Define image resolution and explain why it only applies to raster images.
24.0	Identify effective 2D presentation techniques. The student will be able to:
	24.01 Identify the fundamental elements used to produce visual aids (images, words, shapes, and color)
	24.02 Explain how theme, focus, balance, weight, and placement affect visual representations.
	24.03 Explain the differences in presentation between demonstration, setting, and product along.
	24.04 Describe common conceptual techniques employed in presentations (picture windows, type specimen, copy heavy, Mondrian, omnibus, multi-panel or cartoon, and silhouette).
25.0	Describe 2D software applications and their basic functions. The student will be able to:

CTE Standards and Benchmarks	
25.01	Identify and describe the purpose of the various tools used in a basic 2D graphics application (select, knife, magnify/zoom, text, fill, pan, eyedropper, gradient blend, and crop).
25.02	Identify and describe various drawing techniques used in 2D representations, to include Bezier curves, closed and open splines, control points, layering, welding, grouping, desktop, grids and snaps, brushes and brush effects, line thickness, rotation, transparency, and printing).
25.03	Create a slide presentation (using software such as Microsoft PowerPoint) that employs backgrounds, master slides, images, movies, slide transitions, internal navigation, and timed sequencing.
25.04	Use layout concepts in creating a slide presentation; including use of a common background, the 6-6-6 rule, maximum of two images per slide, appropriate white space, adheres to SAFE design methods, and appropriate text size.
26.0	Demonstrate effective presentation techniques using appropriate design fundamentals. The student will be able to:
26.01	Design and produce a flyer or brochure about an organism for use in a high school biology or other science program.
26.02	Conduct research on a target organism for a flyer or brochure and include parts of the organism, habitat, feeding habits, special adaptations, and role in the environment.
26.03	Create two original images of the target organism in 2D software.
26.04	Identify the image for use as the dominant element in the layout and include labels and tags.
26.05	Sketch the layout of the flyer or brochure and select the appropriate typeface and color theme.
26.06	Size images to fit provided in the layout design.
26.07	Design a logo for use as an identity mark.
27.0	Evaluate methods for displaying data using charts and graphs. The student will be able to:
27.01	Recognize different types of charts and their uses and advantages.
27.02	Describe the characteristics and uses of bar charts.
27.03	Describe the characteristics and uses of a stacked column chart.
27.04	Describe the characteristics and uses of a line (x-y) graph.
27.05	Describe the characteristics and uses of a pie chart.
27.06	Describe the characteristics and uses of a scatter plot.
27.07	Describe the characteristics and uses of a histogram.

CTE Standards and Benchmarks	
	27.08 Identify and describe the different parts of a chart (axis, title, legend, labels).
	27.09 Describe the basic rules for chart construction.
28.0	Describe the steps of a design brief. The student will be able to:
	28.01 Describe the problem identification and definition step of producing a design brief.
	28.02 Describe the plan of work step of producing a design brief.
	28.03 Describe the literature review step of producing a design brief.
	28.04 Describe the hypothesis step of producing a design brief.
	28.05 Describe the data collection step of producing a design brief.
	28.06 Describe the visualization selection step of producing a design brief.
	28.07 Describe the self-evaluation step of producing a design brief.
	28.08 Describe the IDEAL problem-solving process (Identify the problem, Define the plan of work, Explore the problem through research, Act on the possible solution, Look back at the process).
	28.09 Describe each aspect of the SAFE design process (Simple, Appropriate, Functional, and Economical).
	28.10 Compare data-driven design to concept-driven design.
29.0	Describe various organizational and diagramming tools. The student will be able to:
	29.01 Describe flowcharting and its use in visualization.
	29.02 Identify and describe the basic flowcharting shapes.
	29.03 Describe brainstorming and its role in visualization.
	29.04 Describe the nominal group technique and its role in visualization.
	29.05 Define and explain the use of Venn diagramming in visualization.
30.0	Interpret data for use in charts and graphs. The student will be able to:
	30.01 Compare and contrast the 2D and 3D differences in the Cartesian coordinate system.
	30.02 Identify and give examples of direct or positive relationships.

CTE Standards and Benchmarks
30.03 Identify and give examples of inverse or negative relationships.
30.04 Read data values on charts and graphs and plot a regression line.
30.05 Describe and give examples of the following data types:
• Ordinal data
• Nominal data
• Scalar quantities
• Vector quantities
• Qualitative data
• Quantitative data
• Mean
• Median
• Mode
• Independent variable
• Dependent variable
• Control
• Empirically or computationally derived data
31.0 Apply data to make an appropriate graph. The student will be able to:
31.01 Select and create a graph or chart to appropriately illustrate a data set depicting rates of photosynthesis (time in minutes and rate in cubic millimeters).
31.02 Select and create a graph or chart to appropriately illustrate a data set depicting number of red eyes in fruit flies over generations (frequency of x).
31.03 Select and create a graph or chart to appropriately illustrate a data set depicting the diet of the coyote in the summer (diet item and percent).
31.04 Select and create a graph or chart to appropriately illustrate a data set depicting length of cottonwood leaves (length range and quantity).

CTE Standards and Benchmarks	
	31.05 Select and create a graph or chart to appropriately illustrate a data set depicting energy expenditures in the production of corn in 1945 and 1970 (energy input and 1945 and 1970 kcal/m^2 units).
	31.06 Select and create a graph or chart to appropriately illustrate a data set depicting income differences between men and women with different education backgrounds (education level and men and women
32.0	Recognize digital image formats. The student will be able to:
	32.01 Explain the difference between native and non-native file formats.
	32.02 Describe the difference between lossy and lossless file compression.
	32.03 Describe the characteristics, advantages, disadvantages, and uses of various image file formats (TIFF, JPEG, GIF, and BMP).
	32.04 Describe the characteristics, advantages, disadvantages, and uses of various audio and video file formats (WAV, AVI, MPEG, MP3, and SWF).
33.0	Summarize basic 3D modeling concepts. The student will be able to:
	33.01 Compare and contrast 3D modeling software applications that offer a perspective view, an orthographic view, or a combination.
	33.02 Explain how coordinate systems are used to locate objects in three-dimensional space.
	33.03 Describe basic geometric shapes available in 3D modeling software (sphere, cube, cylinder, torus, cone, plane).
	33.04 Describe basic shapes available in 2D modeling software (arcs, ellipses, circles, curve, freehand curves, polygons, splines).
	33.05 Define the parameters used for determining the size, placement, and orientation of a modeling object.
	33.06 Describe the Boolean modeling operations of union, subtraction, and intersection.
	33.07 Describe how extrusion or sweeping techniques transform 2D objects into 3D objects.
	33.08 Describe the lofting technique for creating 3D objects.
	33.09 Describe the revolve or lathe techniques for animating a 2D object and give examples of their application.
	33.10 Describe the scale, rotate, and move actions that comprise the transformation technique for animating a 3D object.
	33.11 Describe the object parameters modified using the deformation technique and provide examples of its use.
	33.12 Describe the copy or clone technique.
	33.13 Describe the mirror technique.

CTE Standards and Benchmarks	
	33.14 Compare and contrast the wire frame and sold viewing tools.
	33.15 Describe basic viewing navigation tools such as zoom, rotate, and panning.
	33.16 Define plug-in and describe how it extends the capability of the modeling program.
	33.17 Describe the export function and its value when producing visualizations.
34.0	Recognize basic rendering techniques. The student will be able to:
	34.01 Define rendering and describe its role in 3D modeling.
	34.02 Define texture mapping and describe its role in 2D and 3D modeling.
	34.03 Define UV mapping and describe its role in rendering visualizations.
	34.04 Define bump mapping and describe its role in rendering visualizations.
	34.05 Describe the role of lighting in rendering a 3D visualization.
35.0	Summarize basic animation techniques. The student will be able to:
	35.01 Describe how the human brain processes images that make up an animation.
	35.02 Identify the NTSC frame rate.
	35.03 Identify the PAL frame rate.
	35.04 Identify the standard frame rate for motion pictures.
	35.05 Calculate the number of images required a one second of animation.
	35.06 Describe the use of scenes, layers, keyframes, and tweens in animation.
	35.07 Describe stop-action animation.
	35.08 Describe the steps or processes involved in creating a computer animation.
	35.09 Define storyboarding and describe its role in computer animation.
36.0	Produce a 3D model with animation and rendering. The student will be able to:
	36.01 Select a topic suitable for animation (e.g., lytic cycle of a T4 bacteriophage virus, a scientific concept or law, replication of a famous experiment, explain how something works, explain a disease) and conduct background research.

CTE Standards and Benchmarks
36.02 Create a script and storyboard for the animation.
36.03 Use a 3D modeling program to build the appropriate graphics to be used in the animation scenes.
36.04 Create a 3-4 second animation for each scene in the animation.
36.05 Render each scene and export to an appropriate file format (e.g., AVI, MPEG, MP3, SWF).
36.06 Integrate the animation scene into a slide presentation using an application such as PowerPoint.

Florida Department of Education
Student Performance Standards

Course Title: **Data Modeling**
Course Number: **9400120**
Course Credit: **1**

Course Description:

In this course, students learn about the nature of data and various tools and techniques used in different industries to retrieve, render, and display 2-D and 3-D data. Students are provided instruction in the concepts and techniques associated with rendering dynamic or changing data as animation. They are also introduced to various imaging techniques used in different industries, their implications, applications, and challenges. The ultimate output of this course is a portfolio created by the student from a scenario related to the student's industry of interest. The portfolio should include a narrative description of the scenario, the approach to data collection, a description of the tools and techniques used for rendering, and an interpretation of each data model. Research references should be cited appropriately. Given the advanced nature of this course, consideration should be given to having students produce the portfolio using presentation software.

CTE Standards and Benchmarks	
37.0	Describe 3D modeling. The student will be able to:
37.01	Define 3D modeling.
37.02	Compare and contrast the solid and shell categories of 3D models.
37.03	Describe the polygonal, NURBS, splines and patches, primitives, and sculpting methods of 3D modeling.
37.04	Describe the constructive solid geometry method of 3D modeling and give examples of its value to data visualization.
37.05	Describe the implicit surfaces (iso-surfaces) method of 3D modeling and give examples of its value to data visualization.
37.06	Describe the subdivision surfaces method of 3D modeling and give examples of its value to data visualization.
37.07	Identify common 2D and 3D modeling tools.
38.0	Apply basic 3D modeling concepts. The student will be able to:
38.01	Manipulate primitive modeling views by using the three Boolean operations (union, subtract, and intersect) to create 3D objects.
38.02	Utilize revolve or extrude commands to create 3D objects from 2D shapes.
38.03	Enhance a 3D object's realism by using the shading technique.

CTE Standards and Benchmarks	
	38.04 Use 3D orbit to rotate objects for better visualization.
	38.05 Adjust the lighting of a 3D object to enhance the visualization.
39.0	Render 3D objects to final form. The student will be able to:
	39.01 Use texture mapping in rendering a 3D object.
	39.02 Use UV mapping in rendering visualizations.
	39.03 Use bump mapping in rendering visualizations.
	39.04 Use lighting in rendering a 3D visualization.
40.0	Animate 3D objects using dynamic data. The student will be able to:
	40.01 Assign values to points of a 3D object based on information from a database.
	40.02 Create a script and storyboard for the animation.
	40.03 Use a 3D modeling program to alter the dataset to create an animated 3D object.
	40.04 Vary the data if fixed ways to observe/analyze results.
	40.05 Integrate the animation scene into a slide presentation using an application such as PowerPoint.
41.0	Render an animated 3D model. The student will be able to:
	41.01 Select a topic suitable for animation (e.g., lytic cycle of a T4 bacteriophage virus, a scientific concept or law, replication of a famous experiment, explain how something works, explain a disease) and conduct background research.
	41.02 Create a script and storyboard for the animation, including identifying needed data.
	41.03 Use a 3D modeling program to build the appropriate graphics and corresponding data to be used in the animation scenes.
	41.04 Create a data-driven, 3-4 second animation for each scene in the animation.
	41.05 Render each scene and export to an appropriate file format (e.g., AVI, MPEG, MP3, SWF).
	41.06 Integrate the animation scene into a slide presentation using an application such as PowerPoint.
42.0	Interpret different types of spatial data used in 3D visualization and analysis. The student will be able to:
	42.01 Explore methods of obtaining, downloading, and extracting free data using the Internet.

CTE Standards and Benchmarks	
	42.02 Build 3D datasets.
	42.03 Display 2D features onto a 3D surface.
	42.04 Create shapefiles to view in a 3D environment.
	42.05 Construct a 3D model of a physical environment.
	42.06 Display georeferenced data measurements in 3D.
	42.07 Apply Interpolation methods.
	42.08 Utilize georeferenced 2D data in a 3D environment.
	42.09 Create contour lines in a 3D environment.
43.0	Customize the display of geospatial data. The student will be able to:
	43.01 Edit Layer Properties.
	43.02 Create Layer Files.
	43.03 Edit an attribute table by adding a new field with calculating values.
	43.04 Perform relates and joins with data tables.
44.0	Manage, query, and symbolize geospatial data. The student will be able to:
	44.01 Label features.
	44.02 Insert, copy, and paste data into new data frames.
	44.03 Create graphs and reports from data.
45.0	Create, change, and manipulate remotely sensed image data. The student will be able to:
	45.01 View single band and multispectral images.
	45.02 Perform various manipulations to an image including creating a subset of an image, mosaic two georeferenced images, and orthorectification.
	45.03 Perform image analysis by orthorectifying non-georeferenced digital images to existing map features.
	45.04 Enhance an image by adjusting the brightness and contrast, adjusting the histogram, applying custom histogram stretches,

CTE Standards and Benchmarks	
	sharpening and smoothing its appearance.
45.05	Convert an image from color IR to natural color by performing a resolution merge.
46.0	Construct a 3D model of a physical environment. The student will be able to:
46.01	Display georeferenced data measurements in 3D.
46.02	Apply Interpolation methods.
46.03	Utilize georeferenced 2D data in a 3D environment.
46.04	Create contour lines in a 3D environment.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Applications in Scientific Visualization**
Course Number: **9400130**
Course Credit: **1**

Course Description:

This course provides students with instruction in advanced imaging techniques relative to both static and dynamic visualization. In addition to digital imaging, students receive instruction in video editing and the integration of animated 3-D rendered data model. Students will create visualizations related to biological cells, plate tectonics, DNA and gel electrophoresis, and one of simple machines. The ultimate output of this course is a portfolio created by the student from a scenario. The portfolio should include a narrative description of the scenario, the approach to data collection, resulting renderings, and an interpretation of each chart/graph. Research references should be cited appropriately. Given the advanced nature of this course and the need to illustrate skills in dynamic renderings, students should produce the portfolio using presentation software suitable for dissemination via the Internet.

CTE Standards and Benchmarks	
47.0	Apply advanced tools of visualization. The student will be able to:
47.01	Describe how computers store information.
47.02	Define how to apply pixel values to digital images.
47.03	Apply pixel values to digital images.
47.04	Identify trends in scientific and technical visualization tools.
48.0	Demonstrate advanced principles of visualization. The student will be able to:
48.01	Recognize advanced 2D design concepts.
48.02	Describe advanced imaging techniques.
48.03	Identify advanced presentation techniques.
48.04	Demonstrate advanced presentation techniques.
48.05	Identify basic web page design.
48.06	Demonstrate basic web page design.

CTE Standards and Benchmarks	
49.0	Demonstrate advanced visualization processes. The student will be able to:
49.01	Summarize advanced 3D modeling.
49.02	Interpret advanced animation techniques.
49.03	Describe video-editing techniques.
49.04	Demonstrate video-editing techniques.
50.0	Demonstrate advanced scientific visualization. The student will be able to:
50.01	Recognize cells and their parts.
50.02	Create a visualization of the cell and its parts.
50.03	Recognize plate tectonics.
50.04	Create a visualization of plate tectonics.
50.05	Describe DNA and gel electrophoresis.
50.06	Create a visualization of DNA and gel electrophoresis.
50.07	Explain different simple machines.
50.08	Create a visualization of simple machines.
50.09	Create an advanced visualization.
51.0	Demonstrate preparedness for the future**.** The student will be able to:
51.01	Summarize different types of portfolios.
51.02	Synthesize an electronic portfolio.
51.03	Create an electronic portfolio of their work.

Florida Department of Education
Student Performance Standards

Course Title: SciViz Internship
Course Number: 9400140
Course Credit: 1

Course Description:

The SciViz internship course provides students with the opportunity to stimulate their career interest, to demonstrate human relations, communications, and employability skills, and to gain professional job experience related to a career in scientific visualization related to an industry of their choosing. Students will enhance and apply instructional competencies learned in the classroom through the internship experience. For this six to eight-week internship, the rules, guidelines, and requirements specified in the Florida Department of Education Cooperative Education Manual apply.

This manual is available online at: http://fldoe.org/academics/career-adult-edu/career-tech-edu/additional-cte-programs-courses/diversified-edu.stml

The internship must include the following components:

Pre-Placement Planning Conference

The student, teacher, and the workplace-learning site supervisor must participate in a pre-placement conference. It is also recommended that the parent/guardian of the student be included in the pre-placement planning conference. Pre-placement planning is essential in designing learning experiences that are appropriate for each individual's learning needs and career interests. Also, it is critical that all parties involved understand and agree on time schedules, expectations, training/learning activities, and evaluation methods. The internship agreement should be signed by the student, teacher/coordinator, parent/guardian, and the workplace-learning site supervisor.

Workplace-Learning Site

The following criteria should be met when choosing the workplace-learning site:

1. The workplace experience must allow experiences that utilize both skills and knowledge directly related to the student's career goal and the career and technical course/program in which the student is enrolled or has completed.
2. The workplace experience must provide opportunities for rotation through a wide variety of increasingly responsible experiences beyond routine activities.
3. The workplace experience must provide skilled workplace-learning site supervisors and/or mentors who are interested and willing to assist the student.
4. The workplace experience must provide a safe and ethically sound environment with up-to-date facilities and equipment. The workplace experience must adhere to all state and federal laws and rules regarding the employment of minors. The workplace experience must not displace a paid employee.

5. The student does not have to be paid.
6. Timecards documenting the time spent at the workplace-learning site must be maintained.

Job Experience

This component shall provide a match between the student's career goal and a work-based situation that will provide exposure to the broad aspects of the selected industry. The assigned tasks should allow for a progression of and rotation through experiences requiring a variety of skills and knowledge at increasingly higher levels as relates to the student's career major.

Workplace-Learning Plan

A workplace-learning plan must be developed and implemented for each student. The student performance standards of the workplace-learning plan should include an outline of learning objectives, methods of learning, activities/responsibilities, time required, provisions for supervision, and method(s) of student evaluation. The workplace-learning plan must be signed by the student, teacher/coordinator, parent/guardian, and the workplace-learning site supervisor.

Weekly Class or Seminar

Students in the SciViz internship must meet a minimum of once per week for the purpose of related instruction and developmental activity. These seminars should provide a forum for students to share and learn from each other's experiences through discussion and group activities/projects. Faculty should also use this time to reinforce the application of subject matter in the workplace-learning setting. Students should be encouraged to reflect upon and personalize their experiences through individual journals and also through interaction with the teacher/coordinator and the workplace-learning site supervisor.

Supervision/Site Visits

Teacher/Coordinators of the SciViz internship must monitor and support learning while students are in the field. Teacher/coordinators should visit the workplace-learning site as frequently as once every two weeks, but not less than once per month so that students may be observed performing all facets of their workplace-learning experiences. Students must also be evaluated a minimum of once per grading period the workplace-learning site supervisor. The evaluation should assess how well the student is progressing towards goals established by the student, teacher/coordinator, and workplace-learning site supervisor. Portfolio assessment is a recommended method of student assessment.

For every 20 students (or portion thereof) enrolled in this internship course, the teacher/coordinator should be given one hour of coordination release time per day for the purposes of visiting students on the job and managing the cooperative method of instruction.

Additional Information

Equipment List

Recommendations Per Student

Hardware - (minimum)

- Intel® Pentium® 4, 2.80GHz, 1 GB RAM
- 40 GB hard drive
- Video/graphics accelerator card to match animation software
- 17” monitor or larger
- 10/100/1000 MB/sec network card
- Operating System
- Network card
- USB serial and parallel ports
- DVD Drive
- 3 button mouse (optical)
- Sound card
- Headphone / microphone
- Surge protector
- Broadband Internet connection

Software

- Animation
- Office Suite
- Graphics
- Image
- Video editor
- Web editor
- Geospatial Information Systems (GIS) Software

Supplemental Software

- Adobe Creative Suite
- File Compression Software
- Classroom Management Software
- Screen Capturing Software

Recommendations Per Lab – (minimum)

- 24 computer stations recommended (Networked)
- Scanner-flatbed
- Digital camera
- Color printer capable of graphics output

- 2 Flash drives: 1 GB minimum
- Video input device with Firewire cabling
- Data projector (1000 or better lumens) with screen OR SmartBoard
- Teacher computer station w/DVD
- One additional computer for rendering (80 GB hard drive, 4 GB RAM, Video port, DVD burner)

Supplies

- Blank DVD-R or DVD-RW disks
- Printer cartridges
- Replacement bulb for projector

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition a SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Engineering Pathways**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	9400300
CIP Number	0821010102
Grade Level	9-12
Program Length	5 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of the applications of engineering and its effect upon our lives and the choosing of an occupation. The content and activities will also include the study of entrepreneurship, safety, and leadership skills. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

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. Although there are variations in course sequence depending on implementation, students typically (but are not required to) complete the three foundation courses (8600550, 8600520, and 8600530), at least one additional course, and the capstone course. Listed below are the courses that comprise this program. Note that the sequence of courses shown is not binding.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8600550	Introduction to Engineering Design	ENG 7G PLTW PTE 7G TEC ED 1 @2	1 credit	3	CT
8600520	Principles of Engineering		1 credit	3	CT
8600530* 8600560* 8600590* 8600620* 8600630*	Digital Electronics Computer Integrated Manufacturing Civil Engineering and Architecture Aerospace Engineering Biotechnical Engineering		1 credit 1 credit 1 credit 1 credit 1 credit	3 3 3 3 3	CT CT CT CT CT
8600650**	Engineering Design and Development		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

** Note: Students must select at least two of these courses.*
*** Note: Course 8600650 is intended to serve as a capstone course.*

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:

Introduction to Engineering Design

01.0 Demonstrate an understanding of the design process and the activities associated with each step.
02.0 Demonstrate skill in sketching and drawing, and describe their importance to engineering design.
03.0 Create and assemble a CAD model and prototype.
04.0 Demonstrate an understanding of mathematics and dimensioning associated with CAD design software.
05.0 Demonstrate an understanding of tolerances and their implications on an engineering design.
06.0 Demonstrate proficiency in designing and assembling parts using CAD software to animate the parts and control design constraints.
07.0 Create an advanced modeling project using CAD software.
08.0 Take, record, manipulate, and convert measurements using both the standard and metric system of linear measurement.
09.0 Describe the impact of visual design on the success or acceptability of an engineering design.
10.0 Demonstrate an understanding of reverse engineering and reverse engineer a product.
11.0 Actively participate on a team driven project.

Principles of Engineering

12.0 Demonstrate an understanding of the engineering field.
13.0 Demonstrate an understanding of engineering complexities ranging from simple machines to compound machine design.
14.0 Demonstrate an understanding of energy sources, their characteristics, and their renewability.
15.0 Perform mathematical operations specific to electrical systems.
16.0 Demonstrate an understanding of the applications of alternative energy solutions.
17.0 Demonstrate an understanding of insulation, the suitability of specific materials for use as insulation, and associated mathematics.
18.0 Analyze an energy-related problem and design a solution to the problem.
19.0 Demonstrate an understanding of machine control systems, logic, and devices.
20.0 Demonstrate an understanding of the characteristics, devices, components, limitations, and associated mathematics of hydraulic and pneumatic systems.
21.0 Demonstrate an understanding of the analysis of loads on physical systems in static equilibrium (statics).
22.0 Demonstrate an understanding of analyzing the material properties of products.
23.0 Perform tensile and stress tests on sample material.
24.0 Analyze problem related to materials and structures, and design a solution to the problem.
25.0 Design and create a control system based on given needs and constraints.
26.0 Design, create, test, and present a workable solution to a design problem involving hydraulic and/or pneumatic technology.
27.0 Apply principles of statistics to calculate the theoretical probability that an event will occur.
28.0 Apply principles of kinematics and statistics to design and present a workable solution to a design problem associated with bodies in motion.

Digital Electronics

29.0 Demonstrate an understanding of the foundations of digital electronics.
30.0 Demonstrate an understanding of combinational logic analysis and design.

31.0 Demonstrate an understanding of sequential logic analysis and design.
32.0 Demonstrate an understanding of the role of microcontrollers in process control.

Computer Integrated Manufacturing Technical
33.0 Demonstrate an understanding of manufacturing, its history, models, and procedures.
34.0 Demonstrate an understanding of control systems and methods to describe or document their processes.
35.0 Demonstrate an understanding of the cost of manufacturing.
36.0 Demonstrate proficiency in designing products for manufacturability.
37.0 Demonstrate an understanding of manufacturing processes.
38.0 Demonstrate an understanding of computer numeric control (CNC) as it relates to product design and development.
39.0 Demonstrate an understanding of automation and robotics relative to the manufacturing process.
40.0 Demonstrate an understanding of the elements of power and the associated mathematics.
41.0 Build, program, and configure a robot to perform predefined tasks.
42.0 Demonstrate an understanding of the elements of Computer Integrated Manufacturing (CIM).
43.0 Demonstrate proficiency in designing an efficient flexible manufacturing system (FMS) that contains CIM elements.

Civil Engineering & Architecture Technical
44.0 Demonstrate an understanding of civil engineering and architecture, its history, innovations, and evolution of styles and materials.
45.0 Demonstrate an understanding of the civil engineering and architecture field.
46.0 Demonstrate an understanding of residential building structure, elements of design, and associated processes.
47.0 Perform mathematical operations associated with cost and efficiency analysis of a residential design.
48.0 Demonstrate proficiency in designing a residential structure, ascertaining appropriateness of electrical and plumbing elements, and considering site constraints and applicable codes.
49.0 Demonstrate proficiency in designing commercial building structures, including compliance with building and zoning regulations, appropriate wall structures, and appropriate material selection.
50.0 Demonstrate proficiency in designing wall, floor, and foundation structures to meet specific load requirements using structural analysis software.
51.0 Demonstrate proficiency in designing heating, ventilation, and air conditioning services and utilities for a commercial project to achieve energy conservation.
52.0 Demonstrate proficiency in creating a commercial site design that considers soil characteristics, storm water runoff, and specification/code requirements.
53.0 Design a commercial building.
54.0 Create and deliver a presentation for a commercial building design.

Aerospace Engineering Technical
55.0 Demonstrate an understanding of the foundations of flight.
56.0 Demonstrate an understanding of aerodynamics fundamentals and aerodynamic testing.
57.0 Demonstrate an understanding of propulsion systems and their performance factors.
58.0 Demonstrate an understanding of propulsion-less flight.
59.0 Demonstrate an understanding of technologies used in aerial navigation.

60.0 Demonstrate an understanding of rocketry and associated performance factors.
61.0 Demonstrate an understanding of rocket/satellite-based aerial photography.
62.0 Demonstrate an understanding of orbital mechanics.
63.0 Demonstrate an understanding of gravity and its effects on the human body.
64.0 Demonstrate an understanding of composite materials and their fabrication.
65.0 Demonstrate an understanding of thermal protection systems.
66.0 Demonstrate an understanding of intelligent vehicles.

Biotechnical Engineering Technical

67.0 Demonstrate an understanding of documentation procedures associated with biotechnical engineering.
68.0 Demonstrate an understanding of the evolution of biotechnical engineering.
69.0 Demonstrate an understanding of the role of values, morals, and ethics in the field of biotechnology.
70.0 Demonstrate an understanding of the roles of forensics, reverse engineering, and genetic engineering to biotechnology applications.
71.0 Demonstrate an understanding of fermentation as it relates to the production of renewable energy.
72.0 Demonstrate an understanding of engineering design principles relative to the field of biotechnology.
73.0 Demonstrate an understanding of engineering as it relates to the design of prosthetic devices.
74.0 Research heart diseases, disorders, treatment options, and procedures.

Engineering Design & Development Technical

75.0 Identify, define, and justify a technical design problem for resolution.
76.0 Conduct research and investigation into the stated problem.
77.0 Perform and graphically represent an evaluation of proposed design solutions using specific criteria, including product specifications.
78.0 Design a solution to the problem and create a working prototype for testing.
79.0 Evaluate and select appropriate testing methodologies for testing the product, conduct product testing, refine the design as needed, and document the process and results.
80.0 Create and deliver a formal presentation of the solution to the problem.

Florida Department of Education
Student Performance Standards

Course Title: **Introduction to Engineering Design**
Course Number: **8600550**
Course Credit: **1**

Course Description:

This course exposes students to the design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards, and technical documentation. Students will employ engineering and scientific concepts in the solution of engineering design problems. In addition, they will learn to use 3D solid modeling design software to design solutions to problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions, document the process, and communicate the results.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of the design process and the activities associated with each step. The student will be able to:
01.01	Apply engineering notebook standards and protocols.
01.02	Identify and apply group brainstorming techniques and the rules associated with brainstorming.
01.03	Create and deliver a presentation depicting research on the impact of innovation on the evolution of a product.
01.04	Use online and published works to research aspects of design problems.
01.05	Describe the design process steps used in developing solutions to problems given real world scenarios.
01.06	Explain what a design brief is and what it is used for.
02.0	Demonstrate skill in sketching and drawing, and describe their importance to engineering design. The student will be able to:
02.01	Identify, sketch, and explain the function of points, construction lines, object lines, and hidden lines.
02.02	Plot points on grid paper to aid in the creation of sketches and drawings.
02.03	Explain the concepts of technical sketching and drawing.
02.04	Sketch an isometric view of simple geometric solids.
02.05	Sketch multiview drawings of simple geometric solids.
02.06	Determine the front view for a given object.

CTE Standards and Benchmarks	
03.0	Create and assemble a CAD model and prototype. The student will be able to:
03.01	Brainstorm and sketch possible solutions to an existing design problem.
03.02	Select an approach that meets or satisfies the constraints given in a design brief.
03.03	Create simple extruded solid Computer Aided Design (CAD) models from dimensioned sketches.
03.04	Generate dimensioned multi-view drawings from simple CAD models.
03.05	Measure and Fabricate parts for a functional prototype from the CAD multiview drawings.
03.06	Assemble the product using the CAD modeling software.
03.07	Test and evaluate the prototype and record results.
03.08	Apply geometric and numeric constraints to CAD sketches.
03.09	Identify the purpose of packaging in the design of consumer products.
04.0	Demonstrate an understanding of mathematics and dimensioning associated with CAD design software. The student will be able to:
04.01	Identify and explain the various geometric relationships that exist between the elements of two-dimensional shapes and three-dimensional forms.
04.02	Identify and define the axes, planes, and sign conventions associated with the Cartesian coordinate system.
04.03	Utilize sketch-based, work reference, and placed features to develop solid CAD models from dimensioned drawings.
04.04	Explain how a given object's geometry is the result of sequential additive and subtractive processes.
04.05	Explain the differences between size and location dimensions.
04.06	Differentiate between datum dimensioning and chain dimensioning.
04.07	Identify and dimension fillets, rounds, diameters, chamfers, holes, slots, and screw threads in orthographic projection drawings.
04.08	Explain the rules that are associated with the application of dimensions to multiview drawings.
05.0	Demonstrate an understanding of tolerances and their implications on an engineering design. The student will be able to:
05.01	Identify, sketch, and explain the difference between general tolerances, limit dimensions, unilateral, and bilateral tolerances.
05.02	Apply appropriate engineering tolerances to specify the allowable variation, size of individual features, and orientation and location between features of an object.

CTE Standards and Benchmarks	
	05.03 Differentiate between clearance and interference fits.
	05.04 Describe the purpose and demonstrate the application of section lines and cutting plane lines in a section view drawing.
	05.05 Sketch a full and half section view of a given object to communicate its interior features.
	05.06 Identify algebraic relationships between the dimensional values of a given object.
06.0	Demonstrate proficiency in designing and assembling parts using CAD software to animate the parts and control design constraints. The student will be able to:
	06.01 Apply assembly constraints to individual CAD models to create mechanical systems.
	06.02 Perform part manipulation during the creation of an assembly model.
	06.03 Explain how assembly constraints are used to systematically remove the degrees of freedom for a set of components in a given assembly.
	06.04 Create an exploded model of a given assembly.
	06.05 Determine ratios and apply algebraic formulas to animate multiple parts within an assembly model.
	06.06 Create and describe the purpose of the following items: exploded isometric assembly view, balloons, and parts list.
07.0	Create an advanced modeling project using CAD software. The student will be able to:
	07.01 Brainstorm and sketch possible solutions to an existing design problem.
	07.02 Explain and describe the purpose of decision matrix.
	07.03 Create a decision making matrix.
	07.04 Select an approach that meets or satisfies the constraints given in a design brief.
	07.05 Create solid CAD models of each part from dimensioned sketches using a variety of methods.
	07.06 Apply geometric numeric and parametric constraints to form CAD modeled parts.
	07.07 Assemble the product using the CAD modeling software.
	07.08 Explain what constraints are and why they are included in a design brief.
	07.09 Describe the difference between a criteria and a constraint.

CTE Standards and Benchmarks	
	07.10 Create a marketing tool related to the designed solution for the chosen problem, such as a consumer product, a dispensing system, a new form of control system, or extend a product design to meet a new requirement.
08.0	Take, record, manipulate, and convert measurements using both the standard and metric system of linear measurement. The student will be able to:
	08.01 Using a variety of measuring devices, measure and report quantities accurately and to a precision appropriate for the purpose.
	08.02 Measure and record linear distances using a dial caliper to a precision of 0.001 inch.
	08.03 Use appropriate statistical methods and visualization techniques to justify claims based on evidence.
	08.04 Calculate the mean, mode, median, range, standard deviation of a data set.
	08.05 Create a histogram of recorded measurements showing data elements or class intervals, and frequency.
	08.06 Apply mathematical (including graphical) models and interpret the output of models to test ideas or make predictions.
09.0	Describe the impact of visual design on the success or acceptability of an engineering design. The student will be able to:
	09.01 Describe the elements of design.
	09.02 Identify visual design elements within a given object.
	09.03 Explain how visual design principles were used to manipulate design elements within a given object.
	09.04 Explain what aesthetics is, and how it contributes to a design's commercial success.
	09.05 Identify the purpose of packaging in the design of consumer products.
	09.06 Identify visual design principles and elements that are present within marketing ads.
	09.07 Identify the intent of a given marketing ad and demographics of the target consumer group for which it was intended.
10.0	Demonstrate and understanding of reverse engineering and reverse engineer a product. The student will be able to:
	10.01 Define reverse engineering and describe its value to engineering design.
	10.02 Analyze a consumer product using reverse engineering techniques to document visual, functional, and structural aspects of the design.
	10.03 Describe the life cycle of a product or service.
	10.04 Understand how different machine elements influence motion of a mechanical system.

CTE Standards and Benchmarks	
10.05	Describe different types of materials and their common usage in product design.
10.06	Identify material processing methods that are used to manufacture the components of a given commercial product.
10.07	Assign a density value to a material, and apply it to a given solid CAD model.
10.08	Perform computer analysis to determine mass, volume, and surface area of a given object.
10.09	Describe the function of a given manufactured object as a sequence of operations through visual analysis and inspection (prior to dissection).
11.0	Actively participate on a team driven project. The student will be able to:
11.01	Define what a team is and explain why teams of people are used to solve problems.
11.02	Describe and illustrate group norms and why they are essential to a highly effective team.
11.03	Identify group norms that allow a virtual design team to function efficiently.
11.04	Establish file management and file revision protocols to ensure the integrity of current information.
11.05	Use internet resources, such as email, to communicate with a virtual design team member throughout a design challenge.
11.06	Identify strategies for addressing and solving conflicts that occur between team members.
11.07	Describe a Gantt chart and explain its purpose.
11.08	Create a Gantt chart to manage the various phases of their design challenge.

Florida Department of Education
Student Performance Standards

Course Title: **Principles of Engineering**
Course Number: **8600520**
Course Credit: **1**

Course Description:

This course helps students understand the field of engineering/engineering technology and prepares them for postsecondary engineering programs by developing a more in-depth mastery of the required knowledge and skills in mathematics, science, and technology. Through problem-based learning strategies, students study key engineering topics, including mechanisms, energy sources, energy applications, machine control, fluid power, statics, material properties, material testing, statistics, and kinematics. Exploring various technology systems and manufacturing processes help students learn how engineers and technicians use math, science and technology in an engineering problem solving process to benefit people. The course also includes concerns about social and political consequences of technological change.

CTE Standards and Benchmarks	
12.0	Demonstrate an understanding of the engineering field. The student will be able to:
12.01	Differentiate between engineering and engineering technology.
12.02	Identify and differentiate among different engineering disciplines.
13.0	Demonstrate an understanding of engineering complexities ranging from simple machines to compound machine design. The student will be able to:
13.01	Measure forces and distances related to mechanisms.
13.02	Distinguish between the six simple machines, their attributes, and components.
13.03	Calculate mechanical advantage and drive ratios of mechanisms.
13.04	Design, create, and test gear, pulley, and sprocket systems.
13.05	Calculate work and power in mechanical systems.
13.06	Determine efficiency in a mechanical system.
13.07	Design, create, test, and evaluate a compound machine design.
14.0	Demonstrate an understanding of energy sources, their characteristics, and their renewability. The student will be able to:
14.01	Identify and categorize energy sources as nonrenewable, renewable, or inexhaustible.

CTE Standards and Benchmarks	
	14.02 Create and deliver a presentation to explain a specific energy source.
15.0	Perform mathematical operations specific to electrical systems. The student will be able to:
	15.01 Define the possible types of power conversion.
	15.02 Calculate work and power.
	15.03 Demonstrate the correct use of a digital multimeter.
	15.04 Calculate power in a system that converts energy from electrical to mechanical.
	15.05 Determine efficiency of a system that converts an electrical input to a mechanical output.
	15.06 Calculate circuit resistance, current, and voltage using Ohm's law.
	15.07 Understand the advantages and disadvantages of parallel and series circuit design in an application.
16.0	Demonstrate an understanding of the applications of alternative energy solutions. The student will be able to:
	16.01 Test and apply the relationship between voltage, current, and resistance relating to a photovoltaic cell and a hydrogen fuel cell.
	16.02 Experiment with a solar hydrogen system to produce mechanical power.
17.0	Demonstrate an understanding of insulation, the suitability of specific materials for use as insulation, and associated mathematics. The student will be able to:
	17.01 Design, construct, and test recyclable insulation materials.
	17.02 Test and apply the relationship between R-values and recyclable insulation.
	17.03 Complete calculations for conduction, R-values, and radiation.
18.0	Analyze an energy-related problem and design a solution to the problem. The student will be able to:
	18.01 Brainstorm and sketch possible solutions to the design problem.
	18.02 Create a decision-making matrix for the design problem.
	18.03 Select an approach that meets or satisfies the constraints provided in the design brief.
	18.04 Create a detailed pictorial sketch or use 3D modeling software to document the best choice, based upon the design team's decision matrix.
	18.05 Present a workable solution to the design problem.

CTE Standards and Benchmarks	
19.0	Demonstrate an understanding of machine control systems, logic, and devices. The student will be able to:
19.01	Create detailed flow charts utilizing a computer software application.
19.02	Create control system operating programs utilizing computer software.
19.03	Create system control programs that utilize flowchart logic.
19.04	Choose appropriate inputs and outputs devises based on the need of a technological system.
19.05	Differentiate between the characteristics of digital and analog devices.
19.06	Judge between open and closed loop systems in order to choose the most appropriate system for a given technological problem.
19.07	Design and create a control system based on given needs and constraints.
20.0	Demonstrate an understanding of the characteristics, devices, components, limitations, and associated mathematics of hydraulic and pneumatic systems. The student will be able to:
20.01	Identify devices that utilize fluid power.
20.02	Identify and explain basic components and functions of fluid power devices.
20.03	Differentiate between the characteristics of pneumatic and hydraulic systems.
20.04	Distinguish between hydrodynamic and hydrostatic systems.
20.05	Design, create, and test a hydraulic device.
20.06	Design, create, and test a pneumatic device.
20.07	Calculate values in a fluid power system utilizing Pascal's Law.
20.08	Distinguish between pressure and absolute pressure.
20.09	Distinguish between temperature and absolute temperature.
20.10	Calculate values in a pneumatic system utilizing the perfect gas laws.
20.11	Calculate flow rate, flow velocity, and mechanical advantage in a hydraulic system.
21.0	Demonstrate an understanding of the analysis of loads on physical systems in static equilibrium (statics). The student will be able to:
21.01	Create free body diagrams of objects, identifying all forces acting on the object.

CTE Standards and Benchmarks	
21.02	Define centroid.
21.03	Mathematically locate the centroid of structural members.
21.04	Define moment of inertia.
21.05	Calculate moment of inertia of structural members.
21.06	Differentiate between scalar and vector quantities.
21.07	Identify magnitude, direction, and sense of a vector.
21.08	Calculate the X and Y components given a vector.
21.09	Calculate moment forces given a specified axis.
21.10	Use equations of equilibrium to calculate unknown forces.
21.11	Use the method of joints strategy to determine forces in the members of a statically determinate truss.
22.0	Demonstrate an understanding of analyzing the material properties of products. The student will be able to:
22.01	Investigate specific material properties related to a common household product.
22.02	Conduct investigative non-destructive material property tests on selected common household products. Property testing conducted to identify continuity, ferrous metal, hardness, and flexure.
22.03	Calculate weight, volume, mass, density, and surface area of selected common household product
22.04	Identify the manufacturing processes used to create the selected common household product.
22.05	Identify the recycling codes.
23.0	Perform tensile and stress tests on sample material. The student will be able to:
23.01	Obtain measurements of material samples.
23.02	Tensile test a material test sample.
23.03	Identify and calculate test sample material properties using a stress strain curve.
24.0	Analyze problem related to materials and structures, and design a solution to the problem. The student will be able to:
24.01	Brainstorm and sketch possible solutions to the design problem.

CTE Standards and Benchmarks	
	24.02 Create a decision making matrix for the design problem.
	24.03 Select an approach that meets or satisfies the constraints given in the design brief.
	24.04 Create a simulation, detailed pictorial sketch, or use 3D modeling software to document the best choice, based upon your team's decision matrix.
	24.05 Present a workable design solution.
25.0	Design and create a control system based on given needs and constraints. The student will be able to:
	25.01 Create detailed flow charts utilizing a computer software application.
	25.02 Create control system operating programs utilizing computer software.
	25.03 Create system control programs that utilize flowchart logic.
	25.04 Choose appropriate inputs and output devices based on the need of a technological system.
	25.05 Differentiate between the characteristics of digital and analog devices.
	25.06 Judge between open and closed loop systems in order to choose the most appropriate system for a given technological problem.
26.0	Design, create, test, and present a workable solution to a design problem involving hydraulic and/or pneumatic technology. The student will be able to:
	26.01 Brainstorm and sketch possible solutions to the design problem.
	26.02 Create a decision-making matrix for the design problem.
	26.03 Select an approach to satisfy the constraints provided in the design brief.
	26.04 Create a detailed pictorial sketch or use 3D modeling software to document the best choice, based upon the team's decision matrix.
	26.05 Present a workable solution to the design problem.
27.0	Apply principles of statistics to calculate the theoretical probability that an event will occur. The student will be able to:
	27.01 Calculate the experimental frequency distribution of an event occurring.
	27.02 Apply the Bernoulli process to events that only have two distinct possible outcomes.
	27.03 Apply AND, OR, and NOT logic to probability.

CTE Standards and Benchmarks	
	27.04 Apply Bayes' theorem to calculate the probability of multiple events occurring.
	27.05 Create a histogram to illustrate frequency distribution.
	27.06 Calculate the central tendency of a data array, including mean, median, and mode.
	27.07 Calculate data variation, including range, standard deviation, and variance.
28.0	Apply principles of kinematics and statistics to design and present a workable solution to a design problem associated with bodies in motion. The student will be able to:
	28.01 Calculate distance, displacement, speed, velocity, and acceleration from data.
	28.02 Design, build, and test a vehicle that stores and releases potential energy for propulsion.
	28.03 Calculate acceleration due to gravity given data from a free fall device.
	28.04 Calculate the X and Y components of a projectile motion.
	28.05 Determine the needed angle to launch a projectile a specific range given the projectile's initial velocity.
	28.06 Brainstorm and sketch possible solutions to an existing design problem.
	28.07 Create a decision-making matrix for their design problem.
	28.08 Select an approach that meets or satisfies the constraints provided in a design brief.
	28.09 Create a detailed pictorial sketch or use 3D modeling software to document the best choice, based upon the design team's decision matrix.

Florida Department of Education
Student Performance Standards

Course Title: **Digital Electronics**
Course Number: **8600530**
Course Credit: **1**

Course Description:

This is a course in applied logic that encompasses the application of electronic circuits and devices. Students are exposed to the design process of combinational and sequential logic design, teamwork, communication methods, engineering standards, and technical documentation. Computer simulation software is used to design and test digital circuitry prior to the actual construction of circuits and devices.

CTE Standards and Benchmarks	
29.0	Demonstrate an understanding of the foundations of digital electronics. The student will be able to:
29.01	Describe and apply three common notational forms of expressing numbers.
29.02	Identify and describe the operation of common electronic components.
29.03	Perform basic soldering techniques and printed circuit board construction.
29.04	Define and apply Ohm's Law and Kirchhoff's Laws in the design of series and parallel electronic circuitry.
29.05	Analyze simple analog and digital circuits using common electronic test equipment and tools.
29.06	Determine the characteristics of analog and digital signals.
29.07	Translate data specifications into truth tables and extract logical expressions.
29.08	Use Boolean algebra and DeMorgan's Theorem to simplify logic expressions.
30.0	Demonstrate an understanding of combinational logic analysis and design. The student will be able to:
30.01	Describe the operation of basic logic components, including gates, inverters, and flip-flops.
30.02	Design a combinational logic circuit using basic logic gates.
30.03	Simulate and prototype a logic circuit.
30.04	Design a combinational logic circuit incorporating universal gates logic.
30.05	Simulate and prototype a logic circuit employing universal gates logic.

CTE Standards and Benchmarks	
	30.06 Design half-adder, full-adder, and binary adder logic circuits using exclusive logic.
	30.07 Design a combinational logic circuit using a programmable logic device.
	30.08 Simulate and prototype a combinational logic circuit employing a programmable logic device.
31.0	Demonstrate an understanding of sequential logic analysis and design. The student will be able to:
	31.01 Design, simulate, and prototype a basic flip-flop application.
	31.02 Analyze and design basic flip-flop applications, including event detection circuits, data synchronizers, shift registers, and frequency dividers.
	31.03 Design, simulate, and prototype SSI and MSI asynchronous counters.
	31.04 Describe the components of a state machine.
	31.05 Design, simulate, and prototype state machines using discrete or programmable logic.
32.0	Demonstrate an understanding of the role of microcontrollers in process control. The student will be able to:
	32.01 Use a microcontroller to create a light pattern.
	32.02 Use a microcontroller to read sensory input.
	32.03 Use a microcontroller to control a motor or servo output.

Florida Department of Education
Student Performance Standards

Course Title: **Computer Integrated Manufacturing**
Course Number: **8600560**
Course Credit: **1**

Course Description:

This course applies principles of robotics and automation. The course builds on computer solid modeling skills developed in Introduction to Engineering Design. Students use CNC equipment to produce actual models of their three-dimensional designs. Fundamental concepts of robotics used in automated manufacturing, and design analysis are included.

CTE Standards and Benchmarks	
33.0	Demonstrate an understanding of manufacturing, its history, models, and procedures. The student will be able to:
33.01	Explore manufacturing through research and projects.
33.02	Understand what the enterprise wheel represents and how it represents the overall manufacturing scheme.
33.03	Research a topic in manufacturing, develop a presentation, and present findings to a group.
33.04	Explain the different procedures used in manufacturing.
34.0	Demonstrate an understanding of control systems and methods to describe or document their processes. The student will be able to:
34.01	Identify basic flowcharting symbols and discuss their functions.
34.02	Create a flowchart that portrays a manufacturing process.
34.03	Apply flowcharting to areas other than manufacturing.
34.04	Identify a control system and explain its application to manufacturing.
34.05	Model and create a program to control an automated system.
35.0	Demonstrate an understanding of the cost of manufacturing. The student will be able to:
35.01	Create a control system that replicates a factory cell.
35.02	Maximize the efficiency of the manufacturing system with respect to time and cost.

CTE Standards and Benchmarks	
	35.03 Compare the efficiency of running multiple systems against that of one large system.
36.0	Demonstrate proficiency in designing products for manufacturability. The student will be able to:
	36.01 Use the design process.
	36.02 Use knowledge of design to analyze products with flaws.
	36.03 Use calculated volume, mass, surface area of parts to determine material cost, waste, and packaging requirements.
	36.04 Use solid modeling software to improve a flawed design.
	36.05 Determine whether a product is safe for a given audience (e.g., children under the age of three).
	36.06 Make ethical decisions about manufacturing.
	36.07 Create a product using solid modeling software.
37.0	Demonstrate an understanding of manufacturing processes. The student will be able to:
	37.01 Explain the difference between primary and secondary manufacturing processes.
	37.02 Analyze a product to propose the manufacturing processes used to create it.
	37.03 Explore manufacturing processes via research.
	37.04 Explore prototyping processes.
38.0	Demonstrate an understanding of computer numeric control (CNC) as it relates to product design and development. The student will be able to:
	38.01 Identify machines when given a process and identify the process that a given machine performs.
	38.02 Determine the appropriate speed rate for a given material using a tool with a given diameter.
	38.03 Determine the feed rate for a given material using a tool with a given diameter.
	38.04 Read and interpret G & M codes.
	38.05 Transfer the drawings made in CAD to a CAM program.
	38.06 Create numerical code using a CAM program.
	38.07 Verify the creation of a part using simulation software.

CTE Standards and Benchmarks
38.08 Create parts using the machines demonstrated by the instructor.
38.09 Create a product on the computer using knowledge of manufacturing processes.
39.0 Demonstrate an understanding of automation and robotics relative to the manufacturing process. The student will be able to:
39.01 Research a topic in automation.
39.02 Identify the advantages and disadvantages of robotic labor versus human labor.
39.03 Explore materials handling.
39.04 Create and program virtual robotic work cells with simulation software.
39.05 Program the interface between a robot and another machine.
40.0 Demonstrate an understanding of the elements of power and the associated mathematics. The student will be able to:
40.01 Identify the three main power types.
40.02 Solve problems involving electrical, pneumatic, and mechanical power.
40.03 Convert power between units.
40.04 Calculate torque and use it to calculate power.
40.05 Solve problems involving fluid power.
40.06 Construct a system to convert pneumatic power into mechanical power.
41.0 Build, program, and configure a robot to perform predefined tasks. The student will be able to:
41.01 Build a robot.
41.02 Create programs using robotic software that will allow the robot to perform a set of tasks.
41.03 Configure servo motors to operate the robot.
41.04 Formulate a list of tasks in which the robot can be used in a large scale CIM cell operation.
42.0 Demonstrate an understanding of the elements of Computer Integrated Manufacturing (CIM). The student will be able to:
42.01 Identify the three categories of CIM systems.

CTE Standards and Benchmarks	
	42.02 Compare and contrast the benefits and drawbacks of the three categories of CIM systems.
	42.03 Identify the components of an FMS.
	42.04 Create a process design chart for a manufacturing process.
	42.05 Students will explore a manufacturing or automation career of interest and determine the appropriateness and steps required to be a professional in that role.
43.0	Demonstrate proficiency in designing an efficient flexible manufacturing system (FMS) that contains CIM elements. The student will be able to:
	43.01 Identify the potential safety issues with a CIM system and identify solutions for these problems.
	43.02 Understand the significance of teamwork and communication.
	43.03 Design a manufacturing system that contains at least two automated components.
	43.04 Complete the construction of each individual component of the miniature FMS and verify that each component works.
	43.05 Assemble components into a working miniature FMS.
	43.06 Refine each component to improve the total process flow and cycle time.
	43.07 Maintain a journal to document daily work.

Florida Department of Education
Student Performance Standards

Course Title: **Civil Engineering and Architecture**
Course Number: **8600590**
Course Credit: **1**

Course Description:

This course provides an overview of the fields of Civil Engineering and Architecture, while emphasizing the interrelationship and dependence of both fields on each other. Students use state of the art software to solve real world problems and communicate solutions to hands-on projects and activities. This course covers topics such as the Roles of Civil Engineers and Architects, Project Planning, Site Planning, Building Design, and Project Documentation and Presentation.

CTE Standards and Benchmarks	
44.0	Demonstrate an understanding of civil engineering and architecture, its history, innovations, and evolution of styles and materials. The student will be able to:
44.01	Connect modern structural and architectural designs to historical architectural and civil engineering achievements.
44.02	Identify three general categories of structural systems used in historical buildings.
44.03	Explain how historical innovations have contributed to the evolution of civil engineering and architecture.
44.04	Identify and explain the application of principles and elements of design to architectural buildings.
44.05	Determine architectural style through identification of building features, components, and materials.
44.06	Create a mock-up model depicting an architectural style or feature using a variety of materials.
45.0	Demonstrate an understanding of the civil engineering and architecture field. The student will be able to:
45.01	Identify the primary duties, and attributes of a civil engineer and an architect along with the traditional path for becoming a civil engineer or architect.
45.02	Identify various specialty disciplines associated with civil engineering.
45.03	Define charrette and discuss its purpose.
45.04	Participate in a design charrette and recognize the value of using a charrette to develop innovative solutions to support whole building design.
45.05	Understand the relationship among the stakeholders involved in the design and construction of a building project.

CTE Standards and Benchmarks	
46.0	Demonstrate an understanding of residential building structure, elements of design, and associated processes. The student will be able to:
46.01	Identify typical components of a residential framing system.
46.02	Recognize conventional residential roof designs.
46.03	Model a common residential roof design and detail advantages and disadvantages of that style.
46.04	Use 3D architectural software to create a small building.
47.0	Perform mathematical operations associated with cost and efficiency analysis of a residential design. The student will be able to:
47.01	Apply basic math skills to calculate the quantity and cost of concrete needed to pour the pad for a small building.
47.02	Create a cost estimate for a small construction project, including a detailed cost break-down.
47.03	Calculate the heat loss through one wall of a conditioned building.
47.04	Calculate the heat loss for a building envelope with given conditions appropriate for the project.
47.05	Apply principles of sustainable design to a small project.
48.0	Demonstrate proficiency in designing a residential structure, ascertaining appropriateness of electrical and plumbing elements, and considering site constraints and applicable codes. The student will be able to:
48.01	Apply elements of good residential design to the design of a basic house to meet the needs of a client.
48.02	Design a home design that complies with applicable codes and requirements.
48.03	Incorporate sustainable building principles and universal design concepts into a residential design.
48.04	Create bubble diagrams and sketch a floor plan.
48.05	Identify residential foundation types and choose an appropriate foundation for a residential application.
48.06	Calculate the head loss and estimate the water pressure for a given water supply system.
48.07	Create sketches to document a preliminary plumbing and a preliminary electrical system layout for a residence that comply with applicable codes.
48.08	Design an appropriate sewer lateral for wastewater management for a building that complies with applicable codes.
48.09	Create a site opportunities map and sketch a project site.

CTE Standards and Benchmarks	
	48.10 Choose an appropriate building location on a site based on orientation and other site-specific information.
	48.11 Calculate the storm water runoff from a site before and after development.
	48.12 Document the design of a home using 3D architectural design software and construction drawings.
49.0	Demonstrate proficiency in designing commercial building structures, including compliance with building and zoning regulations, appropriate wall structures, and appropriate material selection. The student will be able to:
	49.01 Identify applicable building codes and regulations that apply to a given development.
	49.02 Classify a building according to its use, occupancy, and construction type using the International Building Code.
	49.03 Research Land Use regulations to identify zoning designations and allowable uses of property.
	49.04 Comply with specifications, regulations, and codes during a design process.
	49.05 Compare a variety of commercial wall systems and select an appropriate system for a given commercial application based on materials, strength, aesthetics, durability, and cost.
	49.06 Compare a variety of commercial low-slope roof systems and select an appropriate system for a given commercial application based on materials, strength, durability, and cost.
	49.07 Incorporate sustainable building practices, especially a green roof, into the design of a commercial building.
	49.08 Use 3D architectural design software to incorporate revisions for the redesign of a building.
	49.09 Use 3D architectural design software to create appropriate documentation to communicate a commercial building design.
	49.10 Compare the relative structural adequacy of different structures.
	49.11 Use load-span tables to design structural elements.
50.0	Demonstrate proficiency in designing wall, floor, and foundation structures to meet specific load requirements using structural analysis software. The student will be able to:
	50.01 Research and describe the job responsibilities of a structural engineer.
	50.02 Use building codes and other resources to calculate roof loading to a structure and select appropriate roof beams to safely carry the load.
	50.03 Analyze a simply supported beam subjected to a given loading condition to determine reaction forces, sketch shear and moment diagrams, and determine the maximum moment resulting in the beam.
	50.04 Use beam formula to calculate end reactions and the maximum moments of a simply supported beam subjected to a given loading condition.
	50.05 Use structural analysis software to create shear and moment diagrams of simply supported beams subjected to a given loading

CTE Standards and Benchmarks	
	condition.
50.06	Calculate the deflection of a simply supported beam subjected to a given loading condition.
50.07	Use building codes and other resources to determine the required floor loading and design a structural steel floor framing system (beams and girders) for a given building occupancy.
50.08	Identify and describe the typical usage of foundation systems commonly used in commercial construction.
50.09	Determine the loads transferred from a steel framed structure to the ground through a foundation.
50.10	Size a spread footing for a given loading condition.
50.11	Check structural calculations created by others for correctness.
51.0	Demonstrate proficiency in designing heating, ventilation, and air conditioning services and utilities for a commercial project to achieve energy conservation. The student will be able to:
51.01	Interpret and apply code requirements and constraints as they pertain to the installation of services and utilities.
51.02	Read and understand HVAC construction drawings for a commercial project.
51.03	Apply criteria and constraints to size and locate the new utility service connections for a commercial facility.
51.04	Modify system designs to incorporate energy conservation techniques.
52.0	Demonstrate proficiency in creating a commercial site design that considers soil characteristics, storm water runoff, and specification/code requirements. The student will be able to:
52.01	Use differential leveling to complete a control survey to establish a point of known elevation for a project.
52.02	Design appropriate pedestrian access, vehicular access and a parking lot for a commercial facility.
52.03	Analyze a site soil sample to determine the United Soil Classification System designation and predict soil characteristics important to the design and construction of a building on the site.
52.04	Estimate the increase in storm water runoff from a commercial site and create a preliminary design for a storm water storage facility.
52.05	Apply Low Impact Development techniques to a commercial site design to reduce the impact of development on storm water runoff quantity and quality.
52.06	Follow specifications and codes during a design process.
52.07	Given 3D architectural design software, document a commercial site design.
53.0	Design a commercial building. The student will be able to:

CTE Standards and Benchmarks	
53.01	Work individually and in groups to produce a solution to a team project.
53.02	Research codes, zoning ordinances and regulations to determine the applicable requirements for a project.
53.03	Identify the boundaries of a property based on its legal description.
53.04	Perform research and visit a site to gather information pertinent to the viability of a project on the site.
53.05	Identify the criteria and constraints, and gather information to justify the viability regarding the development of a solution.
53.06	Create an architectural program, a project organization chart, and a Gantt chart and hold project progress meetings to help manage the team project.
53.07	Communicate ideas while developing a project using various drawing methods, sketches, graphics, or other media collected and documented.
53.08	Investigate the legal, physical, and financial requirements of a project and consider the needs of the community to determine project viability.
53.09	Apply current common practices utilized in Civil Engineering and Architecture to develop a viable solution in their project.
54.0	Create and deliver a presentation for a commercial building design. The student will be able to:
54.01	Assemble and organize work from a commercial project to showcase the project in an effective and professional manner.
54.02	Create visual aids for a presentation that include the appropriate drawings, renderings, models, documentation, and the rationale for choosing the proposal for project development.
54.03	Showcase an oral presentation for a proposal for the design and development of a commercial building project.

Florida Department of Education
Student Performance Standards

Course Title: **Aerospace Engineering**
Course Number: **8600620**
Course Credit: **1**

Course Description:

This course is intended to engage students in analyzing and designing solutions to engineering design problems related to aerospace information systems, astronautics, rocketry, propulsion, the physics of space science, space life sciences, the biology of space science, principles of aeronautics, structures and materials, and systems engineering. Students work in teams, exploring hands-on projects and activities to learn the characteristics of aerospace engineering and work on major problems to be exposed to the various situations that aerospace engineers face in their careers.

CTE Standards and Benchmarks	
55.0	Demonstrate an understanding of the foundations of flight. The student will be able to:
55.01	Describe the main components of an aircraft and the forces acting on them.
55.02	Explain and compare the impact of design changes on aircraft performance.
55.03	Describe the factors affecting aircraft performance in flight.
55.04	Analyze the design of an airfoil using simulation software and identify the design changes needed to meet specifications.
55.05	Design and test an airfoil to meet specifications using simulation software.
55.06	Construct an airfoil from a designed template.
55.07	Perform a wind tunnel test of a designed airfoil.
56.0	Demonstrate an understanding of aerodynamics fundamentals and aerodynamic testing. The student will be able to:
56.01	Synthesize a test plan for performance analysis of an airfoil.
56.02	Analyze performance data from a wind tunnel test.
56.03	Create and present a technical report of the wind tunnel test results.
57.0	Demonstrate an understanding of propulsion systems and their performance factors. The student will be able to:

CTE Standards and Benchmarks
57.01 Relate Newton's Three Laws of Motion to propulsion.
57.02 Describe the main forms of propulsion.
57.03 Analyze and compare performance of the different forms of propulsion.
57.04 Design and test an engine or propulsion system using simulation software.
58.0 Demonstrate an understanding of propulsionless flight. The student will be able to:
58.01 Describe the requirements for a glider to be stable in flight.
58.02 Analyze the design of a glider and identify the design changes needed to meet specifications using simulation software.
58.03 Design and construct a glider to meet specifications.
58.04 Evaluate glider design relative to performance.
58.05 Write a proposal to receive "funding" to revise the current design.
59.0 Demonstrate an understanding of technologies used in aerial navigation. The student will be able to:
59.01 Measure the GPS location of a number of objects.
59.02 Create a navigational chart.
59.03 Create a multi-segment flight plan.
59.04 Compare textual versus visual information relative to situational awareness.
59.05 Describe technological advances in the Global Positioning System.
60.0 Demonstrate an understanding of rocketry and associated performance factors. The student will be able to:
60.01 Design and build a rocket engine thrust test device.
60.02 Test the thrust of a rocket engine using an engine thrust test device.
60.03 Modify the test to show thrust versus time data.
60.04 Describe the design factors and forces impacting rocket flight and how they interact using simulation software.
60.05 Describe how changes in design characteristics affect rocket performance.

CTE Standards and Benchmarks
60.06 Work as an engineering team to construct, fly, and create a formal report on a model rocket.
60.07 Estimate the maximum altitude of a model rocket.
60.08 Calculate a rocket's maximum acceleration and velocity.
60.09 Describe how lift, drag, thrust, and weight are affected by launch angle.
61.0 Demonstrate an understanding of rocket/satellite-based aerial photography. The student will be able to:
61.01 Design and construct an aerial photography project.
61.02 Calculate the scale factor of aerial photographs.
61.03 Calculate rocket altitude using the scale factor of an aerial photograph.
62.0 Demonstrate an understanding of orbital mechanics. The student will be able to:
62.01 Describe a conic section and explain its relation to orbital theory.
62.02 Describe the orbital parameters associated with earth satellite motion.
63.0 Demonstrate an understanding of gravity and its effects on the human body. The student will be able to:
63.01 Describe g-force and explain its relationship to gravity.
63.02 Design and conduct a g-force experiment, synthesizing the collected data to real world situations.
63.03 Describe vestibular stimulation and explain its effects in reduced gravity environments.
63.04 Describe microgravity and its importance to space flight environments.
64.0 Demonstrate an understanding of composite materials and their fabrication. The student will be able to:
64.01 Mold various composite materials into test samples.
64.02 Conduct deflection tests on various test samples and graph the results.
64.03 Describe the role of composite materials in aircraft and spacecraft construction.
65.0 Demonstrate an understanding of thermal protection systems. The student will be able to:
65.01 Identify the material properties necessary to provide thermal protection.

CTE Standards and Benchmarks
65.02 Conduct a thermal test on various materials, evaluate the results, and select the best candidate material.
66.0 Demonstrate an understanding of intelligent vehicles. The student will be able to:
66.01 Describe the role of robotics in space environments.
66.02 Design a computer-controlled robot to deliver a payload to a location by navigating an obstacle course.
66.03 Design, build, and test an intelligent vehicle to meet specifications and pre-defined criteria.

Florida Department of Education
Student Performance Standards

Course Title: **Biotechnical Engineering**
Course Number: **8600630**
Course Credit: **1**

Course Description:

This course is intended to expose students to the diverse fields of biotechnology including biomedical engineering, bio-molecular genetics, bioprocess engineering, and agricultural and environmental engineering. Students will be engaged in engineering design problems related to biomechanics, cardiovascular engineering, genetic engineering, agricultural biotechnology, tissue engineering, biomedical devices, human interface, bioprocesses, forensics, and bio-ethics. This course applies and concurrently develops secondary level knowledge and skills in biology, physics, technology, and mathematics.

CTE Standards and Benchmarks
67.0 Demonstrate an understanding of documentation procedures associated with biotechnical engineering. The student will be able to:
67.01 Describe the various methods of documentation in biotechnical engineering.
67.02 Compare and contract various methods of information gathering.
67.03 Follow procedures for ensuring accuracy and precision in measuring solutions.
68.0 Demonstrate an understanding of the evolution of biotechnical engineering. The student will be able to:
68.01 Research and create a timeline depicting the evolution of biotechnical engineering, describing the impact of individual milestones.
68.02 Describe the fundamental concepts common to all major industries in biotechnical engineering.
68.03 Explain how biotechnical engineered products impact society.
68.04 Describe the relationship between the financial markets and biotechnical engineering.
69.0 Demonstrate an understanding of the role of values, morals, and ethics in the field of biotechnology. The student will be able to:
69.01 Differentiate among values, morals, and ethics.
69.02 Analyze the bioethical issues arising from options created by technological advancements.
69.03 Create a public opinion survey.

CTE Standards and Benchmarks	
70.0	Demonstrate an understanding of the roles of forensics, reverse engineering, and genetic engineering to biotechnology applications. The student will be able to:
70.01	Describe molecular techniques used by bioinformaticists.
70.02	Analyze and apply the technologies used in the field of forensics.
70.03	Reverse engineer a crime scene.
70.04	Evaluate evidence and justify conclusions.
70.05	Apply practical knowledge of genetic engineering.
70.06	Form a start-up company that expands on previous genetic engineering work.
70.07	Conduct facial reconstruction as would a forensic artist.
71.0	Demonstrate an understanding of fermentation as it relates to the production of renewable energy. The student will be able to:
71.01	Design a method or instrument for measuring fermentation rate.
71.02	Research and determine ideal conditions for fermentation.
71.03	Design and run a yeast-powered vehicle.
72.0	Demonstrate an understanding of engineering design principles relative to the field of biotechnology. The student will be able to:
72.01	Apply engineering design principles by improving the design of a hospital or surgical instrument.
72.02	Demonstrate the application of product liability, product reliability, product reusability, and product failure.
73.0	Demonstrate an understanding of engineering as it relates to the design of prosthetic devices. The student will be able to:
73.01	Design and build a joint model that mirrors human movement.
73.02	Design and model a new joint replacement.
73.03	Synthesize skeletal system concepts with the design process for engineering joints.
74.0	Research heart diseases, disorders, treatment options, and procedures. The student will be able to:
74.01	Sketch and provide a solid model of heart chambers and valves.
74.02	Research procedures involving artificial heart surgery and present the cost of a proposed noninvasive implant.

CTE Standards and Benchmarks
74.03 Research and create a set of improvements for imaging techniques.
74.04 Design a portable ECG monitor and study the electrical aspects associated with the heart.
74.05 Research and design improvements in heart implants or instruments.
74.06 Perform a virtual heart surgery to better understand the instruments and implants in need of improving.

Florida Department of Education
Student Performance Standards

Course Title: **Engineering Design and Development**
Course Number: **8600650**
Course Credit: **1**

Course Description:

The purpose of this course is to serve as a capstone course to provide students with the opportunity to develop a solution to a design problem from start to finish. Students work in teams to design, engineer, create a prototype, perform product testing, and then produce a finished product. This would involve using ALL of the knowledge previously learned, not only in technology education, but across the curriculum. Students will be expected to create and deliver a formal report on the project.

CTE Standards and Benchmarks	
75.0	Identify, define, and justify a technical design problem for resolution. The student will be able to:
75.01	Brainstorm problem statements for unique innovations or inventions.
75.02	Write a concise problem statement using technical writing skills.
75.03	Document research that justifies using the problem statement for the engineering design and development project.
76.0	Conduct research and investigation into the stated problem. The student will be able to:
76.01	Use a list of specifications and constraints identified in a decision matrix to develop a list of alternative solutions to the stated problem.
76.02	Research and identify patents related to their identified problem.
76.03	Conduct research to investigate and determine the merit of the alternative solution based on past solutions to the problem.
76.04	Explain the feasibility of the solution based on his or her research.
76.05	Develop research strategies for the solution, including the use of surveys, phone interviews, and personal contact with experts related to the field of the technical problem.
76.06	Create a matrix table to analyze the data found from the patent research.
76.07	Write a fictional scenario for an innovation of interest.
76.08	Conduct research and perform a trend analysis on a technical problem.
77.0	Perform and graphically represent an evaluation of proposed design solutions using specific criteria, including product specifications. The student will be able to:

CTE Standards and Benchmarks	
	77.01 Create a description of the product specifications for the design solution.
	77.02 Objectively evaluate proposed design solutions using specific criteria.
	77.03 Select the best design solution option using a decision matrix.
	77.04 Graphically represent the results of the design solution evaluation.
78.0	Design a solution to the problem and create a working prototype for testing. The student will be able to:
	78.01 Sketch all parts of the design solution including an isometric view of the assembled product.
	78.02 Create a set of working drawings for their design solution.
	78.03 Interpret and apply the feedback they receive from experts to improve the design solution.
	78.04 Refine the design solution, if necessary, based upon expert feedback.
	78.05 Create a detailed set of instructions for production and assembly of a testable prototype based on the information gained through their research.
	78.06 Identify methods and sources for obtaining materials and supplies.
	78.07 Compile a materials list that includes vendors and cost for all necessary materials and equipment to build the prototype.
	78.08 Build a working prototype that can be tested.
79.0	Evaluate and select appropriate testing methodologies for testing the product, conduct product testing, refine the design as needed, and document the process and results. The student will be able to:
	79.01 Select and describe a valid testing method that will be used to accurately evaluate the design solution's ability to solve their problem.
	79.02 Prepare a description of the testing method that will be used to valid the designed solution.
	79.03 Create a valid justification for the selected testing method.
	79.04 Devise a list of testing criteria that will be used to evaluate the success or failure of the prototype testing
	79.05 Create a detailed set of instructions for testing the prototype that will be valid, repeatable, and reliable.
	79.06 Apply the appropriate statistical analysis tools to the test results to ensure validity.
	79.07 Identify, define, and implement necessary modifications to the design based upon the test results and expert feedback.

CTE Standards and Benchmarks	
	79.08 Evaluate and explain the effectiveness of solving the design problem as defined.
80.0	Create and deliver a formal presentation of the solution to the problem. The student will be able to:
	80.01 Gather data and information compiled throughout the project and create a technical research paper, presentation, or three panel display of the design solution.
	80.02 Create a website, if appropriate, in order to depict all aspects of the design solution.
	80.03 Choose one of the formats used to depict the design solution, such as technical research paper, PowerPoint, three panel display, or website, if created, for the presentation of the solution to the problem.
	80.04 Orally present a technical presentation on the design solution.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Technological Systems**
Program Type: **Non Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non Career Preparatory	
Program Number	9400900
CIP Number	0821010103
Grade Level	9-12
Program Length	Max of 5 credits (.5 credit for each course)
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of the applications of technology and its effect upon our lives and the choosing of an occupation. Students will be introduced to the concepts that underlie technological systems and the influence of technological systems at home, school, and the world of work. This program focuses on transferable skills and stresses understanding and demonstration of the technological tolls, machines, instruments, materials, processes and systems in business and industry.

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

Program Structure

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8600410	Communication Systems	COMM ART @7 7G ENG 7G GRAPH ARTS @4	.5 Credit	2	CT

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
		PRINTING @7 7G TEC ED 1 @2 ENG&TEC ED1@2			
8600420	Power and Transportation Systems	AIR MECH @7 7G AUTO IND @7 %7G AUTO MECH @7 7G DIESEL MECH @7 7G ENG 7G GASENG RPR @7 7G TEC ED 1 @2 ENG&TEC ED1@2 TEC MECH 7G TRANSPORT 7G	.5 Credit	2	CT
8600430	Production Systems	AUTO PROD 7G ENG 7G ENG TEC 7G TEC ED 1 @2 ENG&TEC ED1@2	.5 Credit	2	CT
8600440	Technical Design Systems	DRAFTING @7 7G GRAPH ARTS @4 ENG 7G ENG TEC 7G TEC ED 1 @2 ENG&TEC ED1@2	.5 Credit	2	CT
8600450	Electronics Systems	ELECTRICAL @7 7G ELECTRONIC @7 7G ENG 7G ENG TEC 7G TEC ED 1 @2 ENG&TEC ED1@2 TEC ELEC @7 7G	.5 Credit	2	CT
8600460	Engineering Systems	ENG 7G ENG TEC 7G TEC ED 1 @2 ENG&TEC ED1@2	.5 Credit	2	CT
8600470	Applied Technology Systems		.5 Credit	2	CT
8600480	Construction Technology Systems	BLDG CONST @7 7G BLDG MAINT @7 7G CARPENTRY @7 7G	.5 Credit	2	CT

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
		DRAFTING @7 7G ENG 7G ENG TEC 7G TEC ED 1 @2 ENG&TEC ED1@2 TEC CONSTR @7 7G			
9400910	Aerospace Technology Systems	AEROSPACE 7G ENG 7G ENG TEC 7G TEC ED 1 @2 ENG&TEC ED1@2	.5 Credit	2	CT
9400920	Robotics Systems	ENG 7G ENG TEC 7G ROBOTICS 7G TEC ED 1 @2 ENG&TEC ED1@2	.5 Credit	2	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

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 the ability to work safely with a variety of Technologies.
02.0 Demonstrate interpersonal skills as they relate to the workplace.
03.0 Identify and apply methods of information acquisition and utilization.
04.0 Apply basic skills in communications mathematics, and science appropriate to technological content and learning activities.
05.0 Demonstrate and apply design/problem-solving processes.
06.0 Express an understanding of technology systems and their complex interrelationships.
07.0 Demonstrate the ability to properly identify, organize, plan and allocate resources.

Communication Systems
08.0 Understand, select, and use information and communication technologies.
09.0 Demonstrate technical knowledge and understanding of major printing processes.
10.0 Apply communications technology skills.

Power and Transportation Systems
11.0 Demonstrate an understanding of and be able to select and use energy and power technologies.
12.0 Describe sources of energy.
13.0 Describe the application of energy to power and transportation systems.
14.0 Demonstrate an understanding of and be able to select and use transportation technologies.

Production Systems
15.0 Demonstrate knowledge of the production systems found in modern industries.
16.0 Define the processes related to materials utilized in manufacturing and production.
17.0 Demonstrate an understanding of and be able to select and use manufacturing technologies.
18.0 Plan and develop a system to produce a product from available materials.

Technical Design Systems
19.0 Demonstrate proper and safe procedures and technical knowledge and skills in the use and care of drafting instruments, materials equipment.
20.0 Demonstrate technical skills and applications common to all types of drafting.
21.0 Demonstrate technical knowledge and skills for making three-view orthographic drawings.
22.0 Demonstrate technical knowledge and skills for making oblique pictorial drawings.
23.0 Demonstrate technical knowledge and skills for making isometric pictorial drawings.
24.0 Demonstrate technical knowledge and skills for making perspective drawings.
25.0 Demonstrate technical knowledge and skills for making sectional drawings.
26.0 Demonstrate technical knowledge and skills for making auxiliary view drawings.
27.0 Demonstrate technical knowledge and skills for making and reproducing a computer-aided drawing (CAD).

28.0 Demonstrate knowledge of computer file management.
29.0 Demonstrate proficiency using the Internet to locate information.
30.0 Demonstrate an understanding of Internet safety and ethics.

Electronics Systems
31.0 Apply electricity/electronics technology skills.
32.0 Demonstrate technological literacy about electricity/electronics systems.
33.0 Demonstrate knowledge of the role electronics plays in magnetic, optical, fluid and mechanical control systems.

Engineering Systems
34.0 Demonstrate the engineering analysis and design methods.
35.0 Communicate through oral, written, or graphic means the results of solutions or designs.
36.0 Demonstrate and apply mechanical, fluid, electrical and thermal system principles.
37.0 Demonstrate knowledge of materials and processes.
38.0 Use tools, machines, calculators, and computers necessary for obtaining solutions to design problems.
39.0 Describe the functional characteristics of the engineering design team.

Applied Technology Systems
40.0 Discuss the impact of technology on society and the environment.
41.0 Demonstrate and apply mechanical system principles.
42.0 Demonstrate and apply fluid system principles.
43.0 Demonstrate and apply electrical system principles.
44.0 Demonstrate and apply thermal system principles.
45.0 Demonstrate the use of a computer to integrate and control a system composed of mechanical, fluid and electrical systems.
46.0 Demonstrate the use of sensors to control systems.
47.0 Demonstrate the use of fiber optics concepts.
48.0 Demonstrate the use of laser optic concepts.

Construction Technology Systems
49.0 Identify and list the different systems found in the new homes under construction today.
50.0 Draw up a bill of materials required to repair a selected component of a unit in a home technology system.
51.0 Apply home maintenance technology skills to a selected system requiring repair.

Aerospace Technology Systems
52.0 Demonstrate an understanding of the history and development of aviation and space transportation.
53.0 Describe the function of various aviation organizations.
54.0 Describe the aviation/aerospace environment.
55.0 Describe and demonstrate an understanding of the principles of flight.
56.0 Demonstrate an understanding of power systems including, internal combustion engines, jet engines, rocket engines, solar cells and nuclear power used in aviation/aerospace applications.

57.0 Demonstrate an understanding of information provided by a sectional chart.
58.0 Describe and define different categories of aviation.

Robotic Systems
59.0 Demonstrate an understanding of robotics, its history, applications, and evolution.
60.0 Demonstrate an understanding of engineering design.
61.0 Demonstrate an understanding of basic programming concepts.
62.0 Identify the basic subsystems on a robotic system.
63.0 Describe the role of sensors in the field of robotics.
64.0 Build, program, and configure a robot to perform predefined tasks.
65.0 Solve problems using critical thinking skills, creativity and innovation.

Florida Department of Education
Student Performance Standards

Course Title: **Communications Systems**
Course Number: **8600410**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of communications systems.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks	
	06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
	06.02 Explore methods used to monitor and correct performance of technological systems.
	06.03 Design and implement an optimal solution to a given problem.
	06.04 Outline major historical technological developments or events.
	06.05 Identify recent advances in technology.
	06.06 Explain problem-solving roles of technology.
	06.07 Forecast a technological development or event.
	06.08 Define technology.
07.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
	07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
	07.02 Use or prepare budgets, make forecasts, keep records, and adjust to meet objectives.
	07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
	07.04 Display knowledge of the efficient use of human resources.
08.0	Understand, select, and use information and communication technologies. The student will be able to:
	08.01 Describe and give examples of human to human, human to machine, machine to human, and machine to machine communications.
	08.02 Select and use information and communication systems to inform, persuade, entertain, control, manage, and educate.
	08.03 Compare and contrast the means of communicating visual messages (i.e., graphically, electronically) and associated forms (e.g., digital, analog, and multimedia).
	08.04 Compare and contrast the forms for communicating technological information (e.g., symbols, icons, graphic, measurement, et al).
09.0	Demonstrate technical knowledge and understanding of major printing processes. The student will be able to:
	09.01 Explain and demonstrate pre-press operations.
	09.02 Demonstrate an understanding of printing processes (i.e., letterpress, gravure, screen, lithographic).
	09.03 Demonstrate an understanding of digital printing processes (e.g., dye sublimation, direct print, laser jet).

CTE Standards and Benchmarks	
	09.04 Demonstrate an understanding of the lithographic offset press process.
	09.05 Explain the difference between printing and duplicating processes.
10.0	Apply communications technology skills. The student will be able to:
	10.01 Demonstrate technical knowledge and skills in the preparation of art and copy for printing reproduction.
	10.02 Design, layout, and produce a printed product utilizing the above printing processes.
	10.03 Express knowledge of the basic theory of photography.
	10.04 Demonstrate typical features and operation of a digital camera.
	10.05 Demonstrate proficiency in adjusting the hardware features of a basic digital SLR camera, including manual settings, shutter speed, f-stops, et al.
	10.06 Describe the basic characteristics and specifications of materials used in communications technology.
	10.07 List ways in which computers are used in communications systems technology.
	10.08 Operate a computer utilizing a program related to communications technology.
	10.09 Express a technical knowledge and understanding about electronic communications technology, to include telephone, radio, television, digital data transmission, and satellite communications.
	10.10 Apply technical knowledge and skills related to one or more of the above areas of electronic communications.

Florida Department of Education
Student Performance Standards

Course Title: **Power and Transportation Systems**
Course Number: **8600420**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of power and transportation systems.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks
06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
06.02 Explore methods used to monitor and correct performance of technological systems.
06.03 Design and implement an optimal solution to a given problem.
06.04 Outline major historical technological developments or events.
06.05 Identify recent advances in technology.
06.06 Explain problem-solving roles of technology.
06.07 Forecast a technological development or event.
06.08 Define technology.
07.0 Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
07.02 Use or prepare budgets, make forecasts, keep records, and adjust to meet objectives.
07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
07.04 Display knowledge of the efficient use of human resources.
11.0 Demonstrate an understanding of and be able to select and use energy and power technologies. The student will be able to:
11.01 Explain why energy cannot be created nor destroyed; however, it can be converted from one form to another.
11.02 List and group major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.
11.03 Explain impossibility of building an engine to perform work that does not exhaust thermal energy to the surroundings.
11.04 Classify energy resources such as renewable or nonrenewable.
11.05 Construct a power system having a source of energy, a process, and loads.
12.0 Describe sources of energy. The student will be able to:
12.01 Describe sources of thermal energy.
12.02 Describe sources of radiant energy.

CTE Standards and Benchmarks
12.03 Describe sources of nuclear energy.
12.04 Describe sources of chemical energy.
12.05 Describe sources of electrical energy.
12.06 Describe sources of mechanical energy.
12.07 Describe sources of fluid energy.
13.0 Describe the applications of energy to power and transportation systems. The student will be able to:
13.01 Explain the uses and applications of thermal energy in generating electrical power.
13.02 Discuss how radiant energy is used in our homes.
13.03 Describe energy and fuel sources for internal combustion engines.
13.04 Identify and define key terms, categories, and parts of jet engine power systems.
13.05 Identify and explain the uses of hydraulic power in automotive systems.
13.06 List the kinds of exhaustible, renewable, and inexhaustible energy resources.
14.0 Demonstrate an understanding of and be able to select and use transportation technologies. The student will be able to:
14.01 Analyze the vital role played by transportation in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.
14.02 Define intermodalism as the use of different modes of transportation, such as highways, railways, and waterways as part of an interconnected system that can move people and goods easily from one mode to another.
14.03 Discuss how transportation services and methods have led to a population that is regularly on the move.
14.04 Identify processes and innovative techniques involved in the design of intelligent and non-intelligent transportation systems.

Florida Department of Education
Student Performance Standards

Course Title: **Production Systems**
Course Number: **8600430**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of production systems and its effect upon our lives and the choosing of an occupation.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations, and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks	
	06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
	06.02 Explore methods used to monitor and correct performance of technological systems.
	06.03 Design and implement an optimal solution to a given problem.
	06.04 Outline major historical technological developments or events.
	06.05 Identify recent advances in technology.
	06.06 Explain problem-solving roles of technology.
	06.07 Forecast a technological development or event.
	06.08 Define technology.
07.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
	07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
	07.02 Use or prepare budgets, make forecasts, keep records, and adjust to meet objectives.
	07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
	07.04 Display knowledge of the efficient use of human resources.
15.0	Demonstrate knowledge of the production systems found in modern industries. The student will be able to:
	15.01 List and describe the three major types of production activities.
	15.02 Describe resource processing systems.
	15.03 Describe product manufacturing systems.
	15.04 Describe structure construction systems.
	15.05 Identify recent technological advances in production systems.
16.0	Define the processes related to materials utilized in manufacturing and production. The student will be able to:
	16.01 Define manufacturing.
	16.02 List and describe six types of secondary manufacturing processes.

CTE Standards and Benchmarks	
	16.03 List ways in which computers are used in the manufacturing and production systems.
17.0	Demonstrate an understanding of and be able to select and use manufacturing technologies. The student will be able to:
	17.01 Service products to keep them in good operating condition.
	17.02 Classify materials based on their qualities as natural, synthetic, or mixed.
	17.03 Classify goods as durable goods designed to operate for a long period of time, or non-durable goods designed to operate for a short period of time.
	17.04 Identify and classify manufacturing systems into types, such as customized production, batch production, and continuous production.
	17.05 Discuss the interchangeability of parts to increase the effectiveness of manufacturing processes.
	17.06 Identify chemical technologies providing a means for humans to alter or modify materials and to produce chemical products.
	17.07 Employ marketing techniques involving establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it.
18.0	Plan and develop a system to produce a product from available materials. The student will be able to:
	18.01 Sketch, draw and interpret working drawings.
	18.02 Use measuring tools and instruments.
	18.03 Design and construct one or more individual projects utilizing technical skills and processes of woods, metals and plastics technology.
	18.04 Estimate the cost of the job required to produce the project.
	18.05 List groups or organizations that represent specialized manufacturing and production skills.

Florida Department of Education
Student Performance Standards

Course Title: **Technical Design Systems**
Course Number: **8600440**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of drafting/illustrative and design systems.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks	
	06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
	06.02 Explore methods used to monitor and correct performance of technological systems.
	06.03 Design and implement an optimal solution to a given problem.
	06.04 Outline major historical technological developments or events.
	06.05 Identify recent advances in technology.
	06.06 Explain problem-solving roles of technology.
	06.07 Forecast a technological development or event.
	06.08 Define technology.
07.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
	07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
	07.02 Use or prepare budgets, make forecasts, keep records, and adjust to meet objectives.
	07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
	07.04 Display knowledge of the efficient use of human resources.
19.0	Demonstrate proper and safe procedures and technical knowledge and skills in the use and care of drafting instruments, materials and equipment. The student will be able to:
	19.01 Identify the basic tools and instruments for drafting.
	19.02 Outline major technological developments in the history of drafting and design tools and equipment.
	19.03 Interpret a blueprint, working drawing or other type of dimensional technical illustration.
	19.04 Produce a drawing or technical illustration using drafting tools, instruments, and skills.
20.0	Demonstrate technical skills and applications common to all types of drafting. The student will be able to:
	20.01 Apply lettering techniques.
	20.02 Make freehand sketches.
	20.03 Use drafting symbols and alphabet of lines in accordance with technical standards and practices.

CTE Standards and Benchmarks	
	20.04 Apply measuring techniques.
	20.05 Apply industry standard dimensioning techniques.
	20.06 Apply geometric construction techniques.
	20.07 Interpret information from drawings, prints, and sketches.
	20.08 Apply coordinate systems.
	20.09 Produce and reproduce drawings using modern technical methods for drafting reproduction.
21.0	Demonstrate technical knowledge and skills for making orthographic drawings. The student will be able to:
	21.01 Explain the theory of orthographic projections.
	21.02 Identify the six principal views of an object.
	21.03 Produce a three-view orthographic drawing.
	21.04 Produce a three-view orthographic drawing with CAD.
22.0	Demonstrate technical knowledge and skills for making oblique pictorial drawings. The student will be able to:
	22.01 Define types of pictorial drawings.
	22.02 Produce an oblique pictorial drawing.
	22.03 Produce an oblique pictorial drawing with CAD.
23.0	Demonstrate technical knowledge and skills for making isometric pictorial drawings. The student will be able to:
	23.01 Discuss the isometric drawing procedures.
	23.02 Produce an isometric pictorial drawing.
	23.03 Produce an isometric pictorial drawing with CAD.
24.0	Demonstrate technical knowledge and skills for making perspective drawings. The student will be able to:
	24.01 Discuss the perspective drawing procedures.
	24.02 Produce a one-point perspective drawing.

CTE Standards and Benchmarks
24.03 Produce a two-point perspective drawing.
24.04 Produce a perspective drawing using CAD.
25.0 Demonstrate technical knowledge and skills for making sectional drawings. The student will be able to:
25.01 Discuss sectional drawings.
25.02 Produce half, full, and offset sectional drawings.
25.03 Produce a sectional drawing using CAD.
26.0 Demonstrate technical knowledge and skills for making auxiliary view drawings. The student will be able to:
26.01 Discuss the auxiliary view drawing procedure.
26.02 Produce an auxiliary view drawing.
26.03 Produce an auxiliary view drawing with CAD.
27.0 Demonstrate technical knowledge and skills for making and producing a computer-aided drawing (CAD). The student will be able to:
27.01 List the major components of a computer-aided drafting system and their functions.
27.02 Demonstrate technical knowledge and skills in setting up a CAD system.
27.03 Produce a computer-aided drawing, which can be displayed by means of a computer.
27.04 Revise or edit a computer-aided drawing, which can also be plotted/printed or submitted digitally.
28.0 Demonstrate knowledge of computer file management. The student will be able to:
28.01 Produce a computer-aided drawing, which can be displayed by means of a computer.
28.02 Describe and use conventional file naming conventions.
28.03 Demonstrate proficiency with file management tasks (e.g., folder creation, file creation, backup, copy, delete, open, save).
28.04 Be able to identify file types by extension (e.g., .doc, .txt, .wav, xls, etc.).
29.0 Demonstrate proficiency using the Internet to locate information. The student will be able to:
29.01 Identify and use web terminology.

CTE Standards and Benchmarks	
	29.02 Define Universal Resource Locators (URLs) and associated protocols (e.g., http, ftp, telnet, and mailto).
	29.03 Compare and contrast the types of Internet domains (e.g., .com, .org, .edu, .gov, .net, and mil).
	29.04 Demonstrate proficiency using search engines, including Boolean search techniques.
	29.05 Apply the rules for properly citing works or other information obtained from the Internet.
	29.06 Identify and apply Copyright Fair Use guidelines.
	29.07 Evaluate online information for credibility and quality using basic guidelines and indicators (e.g., authority, affiliation, purpose, etc.).
30.0	Demonstrate an understanding of Internet safety and ethics. The student will be able to:
	30.01 Describe cyber-bullying and its impact on perpetrators and victims.
	30.02 Differentiate between viruses and malware, specifically their sources, ploys, and impact on personal privacy and computer operation, and ways to avoid infection.
	30.03 Demonstrate proficiency running an antivirus scan to remove viruses and malware.
	30.04 Describe risks associated with social networking sites (e.g., FaceBook, Linked-In, and Twitter) and ways to mitigate these risks.
	30.05 Adhere to cyber safety practices with regard to conducting Internet searches, email, chat rooms, and other social network websites.
	30.06 Adhere to Acceptable Use Policies when accessing the Internet.

Florida Department of Education
Student Performance Standards

Course Title: **Electronics Systems**
Course Number: **8600450**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of electronics systems.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations, and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks	
	06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
	06.02 Explore methods used to monitor and correct performance of technological systems.
	06.03 Design and implement an optimal solution to a given problem.
	06.04 Outline major historical technological developments or events.
	06.05 Identify recent advances in technology.
	06.06 Explain problem-solving roles of technology.
	06.07 Forecast a technological development or event.
	06.08 Define technology.
07.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
	07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
	07.02 Use or prepare budgets, make forecasts, keep records, and adjust to meet objectives.
	07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
	07.04 Display knowledge of the efficient use of human resources.
31.0	Apply electricity/electronics technology skills. The student will be able to:
	31.01 Identify and use the basic tools used in electricity/electronics.
	31.02 Identify and use the basic instruments used in electricity/electronics.
	31.03 Interpret electricity/electronics wiring diagrams and schematics.
	31.04 Identify electricity/electronics components.
	31.05 Explain the use of electricity/electronics components.
	31.06 Explain the difference between electricity and electronics.
	31.07 Describe and construct the following electricity circuits: switch-controlled lamp holder, three-way switch, four-way switch, split wired receptacle, door buzzers, thermostat, timer, dimmer, photocell, and fluorescent lamp.
32.0	Demonstrate technological literacy about electricity/electronics systems.--The student will be able to:

CTE Standards and Benchmarks
32.01 Outline major technological developments and events in the history of electricity/electronics.
32.02 Identify recent advances in electricity/electronics.
32.03 Explain the problem-solving roles of electricity/electronics.
32.04 Forecast a development or event in electricity/electronics technology.
32.05 Make a technical decision related to electricity/electronics.
32.06 Define electricity/electronics technology.
32.07 Define solid state, analog and digital systems.
32.08 Explain the basic components of electrical/electronic systems.
33.0 Demonstrate knowledge of the role electronics plays in magnetic, optical, fluid and mechanical control systems. The student will be able to:
33.01 Identify examples of each type of control system.
33.02 Explain the role electronics plays in systems feedback giving examples of everyday use.
33.03 Identify by brainstorming new possible applications of control systems to satisfy a need or extend human capabilities.

Florida Department of Education
Student Performance Standards

Course Title: **Engineering Systems**
Course Number: **8600460**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of engineering systems and its effect upon our lives and the choosing of an occupation.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations, and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks
06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
06.02 Explore methods used to monitor and correct performance of technological systems.
06.03 Design and implement an optimal solution to a given problem.
06.04 Outline major historical technological developments or events.
06.05 Identify recent advances in technology.
06.06 Explain problem-solving roles of technology.
06.07 Forecast a technological development or event.
06.08 Define technology.
07.0 Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
07.02 Use or prepare budgets, make forecasts, keep records, and adjust to meet objectives.
07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
07.04 Display knowledge of the efficient use of human resources.
34.0 Demonstrate engineering analysis and design methods. The student will be to:
34.01 Define the terms: analysis, design, and applications.
34.02 Define the experimental method as it is applied to design.
34.03 Describe a design methodology.
34.04 Describe simulation.
34.05 Prepare a model of a design solution to an engineering problem.
34.06 Prepare a graphical solution to an engineering problem.
34.07 Prepare a mathematical solution to an engineering problem (using either a calculator or computer).
35.0 Communicate through oral written, or graphic means, the results of solutions or designs. The student will be able to:

CTE Standards and Benchmarks
35.01 Understand and interpret basic engineering drawings.
35.02 Measure quantities and conduct basic tests according to published procedures.
35.03 Use precision measuring tools and instruments to layout, measure and inspect parts or articles.
35.04 Sketch objects using multi-view and pictorial principles.
35.05 Prepare drawings using basic technical drawing instruments for orthographic and isometric projections.
35.06 Use engineering design graphics and descriptive geometry in the solution of design problems.
35.07 Describe graphic communications principles.
36.0 Demonstrate and apply engineering system (e.g. mechanical, fluid, electrical, and thermal) principles. The student will be able to:
36.01 Identify the parts of a system that demonstrates engineering systems principles.
36.02 Assemble and operate a system that demonstrates engineering systems principles.
37.0 Demonstrate knowledge of materials and processes. The student will be able to:
37.01 Describe the physical and chemical properties of engineering materials in terms of their structure.
37.02 List the causes of failure in materials and give procedures to prevent such failure.
37.03 Experiment with processes used with metal, woods, polymers, composite materials, and adhesives.
38.0 Use tools, machines, calculators, and computers necessary for obtaining solutions to design problems. The student will be able to:
38.01 Demonstrate the use of various graphs to categorize and display data.
38.02 Make decisions using graphical data presentations.
38.03 Demonstrate the use of a number graph in solving equations.
38.04 Use a numerical calculator to solve equations either by direct solution or iteration (trial and error).
38.05 Use a computer and applications software to solve a design problem.
39.0 Describe the functional characteristics of the engineering design team. The student will be able to:

CTE Standards and Benchmarks
39.01 Describe work breakdown organization.
39.02 Describe the function of management in general and project management in particular.
39.03 Outline a research methodology.
39.04 Describe brainstorming.

Florida Department of Education
Student Performance Standards

Course Title: **Applied Technology Systems**
Course Number: **8600470**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of applied technology systems and its effect upon our lives and the choosing of an occupation.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations, and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks	
	06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
	06.02 Explore methods used to monitor and correct performance of technological systems.
	06.03 Design and implement an optimal solution to a given problem.
	06.04 Outline major historical technological developments or events.
	06.05 Identify recent advances in technology.
	06.06 Explain problem-solving roles of technology.
	06.07 Forecast a technological development or event.
	06.08 Define technology.
07.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
	07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
	07.02 Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
	07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
	07.04 Display knowledge of the efficient use of human resources.
40.0	Discuss the impact of technology on society and the environment. The student will be able to:
	40.01 Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
	40.02 List trade-offs of developing technologies to reduce the use of resources.
	40.03 Identify technology to monitor the environment and provide information as a basis for decision-making.
	40.04 Compare and contrast the alignment of technological processes with natural processes to maximize performance and reduce negative impacts on the environment.
	40.05 Identify technologies devised to reduce the negative consequences of other technologies.
	40.06 Discuss the implementation of technologies involving the weighing of trade-offs between predicted positive and negative effects on the environment.
41.0	Demonstrate and apply mechanical system principles. The student will be able to:

CTE Standards and Benchmarks	
	41.01 Define the concepts of force, work, rate, resistance, energy and power as they relate to mechanical systems.
	41.02 Diagram a mechanical system incorporating input, monitoring, controlling, output, and feedback.
	41.03 Report on the six simple machines.
	41.04 Identify various parts of a mechanical system.
	41.05 Assemble and operate the six simple machines.
	41.06 Use the problem-solving model - perform activities using combinations of the six simple machines to meet the described design criteria.
	41.07 Demonstrate the use of a computer to control a mechanical system.
42.0	Demonstrate and apply fluid system principles. The student will be able to:
	42.01 Define the concepts of force, work rate, resistance, energy and power as they relate to fluid systems.
	42.02 Diagram a fluid system incorporating input, monitoring, controlling, output, and feedback.
	42.03 Diagram a fluid power system incorporating input, monitoring, controlling, output, and feedback.
	42.04 Use the problem-solving model - perform activities using fluid power components to meet the described design criteria.
	42.05 Assemble, operate, and identify the parts of a fluid power system.
	42.06 Report on the applications of fluid power used in technology.
	42.07 Demonstrate the use of a computer to control a fluid power system.
43.0	Demonstrate and apply electrical system principles. The student will be able to:
	43.01 Define the concepts of force, work, rate resistance, energy, and power as they relate to electrical systems.
	43.02 Diagram an electrical system incorporating input, monitoring, controlling, output and feedback components.
	43.03 Explain what a system and sub-system is.
	43.04 Describe types of electrical outputs of heat, light, temperature, sound, magnetism, and electrical voltage.
	43.05 Describe types of electrical inputs of light, temperature, sound, magnetism, moisture, movement, pressure, and voltage.
	43.06 Use the problem-solving model - perform activities using electrical system components to meet the describe design criteria.

CTE Standards and Benchmarks	
	43.07 Demonstrate the use of a computer to control an electrical system.
44.0	Demonstrate and apply thermal system principles. The student will be able to:
	44.01 Define and calculate quantities of heat and temperature.
	44.02 Assemble, operate, and identify the parts of a thermal system.
	44.03 Demonstrate and apply principles of force, work, rate, resistance, energy, power, and force transformers relating to fluid systems.
	44.04 Compute the efficiency of a thermal system.
	44.05 Explain the steps in a PV diagram including the phases where work is done.
45.0	Demonstrate the use of a computer to integrate and control a system composed of mechanical, fluid and electrical systems. The student will be able to:
	45.01 Diagram an integrated system incorporating input, monitoring, controlling, output and feedback components.
	45.02 Perform experiments using mechanical, fluid and electrical components in an integrated system.
	45.03 Assemble, operate and identify the parts of computer-controlled mechanical, fluid, and electrical systems.
46.0	Demonstrate the use of sensors to control systems. The student will be able to:
	46.01 Perform experiments using electronic sensors.
	46.02 Assemble, operate and identify the types of sensors used in technology.
	46.03 Write a report on the applications of sensors used in technology.
47.0	Demonstrate the use of fiber optics concepts. The student will be able to:
	47.01 Report on the applications of fiber optics in technology.
	47.02 Use the problem-solving model - perform activities using fiber optics to meet a described design criteria.
	47.03 Assemble, operate and identify the parts of a fiber optics system.
48.0	Demonstrate the use of laser optics concepts. The student will be able to:
	48.01 Report on the applications of laser optics used in technology.
	48.02 Use the problem-solving model – perform activities using laser optics to meet a described design criteria.

CTE Standards and Benchmarks
48.03 Assemble, operate and identify the parts of a laser optics system.

Florida Department of Education
Student Performance Standards

Course Title: **Construction Technology Systems**
Course Number: **8600480**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of home technology systems and its effect upon our lives and the choosing of an occupation.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations, and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks
06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
06.02 Explore methods used to monitor and correct performance of technological systems.
06.03 Design and implement an optimal solution to a given problem.
06.04 Outline major historical technological developments or events.
06.05 Identify recent advances in technology.
06.06 Explain problem-solving roles of technology.
06.07 Forecast a technological development or event.
06.08 Define technology.
07.0 Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
07.02 Use or prepare budgets, make forecasts, keep records, and adjust to meet objectives.
07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
07.04 Display knowledge of the efficient use of human resources.
49.0 Identify and list the different systems found in new homes under construction today. The student will be able to:
49.01 Identify systems used and install in home construction.
49.02 Develop a schedule of routine home system preventative maintenance.
49.03 Identify recent advances in home maintenance technology.
50.0 Draw up a bill of materials required to repair a selected component in a home technology system. The student will be able to:
50.01 Identify a system component requiring repair.
50.02 Identify the problem and parts required to make repairs.
50.03 Estimate the cost of repair.
51.0 Apply home maintenance technology skills to a selected system requiring repair. The student will be able to:

CTE Standards and Benchmarks
51.01 Identify and assemble the tools required to perform the repair.
51.02 Demonstrate knowledge of problem-solving approaches to handle home maintenance needs.
51.03 Demonstrate consumer technical knowledge about home maintenance tools, materials and equipment.
51.04 List ways in which a personal computer may be used for home maintenance purposes.

Florida Department of Education
Student Performance Standards

Course Title: **Aerospace Technology Systems**
Course Number: **9400910**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of aerospace technology systems and its effect upon our lives and the choosing of an occupation.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations, and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks
06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
06.02 Explore methods used to monitor and correct performance of technological systems.
06.03 Design and implement an optimal solution to a given problem.
06.04 Outline major historical technological developments or events.
06.05 Identify recent advances in technology.
06.06 Explain problem-solving roles of technology.
06.07 Forecast a technological development or event.
06.08 Define technology.
07.0 Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
07.02 Use or prepare budgets, make forecasts, keep records, and adjust to meet objectives.
07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
07.04 Display knowledge of the efficient use of human resources.
52.0 Demonstrate an understanding of the history and development of aviation and space transportation. The student will be able to:
52.01 Describe early attempts at flight prior to the Wright Brothers flight in 1902.
52.02 Outline the early attempts at heavier than air powered flight.
52.03 Describe the effect of air power on the outcome of world conflict.
52.04 Describe the history of aviation in Florida.
52.05 Outline the beginnings of commercial aviation.
52.06 Identify the early research centers for aeronautics in the United States.
52.07 Outline the development of space exploration.
52.08 Describe the role of NACA, NASA, and commercial entities in the development of aeronautics and space exploration.

CTE Standards and Benchmarks
52.09 Prepare a forecast of aerospace developments, and interplanetary space travel.
52.10 Describe basic Unmanned Aerial Vehicles
53.0 Describe the function of various aviation organizations. The student will be able to:
53.01 Describe the function various governmental organizations
53.02 Describe the function various non-governmental organizations
54.0 Describe the aviation/aerospace environment. The student will be able to:
54.01 Identify atmospheric regions and elements.
54.02 Describe the roles of water and particulate matter in the atmosphere.
54.03 Describe and identify the elements of the atmosphere in motion.
54.04 Explain the role weather forecasting has as it relates to Aerospace Technologies.
54.05 Demonstrate an understanding of the principal bodies of the solar system.
54.06 Utilize astronomical principles and technology to study the solar systems.
54.07 Develop a radio telemetry system to measure temperature, pressure, humidity, or acceleration during a rocket flight.
54.08 Define interplanetary space.
54.09 Describe the physical properties of interplanetary space including the structure, formation, forces, and bodies.
54.10 Describe interstellar and intergalactic space.
55.0 Describe and demonstrate an understanding of the principles of flight. The student will be able to:
55.01 Define terminology associated with flight and flight principles.
55.02 Identify the structural components of aircraft.
55.03 Construct and test flying models of lighter-than-aircraft.
55.04 Demonstrate an understanding of aircraft lift and the use of control surfaces to control pitch, yaw, and roll.
55.05 Demonstrate an understanding of rocketry design and systems.

CTE Standards and Benchmarks	
	55.06 Develop and construct models to test flight characteristics of powered aircraft.
56.0	Demonstrate an understanding of power systems including, internal combustion engines, jet engines, rocket engines, solar cells and nuclear power used in aviation/aerospace applications. The student will be able to:
	56.01 Identify the basic types of engines used for aircraft propulsion.
	56.02 Describe the change from linear motion to rotary motion in a reciprocating engine.
	56.03 Identify the elements of an aircraft engine and fuel system.
	56.04 Describe the operation of aircraft turbine and ramjet engines.
	56.05 Explain chemical propulsion systems.
	56.06 Explain advanced propulsion systems including heavy lift launch systems, electrical propulsion, and nuclear propulsion.
	56.07 Describe the use and operation of solar cells to generate electrical power.
	56.08 Perform experimental testing, including designing test devices to determine the power (thrust) of a model rocket engine.
57.0	Demonstrate an understanding of information provided by a sectional chart. The student will be able to:
	57.01 Extract and utilize information from an aeronautical chart legend.
	57.02 Identify locations on an aeronautical chart using latitude and longitude
	57.03 Differentiate between statute and nautical miles.
	57.04 Determine a course and distance between two points on an aeronautical chart using a navigational plotter.
58.0	Describe and define different categories of aviation. The student will be able to:
	58.01 Describe military aviation and be able to identify military aircraft types and missions.
	58.02 Define general aviation (including business and executive) and be able identify general aviation aircraft types.
	58.03 Define air carrier and be able identify air carrier aircraft types.

Florida Department of Education
Student Performance Standards

Course Title: **Robotic Systems**
Course Number: **9400920**
Course Credit: **.5 Credit**

Course Description:

The purpose of this course is to provide students with a foundation of knowledge and technically oriented experiences in the study of robotics technology systems and its effect upon our lives and the choosing of an occupation.

CTE Standards and Benchmarks	
01.0	Demonstrate the ability to work safely with a variety of technologies. The student will be able to:
01.01	Select appropriate tools, procedures, and/or equipment needed to produce a product.
01.02	Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment needed to produce a product.
01.03	Demonstrate knowledge required to maintain and troubleshoot.
01.04	Follow laboratory safety rules and procedures.
01.05	Demonstrate good housekeeping at work state and within total laboratory.
01.06	Identify color-coding safety standards.
01.07	Explain fire prevention and safety precautions and practices for extinguishing fires.
01.08	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
02.0	Demonstrate interpersonal skills as they relate to the workplace. The student will be able to:
02.01	Perform roles in a student personnel system or in a career technical student organization (CTSO).
02.02	Participate as a member of a team.
02.03	Teach others new skills.
02.04	Identify skills needed to serve clients/customers.
02.05	Demonstrate leadership skills.

CTE Standards and Benchmarks	
	02.06 Describe strategies necessary for negotiating agreements.
	02.07 Demonstrate the application of skills necessary to work with people of diverse backgrounds.
	02.08 Form an understanding and appreciation for work after listening to or observing technology workers.
	02.09 Form an understanding and appreciation for work after participating in a simulated technology group project in the laboratory.
	02.10 Form an understanding and appreciation for the roles and work of co-workers.
03.0	Identify and apply methods of information acquisition and utilization. The student will be able to:
	03.01 Define terms related to computers.
	03.02 Identify and describe methods of information acquisition and evaluation.
	03.03 Discuss advantages and disadvantages in the application of technologies.
	03.04 Produce a plan to organize and maintain information relevant to emerging technologies.
	03.05 Comprehend and communicate information relevant to emerging technologies.
	03.06 Demonstrate the use of computers to process information.
04.0	Apply basic skills in communications, mathematics, and science appropriate to technological content and learning activities. The student will be able to:
	04.01 Identify and explain the main and subordinate ideas in a written work.
	04.02 Distinguish different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning.
	04.03 Define unfamiliar words by use of structural analysis, decoding, contextual clues, or by using a dictionary.
	04.04 Distinguish fact from opinion.
	04.05 Read critically by asking pertinent questions, by recognizing assumptions and implications, and by evaluating ideas.
	04.06 Select, relate, and organize, ideas using outlining and/or graphic organizers and develop the ideas in coherent paragraphs.
	04.07 Improve one's own writing by restructuring, correcting errors, and rewriting.
	04.08 Gather and organize information from primary and secondary sources; write a report using this research; quote, paraphrase, and summarize accurately; and cite sources properly.

CTE Standards and Benchmarks	
04.09	Vary one's writing style, including vocabulary and sentence structure, for different readers and purposes.
04.10	Write logical and understandable statements, or phrases, to accurately fill out commonly used forms.
04.11	Compose unified and coherent correspondence, directions, descriptions, explanations, and reports.
04.12	Participate critically and constructively in the exchange of ideas, particularly during class discussions and conferences with instructors.
04.13	Conceive and develop ideas about a topic for the purpose of speaking to a group; choose and organize related ideas; present them clearly in Standard English; and evaluate similar presentations by others.
04.14	Use the mathematics of; integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; and geometry.
04.15	Make estimates and approximations and judge the reasonableness of a result.
04.16	Use elementary concepts of probability and statistics.
04.17	Draw, read, and analyze graphs, charts, and tables.
04.18	Ask appropriate scientific questions and recognize what is involved in experimental approaches to the solutions of such questions through familiarity with laboratory and fieldwork.
04.19	Organize and communicate the results obtained by observation and experimentation.
04.20	Apply the basic principles of biology, physics, and chemistry: (properties of matter; structure of compounds; concepts of motion; temperature, pressure and volume; work, power, force and energy; machines; human cell structure).
04.21	Identify problems rooted in basic biology, physics, or chemistry (effects of hazardous materials on health and safety, effects of drugs on health, troubleshooting problems on a machine).
05.0	Demonstrate and apply design/problem-solving processes. The student will be able to:
05.01	Describe and explain steps in the design/problem-solving process.
05.02	Propose solutions to given problems.
05.03	Design and implement the optimal solution to a given problem.
05.04	Document each step of the design/problem-solving process.
05.05	Demonstrate "brainstorming" as a process to solve problems.
05.06	Define "critical thinking" and its value in the problem-solving process.
06.0	Express an understanding of technological systems and their complex interrelationships. The student will be able to:

CTE Standards and Benchmarks	
	06.01 Demonstrate knowledge of how social, organizational, and technological systems work.
	06.02 Explore methods used to monitor and correct performance of technological systems.
	06.03 Design and implement an optimal solution to a given problem.
	06.04 Outline major historical technological developments or events.
	06.05 Identify recent advances in technology.
	06.06 Explain problem-solving roles of technology.
	06.07 Forecast a technological development or event.
	06.08 Define technology.
07.0	Demonstrate the ability to properly identify, organize, plan, and allocate resources. The student will be able to:
	07.01 Demonstrate the ability to select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
	07.02 Use or prepare budgets, make forecasts, keep records, and adjust to meet objectives.
	07.03 Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
	07.04 Display knowledge of the efficient use of human resources.
59.0	Demonstrate an understanding of robotics, its history, applications, and evolution. The student will be able to:
	59.01 Explore robotics history through research of the industry.
	59.02 Describe various applications of automation and robotics.
	59.03 Describe emerging technologies and their implications on the field of robotics.
60.0	Demonstrate an understanding of engineering design. The student will be able to:
	60.01 Document the design process involving a set of steps, which can be performed in different sequences and repeated as needed.
	60.02 Define brainstorming as a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.
	60.03 Model, test, evaluate and modify designs to transform ideas into practical solutions.
61.0	Demonstrate an understanding of basic programming concepts. The student will be able to:

CTE Standards and Benchmarks
61.01 Apply the engineering design process to the creation of a program
61.02 Discuss the use of algorithms
61.03 Demonstrate the use of flowcharting in documenting an algorithm
61.04 Demonstrate the use of pseudocode in documenting an algorithm
61.05 Explain the function of conditional execution (e.g., if, if/else) and their uses
61.06 Explain iterative programming structures (e.g., while, do/while) and their uses.
61.07 Demonstrate the use of testing & debugging in the problem-solving process
61.08 Create functional program that satisfies prescribed criteria
62.0 Identify the basic subsystems on a robotic system. The student will be able to:
62.01 Define drivetrain, manipulator, and chassis
62.02 Understand the difference between Ackermann and skid steering
62.03 Identify the difference between Motors and servos
62.04 Calculate simple gear ratios and their relationship with torque vs speed
62.05 Assess the advantages and disadvantages of wheels vs tank treads
62.06 Analyze the characteristics of a sound chassis design
63.0 Describe the role of sensors in the field of robotics. The student will be able to:
63.01 Define sensor.
63.02 Describe the basic operation common to all sensors.
63.03 Describe the types of sensors and ways in which they can be categorized.
63.04 Investigate the types of manipulators used in a robotic system.
64.0 Build, program, and configure a robot to perform predefined tasks. The student will be able to:
64.01 Design a robot.

CTE Standards and Benchmarks	
	64.02 Create programs as required using robotic software that will allow the robot to perform a set of tasks.
	64.03 Create a flow chart that visually describes a basic robotic task.
	64.04 Configure subsystems to operate the robot.
	64.05 Create a portfolio including drawings and specifications, describing the robot, the tasks and rationale, and the results.
65.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
	65.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
	65.02 Employ critical thinking and interpersonal skills to resolve conflicts.
	65.03 Identify and document workplace performance goals and monitor progress toward those goals.
	65.04 Conduct technical research to gather information necessary for 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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Artificial Intelligence (AI) Foundations**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	9401100
CIP Number	0611010200
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section.
CTSO	FL-TSA, Skills USA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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 Artificial Intelligence (AI)-enabled 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, technical skills, and occupation-specific skills, and knowledge of all aspects of AI and Machine Learning required for AI-enabled professionals working in business and academic environments. The intention of this course is to prepare students to be successful both personally and professionally in an AI-based society.

The content includes fundamental understanding of the Five Big Ideas in AI: Perception, Representation & Reasoning, Machine Learning, Human AI Interaction, Societal impacts of AI; AI system and their components; problems and tools AI-enabled workers use to build models and systems that leverage data to make decisions; mastery of foundational skills required to become power AI users. In addition, the course content includes but is not limited to practical experiences in AI system design, deployment, and evaluation; problem identification; creation, selection, and curation of data sets; computer programming, use of machine learning algorithms, program design structure, evaluation of the societal impact of AI, employing ethical and responsible development methodologies and decision making, essential programming techniques, and implementation issues. Specialized programming skills involving advanced mathematical calculations and statistics 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 4 courses.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
9401010	Artificial Intelligence in the World	BUS ED 1@2 COMPU SCI 6 INFO TECH 7G WEB DEV 7G COMP PROG 7G ENG 7G EG TEC 7G TECH ED 1 @2 ENG & TEC ED 1@2 MATH 6-12	0.5 credit	2	CT
9401020	Applications of Artificial Intelligence		0.5 credit	2	CT
9007220	Procedural Programming	BUS ED 1@2 COMPU SCI 6 COMP PROG 7G	1 credit	3	CT
9401040	Foundations of Machine Learning	Refer to the first two courses for the Teacher Certifications	1 credit	2	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

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.

Standard

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

Artificial Intelligence in the World

01.0 Identify and define intelligent behavior.
02.0 Articulate the relationship between AI, machine learning, and computer science.
03.0 Explain the history and evolution of AI
04.0 Define and investigate examples of AI applications.
05.0 Identify examples of computer perception systems built into AI-enabled technologies.
06.0 Describe different types of data and how they are used in AI.
07.0 Describe the high-level processes, methods and conventions used in computer perception.
08.0 Identify and describe the types of representations and algorithms designed into AI-enabled technologies.
09.0 Explain how agents maintain representations of the world and use them for reasoning.
10.0 Describe machine learning and neural networks in AI-enabled technologies.
11.0 Describe the different methods computers use to learn from data (machine learning).
12.0 Collect and analyze a data set.
13.0 Conduct an investigation of a machine learning model.
14.0 Characterize major elements of intelligent behavior.
15.0 Explain how domain knowledge is used in the design of AI systems.
16.0 Articulate the many types of knowledge needed by AI agents to interact naturally with humans and the current limitations of AI to interact naturally with humans.
17.0 Understand and articulate how AI can impact society in both positive and negative ways.
18.0 Explain the best practices and key characteristics of bias, fairness, transparency, explainability, accountability of ethically designed AI systems and decision-making practices.
19.0 Identify deep fakes and explain critical information processing.

Applications of Artificial Intelligence

20.0 Design and evaluate a perception system and its limits.
21.0 Train and evaluate a range of ML models based on specific accuracy, inclusivity, and ethical design criteria.
22.0 Design and evaluate a data set to solve a problem using specific accuracy, inclusivity, ethical design criteria.
23.0 Design AI solutions using embedded computing.
24.0 Explore the characteristics, tasks, work attributes, options, and tools associated with AI-enabled careers.
25.0 Identify how leadership development, school and community service projects and competitive events are integral parts of career and technology education.
26.0 Use appropriate tools to design an AI System to solve problems.
27.0 Characterize important issues related to privacy and security in the development and use of AI-enable technologies.
28.0 Explain the key technical challenges in design and responsible use of AI technologies.
29.0 Set up and use a ML pipeline to solve a problem.
30.0 Appropriately use automated AI services to accomplish common tasks.

31.0 Explain and use design thinking to solve a problem.
32.0 Show how a system is composed and interacts and be able to express verbally, graphically and in writing how the system functions.
33.0 Understand and interpret different types of data.
34.0 Understand how data is accessed, sorted, and stored.
35.0 Generate and tell stories with data.
36.0 Think critically about data.

Procedural Programming
37.0 Design a computer program to meet specific physical, operational and interaction criteria.
38.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
39.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
40.0 Effectively communicate and collaborate.
41.0 Demonstrate responsible use of technology and information.
42.0 Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages.

Foundations of Machine Learning
43.0 Explain the nature of representations and their importance in AI.
44.0 Use search algorithms to reason with symbolic representations.
45.0 Explain the relationship between representation and reasoning.
46.0 Explain the nature of machine learning.
47.0 Use and evaluate supervised learning techniques to classify or predict outputs.
48.0 Use and evaluate unsupervised learning techniques to solve problems.
49.0 Use and evaluate reinforcement learning techniques to solve problems.
50.0 Use and evaluate different types of neural network architectures and their applications.
51.0 Illustrate Neural Networks and their components.
52.0 Recognize and identify mathematical principles upon which machine learning and AI are built such as calculus, linear algebra, probability, statistics, and optimization partial derivatives.
53.0 Use the most common machine learning algorithms to solve a problem.
54.0 Identify the types of problems that can be solved with machine learning algorithms.
55.0 Evaluate the sources of bias in machine learning/AI and identify appropriate mitigation strategies.
56.0 Program machine learning algorithms to train a model on real world data, then evaluate the results.
57.0 Identify different kinds of data, sources, and how they might be used in decision making.
58.0 Explain the characteristics, collection, storage, and uses of datasets in AI.
59.0 Work with datasets to gain insight, using data analysis and visualization tools.
60.0 Critique data and data-based claims to avoid being misled by data through identifying bias, confounding and random error.
61.0 Apply the machine learning life cycle in the development and use of a machine learning model.
62.0 Design and develop AI systems to solve a problem or design solutions for social and ethical issues.
63.0 Understand how machine learning is applied to solve problems.
64.0 Describe the limitations of machine learning and the decisions that can be made with data.

65.0 Evaluate societal impacts of AI on individuals, society, and the environment.
66.0 Evaluate AI applications to ensure they provide solutions to difficult problems without any unintended negative consequences.
67.0 Research and explain the advancements in computing hardware that make AI possible.
68.0 Create a portfolio of AI projects that demonstrate the ability to program machine learning models using a wide range of AI algorithms.
69.0 Research and evaluate various AI careers involved in AI system usage, design, development, deployment, and maintenance.

Florida Department of Education
Student Performance Standards

Course Title: **Artificial Intelligence in the World**
Course Number: **9401010**
Course Credit: **0.5**

Course Description:

This course introduces students to the principles of Artificial Intelligence (AI). The course defines “Intelligent Behavior”, describes the relationship between AI and computer science, explains the history of AI and showcases applications of AI in the real world. Students will explore the role of data in AI applications and the algorithms which guide AI decision making. Students will learn about the role of perception in AI and how AI agents use information in decision making. Students will engage in hands-on activities related to use of AI in machine learning. This course also covers ethics in AI applications.

CTE Standards and Benchmarks	
01.0	Identify and define intelligent behavior. The student will be able to:
01.01	Explain that "knowing" something means the ability to both represent and reason with it.
01.02	Explain the difference between knowledge/information and “knowing” (e.g., books can represent knowledge, but they do not "know" things because they cannot make use of that knowledge.)
01.03	Know and state conditions where behavior is intelligent using non-trivial sense-deliberate-act cycle.
01.04	Identify examples of intelligent and non-intelligent machine/agent behavior
02.0	Articulate the relationship between AI, Machine learning, and Computer Science. The student will be able to:
02.01	Describe computer science as a discipline focused on the study of computers and algorithmic processes, including their principles, their hardware and software designs, their implementation, and their impact on society.
02.02	Describe AI as a branch of computer science that studies the science and engineering of making intelligent machines, especially intelligent computer programs that enable them to make predictions, decisions, plans, and solve problems.
02.03	Describe machine learning as a set of techniques that that enables a computer system to learn from data rather than through explicit programming. Machine learning techniques can be used to build models that make solve problems, make predictions, and make decisions.
02.04	Describe the differences between the field of AI and ML
03.0	Explain the history and evolution of AI. The student will be able to:
03.01	Research AI and reflect on its current state.

CTE Standards and Benchmarks	
	03.02 Describe the history and evolution of AI over time.
	03.03 Identify important early examples of AI and contributors to AI development.
	03.04 Describe how AI could be used to solve problems, including historical, current, and future problems.
04.0	Define and investigate examples of AI applications. The student will be able to:
	04.01 Identify and describe current examples of AI applications in everyday life
	04.02 Identify and describe AI technologies students interact with frequently and determine what problems and/or needs the AI is intended to solve.
	04.03 Investigate how the different examples AI you interact with daily work and determine what type(s) of AI is being used
	04.04 Discuss how AI is and could be used to enhance areas of student interest, real-world problems, business needs, and the future of work.
	04.05 Identify and analyze how AI is impacting art and other creative fields.
	04.06 Define critical and contemporary areas of AI including machine learning, natural language processing, and computer vision.
05.0	Identify examples of computer perception systems built into AI-enabled technologies. The student will be able to:
	05.01 Explain differences between sensing in intelligent vs. non-intelligent machines.
	05.02 Identify basic types of perception algorithms and explain how they are used in real-world applications.
	05.03 Describe and provide examples of the advantages and limitations of sensors and computer perception and their impact on meaning making.
06.0	Describe different types of data and how they are used in AI. The student will be able to:
	06.01 Identify the different kinds of data we collect and share as Internet users.
	06.02 Define numeric, text, date, graphics and sound types of data that computers use.
	06.03 Distinguish that data requires context to be information.
	06.04 Describe how computers store data using bits (binary digits).
	06.05 Describe and construct a simple model of the data processing cycle (input-processing-output).
	06.06 Define Big Data and describe how it is used in AI.
	06.07 Describe how AI uses data to make predictions or decisions.

CTE Standards and Benchmarks	
	06.08 Define logic and summarize its use in programming, including AI.
07.0	Describe the high-level processes, methods, and conventions used in computer perception. The student will be able to:
	07.01 Describe the differences between human senses vs. animal senses vs. computer sensors in capturing, storing/representing, and making meaning from data.
	07.02 Explain how AI move from sensing data to perceiving meaning for language and vision systems (e.g., sense, perceive, act cycle)
	07.03 Illustrate abstraction hierarchies for speech understanding and perceptual reasoning to highlight the relationship between higher level and lower levels of abstraction in resolving ambiguities in the levels below.
08.0	Identify and describe the types of representations and algorithms designed into AI-enabled technologies. The student will be able to:
	08.01 Identify different types of representations in AI and their uses.
	08.02 Explain how heuristic, combinatorial, state space search algorithms and operators are commonly used in AI to find answers to questions and problems.
	08.03 Identify and describe classification, approximation, inference, optimization, recognition, search families of reasoning algorithms and the work they do.
	08.04 Identify and explain how AI representations and types of reasoning are used in AI systems used in everyday life.
09.0	Explain how agents maintain representations of the world and use them for reasoning. The student will be able to:
	09.01 Explain how representation supports reasoning and reasoning algorithms operate on representations.
	09.02 Describe and provide examples of common implementations of decision trees, rule-based inference, and statistical inference reasoning algorithms and their advantages and limitations in solving problems (human interpretability, transparency).
10.0	Describe machine learning and neural networks in AI-enabled technologies. The student will be able to:
	10.01 Explain the difference between machine learning and human learning.
	10.02 Identify supervised, unsupervised, reinforcement, and transfer learning types of machine learning) and provide examples of the types of problems they solve.
	10.03 Identify CNN, RNN, GAN types of neural networks and the image classification, speech recognition, deep fakes/creativity/art applications they are used in.
11.0	Describe the different methods computers use to learn from data (Machine Learning). The student will be able to
	11.01 Explain how supervised, unsupervised, reinforcement, and transfer learning function.
	11.02 Identify and describe layers (input, hidden, output), activation functions, learning rules and transfer learning components of a neural network and explain how they function.
	11.03 Explain how CNN, RNN, GAN types of neural networks function.

CTE Standards and Benchmarks	
	11.04 Explain the difference between systems designed using symbolic AI vs neural networks
12.0	Collect and analyze a data set. The student will be able to:
	12.01 Identify different kinds of data and how they might be used in decision making
	12.02 Describe and construct a simple model of the data processing cycle (input-processing-output).
	12.03 Collect, organize, manipulate and analyze different types of data using preset spreadsheet functions.
	12.04 Analyze one or more online datasets, describe the information the datasets provide, and identify the types of questions it can and cannot answer
	12.05 Analyze data to construct informed summaries, decisions, and predictions related to the data.
	12.06 Use spreadsheet functions to create tables and graphs to visually represent and communicate data.
	12.07 Explain and demonstrate the ways training data influences learning and decisions made by the model.
13.0	Conduct an investigation of a Machine Learning Model. The student will be able to do:
	13.01 Plan and conduct an experiment using a web tool that trains a machine learning model without coding to train a model to recognize data and distinguish between at least three different categories.
	13.02 Predict what information the trained model from your experiment might use to classify data.
	13.03 Construct an argument using data that explains how your machine learning experiment model works and evaluate if it was. successful
	13.04 Plan and conduct an experiment using a Computer Vision service to analyze an image dataset from an online source.
	13.05 Plan and conduct an experiment using a Text Analytics service to analyze a text dataset from an online source.
14.0	Characterize major elements of intelligent behavior. The student will be able to:
	14.01 Explain differences between intelligent vs. non-intelligent machines.
	14.02 Explain common sense reasoning, emotional intelligence, deductive, and inductive reasoning and characteristics of quintessential human intelligence.
	14.03 Explain and provide examples of intelligent behavior through computer modeling and robotics.
	14.04 Describe the major branches of AI including expert systems, natural language processing, machine perception, machine learning.
	14.05 Describe the limitations of AI for natural interaction.
	14.06 Identify and debate the issues of AI and consciousness (e.g., human-level consciousness vs. similar outcomes).

CTE Standards and Benchmarks	
	14.07 Explain why common-sense reasoning is hard for AI.
	14.08 Identify the types of problems that are difficult for AI to solve (e.g, AI General Intelligence/Strong AI, natural language understanding, computer vision)
	14.09 Explain the basic concepts involved with determining consciousness and understanding philosophy of mind.
15.0	Explain how domain knowledge is used in the design of AI systems. The student will be able to:
	15.01 Understand and describe how AIAI systems rely on domain knowledge from many fields including visual perception, linguistics, human behavior, psychology, anatomy and physiology, philosophy, mathematics.
	15.02 Explain how domain knowledge in AI systems can be provided by human experts or derived from statistics collected from millions of sentences, images, or expert labeled data.
	15.03 Explain and demonstrate how natural language understanding including speech recognition, speech generation, speech translation is used in speech recognition systems.
	15.04 Explain and demonstrate how human language can be ambiguous and strategies AI uses to resolve ambiguity.
	15.05 Explain and demonstrate how domain knowledge is used to determine ambiguity in human writing.
	15.06 Explain and demonstrate how domain knowledge is used to classify, compare, or generate music.
	15.07 Explain and demonstrate how domain knowledge is used to play board games and solve puzzles.
	15.08 Explain and demonstrate how domain knowledge is used to recognize faces, gestures, and scenes.
	15.09 Explain and demonstrate how domain knowledge is used to recognize affect from images (e.g., gestures, facial expressions).
	15.10 Explain and demonstrate how domain knowledge is used to recognize sentiment from text or speech.
	15.11 Identify and demonstrate the use of domain knowledge in the creation and use of medical diagnosis, finance, or manufacturing systems.
	15.12 Understand that domain knowledge and best practices can be one-way human bias can affect the decisions AI systems make, either in the collection and selection of examples to train systems or the interpretation of results of an AI system.
16.0	Articulate the many types of knowledge needed by AI agents to interact naturally with humans and the current limitations of AI to interact naturally with humans. The student will be able to:
	16.01 Identify how natural language understanding of tone, speaker intent and similar attributes impacts AI systems.
	16.02 Explain why it is challenging for AI to demonstrate common sense reasoning to include identification of characteristics of commonsense knowledge and causal reasoning how these differ from encyclopedic knowledge and statistical inference.
	16.03 Explore the knowledge and techniques used by AI systems to understand and recognize human affect or emotion and sentiment
	16.04 Identify and describe the range of natural interactions used to develop AI applications.

CTE Standards and Benchmarks	
	16.05 Explore the AI techniques used to approximate human creativity (e.g., art, music, prose)
	16.06 Explore the techniques use to facilitate smooth human-robot interaction.
	16.07 Explore the limitations of AI for supporting natural interactions.
	16.08 Identify, explain and debate the issues of AI and consciousness.
	16.09 Construct a chatbot and describe the factors that constrain the range of responses.
	16.10 Experiment with software that recognizes emotions in facial expressions.
	16.11 Describe the types of tasks where AI outperforms humans and those where humans outperform AI.
17.0	Understand and articulate how AI can impact society in both positive and negative ways. The student will be able to:
	17.01 Explain the ways that AI Impacts different communities/people in different ways.
	17.02 Demonstrate the use of AI is an economic driver that makes new services possible and businesses more efficient.
	17.03 Describe the ways AI technologies are changing business, healthcare, education, and government.
	17.04 Explain and provide examples of the ways AI and robotics will change the way people work, create new jobs, and eliminate some jobs.
	17.05 Identify, research, and analyze current events in the field of AI, considering new technology developments, social and ethical impact, and future implication.
	17.06 Identify and describe current challenges and opportunities in AI technologies using non-Machine Learning aspects of AI such as genetic algorithms, robotics, and computer vision.
	17.07 Make predictions about the future trends or developments in the field of AI based on current AI applications.
	17.08 Research the purpose of organizations that consider how AI can be used for social and ethical good and describe their role in AI development.
	17.09 Define and compare ethical and legal implications of AI.
	17.10 Identify and describe ethical and societal AI issues in a variety of settings such as public safety, financial implications, social media marketing, government uses, different cultures and countries.
	17.11 Analyze participation in collective online activities considering the possibilities over problems, opportunities over risks, and community successes over personal gain.
	17.12 Explain the ethical use of technology and digital content with a specific understanding of ownership, licensing, and fair use.
	17.13 Students understand consequences of inappropriate technology use.

CTE Standards and Benchmarks	
18.0	Explain the best practices and key characteristics of bias, fairness, transparency, explainability, accountability of ethically designed AI systems and decision-making practices. The student will be able to:
18.01	Define bias, perception, privacy, and accuracy in the context of AI.
18.02	Explore potential examples of bias using a web tool that trains a machine learning model without coding.
18.03	Describe and critique how ethics and philosophy explicitly and implicitly play a role in AI applications.
18.04	Explain the ways in which developing an AI application involves humans making numerous technical and ethical decisions.
18.05	Explain the key principles of responsible and ethical AI design that result in AI systems that keep fairness, transparency, explainability, human-centeredness, privacy and security interests of users in mind.
18.06	Explain the range of views on the need for and types of ethical standards for AI systems that make decisions about people.
18.07	Describe the importance of minimizing bias in AI systems to increase people's trust in AI systems.
18.08	Identify the sources of bias in AI systems and models and explain the key approaches to minimizing bias.
18.09	Describe group and individual types of fairness and various views of fairness that affect the metrics for evaluating fairness in systems.
18.10	Describe model, algorithm, data, goals, outcomes, compliance, influence, and usage principles of transparency in AI and explain the regulatory, responsibility, privacy, security considerations that are important when making decisions with AI systems.
18.11	Explain the challenges of implementing transparency in AI for companies such as vulnerabilities and security, privacy, intellectual property, legal and risk management.
18.12	Provide examples of how explainability vs. interpretability is the most effective means of ensuring AI solutions are transparent, accountable, responsible, fair, and ethical across use cases and industries.
18.13	Provide examples of the judgements humans in the loop make in the development of AI, and the responsibility they have to consider the system's impact in the world.
18.14	Explain how AI designers and developers have an ethical responsibility to be able to explain how AI systems and their components work.
18.15	Provide examples or explain how a company, developer, or decision maker can establish accountability in the development and use of AI to make decisions (e.g., codes of ethics/responsible design, ethical design consideration and choices, and decision tracking).
18.16	Understand the subjective nature of values across cultures and describe the key principles, importance, and challenges of designing AI to align with the norms and values of the user group in mind (e.g., understanding user's values, culture, and norms; defining the value system the AI system is designed for).
18.17	Describe the expertise and process needed to ethically design AI to support users (e.g., multi-disciplinary team incl. Ethicist/sociologist, developers, legal/compliance, tracking, etc.).
19.0	Identify deep fakes and explain critical Information processing. The student will be able to:
19.01	Distinguish between credible and unreliable information sources.

CTE Standards and Benchmarks
19.02 Recognize and describe signs of compromised information or data.

Florida Department of Education
Student Performance Standards

Course Title: **Applications of Artificial Intelligence**
Course Number: **9401020**
Course Credit: **0.5**

Course Description:

The purpose of this course is to assist students in deepening understanding for application of AI and to explore methods and tools utilized to build AI models. The content includes but is not limited to foundational knowledge and skills related to methods and software used to develop AI applications using data sets. Instruction and learning activities are provided in a laboratory setting using hands-on experiences with the equipment, materials and technology appropriate to the course content and in accordance with current practices.

CTE Standards and Benchmarks	
20.0	Design and evaluate a perception system and its limits. The student will be able to:
	20.01 Use a software tool such as a speech transcription or visual object recognition demo to demonstrate machine perception.
	20.02 Explain the difference between sensing and perception.
	20.03 Illustrate how sequences of sounds can be recognized as candidate words, even if some sounds are unclear.
	20.04 Illustrate how face detection works by extracting facial features.
	20.05 Illustrate and explain how outlines of partially occluded (blocked) objects in an image differ from the real shapes of the objects and the affects this has on accurate object recognition.
	20.06 Demonstrate how a text to speech system can resolve ambiguity based on context, and how its error rate goes up when given ungrammatical or meaningless inputs.
	20.07 Describe how domain knowledge needs to encompass the diversity of groups an application is intended to serve.
	20.08 Classify a given image and describe the kinds of knowledge a computer needed to understand classifications of this type.
	20.09 Analyze one or more online image datasets and describe the information the datasets provide and how this can be used to extract domain knowledge for a computer vision system.
	20.10 Describe how a vision system might exhibit cultural bias if it lacked knowledge of objects not found in the culture of the people who created it.
	20.11 Describe the technical difficulties in making computer perception systems function well for diverse groups.
21.0	Train and evaluate a range of ML models based on specific accuracy, inclusivity, and ethical design criteria. The student will be able to:

CTE Standards and Benchmarks	
	21.01 Demonstrate how to train a computer to recognize something.
	21.02 Train a classification model using machine learning and examine the accuracy of the model on new inputs.
	21.03 Using software to calculate misclassification rates and comparing classification algorithms/models to decide which is the better based on total misclassification rate.
	21.04 Explain how a goodness of fit measure can be used to quantify the success of the prediction made by the algorithm/model.
	21.05 Train and evaluate a classification or prediction model using machine learning on a tabular dataset.
	21.06 Use a supervised or unsupervised learning algorithm to train a model on real world data, then evaluate the results.
	21.07 Evaluate the accuracy, inclusivity, and ethical design of the model
	21.08 Explore and utilize packages from a data analysis and manipulation tool when training a machine learning model.
	21.09 Utilize visual reporting and statistical tools to perform, understand, and interpret statistics such as regression analysis, ANOVA, hypothesis testing, and sampling distributions.
22.0	Design and evaluate a data set to solve a problem using specific accuracy, inclusivity, ethical design criteria. The student will be able to:
	22.01 Explain the data pipeline including data collection, manipulation, cleansing, and transformation and describe how these can be used to ethically and responsibly improve datasets.
	22.02 Define and explain the difference between training, validation, and test datasets.
	22.03 Define and distinguish between balanced and imbalanced datasets and Identify potential problems with imbalance datasets.
	22.04 Identify different kinds of data and how they might be used in decision making
	22.05 Identify patterns in labeled data and determine the features that predict labels.
	22.06 Demonstrate how supervised learning identifies patterns in labeled data.
	22.07 Demonstrate how unsupervised learning finds patterns in unlabeled data.
	22.08 Create a labeled dataset with explicit features to illustrate how computers can learn to classify things like foods, movies, or toys.
	22.09 Create a labeled dataset to solve a problem and note the range of labels that can be used to describe the dataset depending on the problem and desire solution space.
	22.10 Identify, evaluate, and utilize existing datasets from reliable sources to train machine learning models.
	22.11 Identify bias and ethical factors to consider when evaluating sources of data.
	22.12 Evaluate and discuss the sources of bias in the dataset and use ethical design principles to address the issues.

CTE Standards and Benchmarks	
	22.13 Explain and demonstrate the ways training data influences learning and decisions made by the model.
23.0	Design AI solutions using embedded computing. The student will be able to:
	23.01 Identify and define the function of circuits, sensors, microcontrollers, motors, and other components used in embedded systems.
	23.02 Assemble an embedded or robotic system that use circuits, sensor(s), microcontroller, microcomputers, motor(s) to complete a specific task.
	23.03 Write a program for an embedded or robotic system that makes a decision based on sensor/user input, controls mechanics of the robot, and completes a “human” task (e.g., delivers items, opens a door for someone, solves a puzzle, etc.).
	23.04 Use a problem-solving method to debug hardware issues.
24.0	Explore the characteristics, tasks, work attributes, options, and tools associated with AI-enabled careers. The student will be able to:
	24.01 Explore a variety of careers that leverage AI tools and systems.
	24.02 Discuss the impact of AI on business and commerce.
	24.03 Evaluate the impacts of irresponsible use of AI technologies.
	24.04 Identify tasks performed by AI-enable professionals.
	24.05 Identify and explain the ways businesses use AI to solve business problems.
	24.06 Investigate AI-enabled career opportunities in business, medicine, engineering, construction, science, social services, government, military, computing, education, manufacturing, and finance/banking fields.
	24.07 Explain different specializations and the related training in AI-enabled careers.
	24.08 Explain the need for continuing education and training of AI-enabled professionals.
	24.09 Explain how AI is used in enterprise software systems and how insights from AI impact decision-making.
	24.10 Describe ethical responsibilities of AI-enabled professionals.
	24.11 Identify credentials and certifications that may improve employability for an AI-enabled professional.
	24.12 Identify devices, datasets, tools, and other environments for which AI-enabled professionals may use, modify, and develop AI systems
	24.13 Students learn that people in various work roles engage in continuous learning to upgrade skills and adapt to change
	24.14 Students execute projects that demand critical and creative thinking, planning and problem-solving using research and investigation skills

CTE Standards and Benchmarks	
	24.15 Students learn that people in various work roles engage in continuous learning to upgrade skills and adapt to change
25.0	Identify how leadership development, school and community service projects and competitive events are integral parts of career and technology education. The student will be able to:
	25.01 Explain the goals, mission, and objectives of the career-technical student organization (CTSO).
	25.02 Explore the impact and opportunities a student organization can develop to bring business and education together in a positive working relationship through innovative leadership and career development programs.
	25.03 Explore the local, state, and national opportunities available to students through participation in related student organization including but not limited to conferences, competitions, community service, philanthropy, and other CTSO activities.
	25.04 Explain how participation in career and technology education student organizations can promote lifelong responsibility for community service and professional development.
	25.05 Explore the competitive events related to the content of this course and the required competencies, skills, and knowledge for each related event for individual, team, and chapter competitions.
	25.06 Students learn that learning can occur in both formal and informal environments and seek opportunities outside of school.
	25.07 Express a positive attitude towards lifelong learning and how it relates to various careers.
	25.08 Students begin to familiarize themselves with and adopt professional qualities such as self-management, agency, self-efficacy, initiative and enterprise.
	25.09 Students learn that people in various work roles engage in continuous learning to upgrade skills and adapt to change.
	25.10 Students execute projects that demand critical and creative thinking, planning and problem-solving using research and investigation skills.
26.0	Use appropriate tools to design an AI System to solve problems. The student will be able to:
	26.01 Select a dataset that is appropriate for a given AI application.
	26.02 Curate and clean a dataset for use.
	26.03 Employ one or more technological tools such as data science, machine learning, natural language processing, neural networks, decision-tree, signal procession, computer vision, and facial recognition to expedite workflow.
	26.04 Provide examples of how AI can inform and drive decision-making and automatization.
	26.05 Use an ethical development process to create, analyze and iterate an AI-enabled solution, individually and collaboratively.
	26.06 Distinguish between the range of tools and services available for AI-enabled professionals and AI experts/developers/engineers.
	26.07 Determine the computing resources (e.g., desktop vs GPU) and time needed (e.g., minutes, hours, days, weeks) to complete a ML/AI task.
	26.08 Identify and research networks and cloud services that use AI solutions (Neural Networks, data management, different industry-

CTE Standards and Benchmarks	
	specific solutions and services, Edge AI).
	26.09 Identify AI in a variety of industry solutions and services and make appropriate recommendations of AI applications based on an industry need.
	26.10 Define and identify and use basic functions of proprietary AI tools.
27.0	Characterize important issues related to privacy and security in the development and use of AI-enable technologies. The student will be able to:
	27.01 Identify and debate the range of views on government regulation of AI usage due to concerns such as privacy, ethics, and security.
	27.02 Identify AI and ethics-related laws and analyze their impact on digital privacy, security, intellectual property, network access, contracts, and harassment.
	27.03 Identify the methods/techniques for collecting data from people and explain the privacy and security risks to people for whom data is collected for use in training machine learning models.
	27.04 Discuss security and privacy issues that relate to networked AI Applications.
	27.05 Explain and demonstrate how training data influences learning.
28.0	Explain the key technical challenges in design and responsible use of AI technologies. The student will be able to:
	28.01 Explain and demonstrate how training data influences learning
	28.02 Explain how developing an AI application involves humans making numerous technical and ethical decisions
	28.03 Explain the current issues with explainability of decisions made with neural networks and other deep learning architectures
	28.04 Explore the challenges of using explainable AI (e.g., cost, ability to develop solutions when issues are discovered)
29.0	Set up and use a ML pipeline to solve a problem. The student will be able to:
	29.01 Identify problem that can be solved with ML.
	29.02 Use appropriate techniques and best practices for selection, collection, and/or curation of data to gain insight on a problem.
	29.03 Use appropriate techniques and best practices for selection of algorithms and architectures to develop and train a model to solve a problem.
	29.04 Use of appropriate tools to evaluate the quality and accuracy of the model.
	29.05 Use of appropriate tools and techniques to deploy and use model.
	29.06 Evaluate the important issues related to privacy and security in the development and use of ML models

CTE Standards and Benchmarks	
	29.07 Demonstrate awareness of the issues that arise in model use (e.g., model degradation) and best practices for maintaining the accuracy of deployed models.
	29.08 Demonstrate an awareness that training a machine learning model is an iterative process that requires time and compute resources.
30.0	Appropriately use automated AI services to accomplish common tasks. The student will be able to:
	30.01 Train a ML model and deploy a model as a service.
	30.02 Select and use of appropriate techniques for setting up a workspace, create computing resource, and exploring data.
	30.03 Create and run a training pipeline, evaluate a regression model, create an inference pipeline, deploy a predictive service.
	30.04 Selection and use of appropriate AI services to create a regression model that predicts numeric values.
	30.05 Selection and use of appropriate AI services to create a clustering model that groups similar entities based on their features.
	30.06 Selection and use of appropriate AI services to create a classification model that predict categories or classes.
	30.07 Selection and use of appropriate AI services to detect and analyze faces.
	30.08 Selection and use of appropriate AI services to analyze and classify images.
	30.09 Selection and use of appropriate AI services to detect objects in images.
	30.10 Selection and use of appropriate AI services to read and analyze text.
	30.11 Selection and use of appropriate AI services to recognize and synthesize speech.
	30.12 Selection and use of appropriate AI services to translate.
	30.13 Selection and use of appropriate AI services to create a language model with language understanding.
	30.14 Selection and use of appropriate AI services to build a QnA or language understanding bot.
31.0	Explain and use design thinking to solve a problem. The student will be able to:
	31.01 Distinguish between social and personal problems to be solved through a design.
	31.02 Identify a challenge of social importance and personal interest.
	31.03 Students develop problem statements embedded within a complex challenge.
	31.04 Understanding challenges and user needs more deeply.

CTE Standards and Benchmarks	
	31.05 Pattern and sort user data to define design challenges.
	31.06 Use a formal brainstorming process to generate ideas.
	31.07 Test and iterate prototypes.
	31.08 Refine prototypes based on user feedback.
	31.09 Create stakeholder maps.
	31.10 Develop point-of-view statements for users.
	31.11 Develop a blueprint for a prototype.
	31.12 Gather feedback from users.
	31.13 Revise prototypes and present rationale for final design.
32.0	Show how a system is composed and interacts and be able to express verbally, graphically and in writing how the system functions. The student will be able to:
	32.01 Recognize and define components of an AI system.
	32.02 Determine the purpose and function of different systems.
	32.03 Draw arrows showing how one part interacts with other parts. Students tell a story about the interactions between parts of a system (in writing and verbally).
	32.04 Observe and analyze different systems that have the same outcome (for example, how one class transitions from reading to lunch compared to another class).
	32.05 Apply multiple literacies (data, information, historical, etc) to identify and understand problems; ask appropriate questions; and design an appropriate solution.
	32.06 Reflect on cause and effect within an observed system.
	32.07 Recognize relationships between variables in a system (feedback loops, interactions between human and physical environment, different information sources related to the same problem).
	32.08 Complete a systems map demonstrating interrelationships between components of a system.
	32.09 Select, observe, and improve a specific component of a system.
	32.10 Conduct interviews and use empathy to understand the role of specific stakeholders within a system.
33.0	Understand and interpret different types of data. The student will be able to:

CTE Standards and Benchmarks	
	33.01 Observe and measure differences between objects, (qualitative or quantitative) and uses charts/graphs to illustrate differences.
	33.02 Understand and explain how information can be collected, used, and presented.
	33.03 Recognize and understand data in various forms including charts, graphs, text, etc.
	33.04 Identify and understand the roles of databases in everyday life.
34.0	Understand how data is accessed, sorted, and stored. The student will be able to:
	34.01 Explain the role that computers play in storing and accessing data.
	34.02 Describe databases and how they organize and transform data.
	34.03 Understand data sets with multiple categories/arranged in scaled graphs (one bar represents 5 items).
	34.04 Collect, organize, manipulate, and transform data, and identify databases.
	34.05 Create a model and use data from a simulation.
	34.06 Understand and show ability to represent and manipulate data/data bases.
	34.07 Explain how computing devices represent and manipulate information.
	34.08 Create, modify, and manipulate databases.
35.0	Generate and tell stories with data. The student will be able to:
	35.01 Collect, organize, and arrange data into charts/graphs.
	35.02 Identify structural components of data representations (e.g., axes on a graph, table rows and columns, scale on a geographic map, key on a color map.
	35.03 Organize data and tell the data story presented in simple charts and graphs.
	35.04 Interpret and explain more complex charts that record more variables.
	35.05 Decode data: Identify and extract measurements, values or data points and what they represent from graphs, tables, or other data representations.
	35.06 Identify structural components of data representations (e.g., axes on a graph, table rows and columns, scale on a geographic map, key on a color map.
	35.07 Identify most appropriate visualization for a given data set.
36.0	Think critically about data. The student will be able to:

CTE Standards and Benchmarks	
36.01	Understand and explain how data changes over time; (e.g., weather through seasons).
36.02	Analyze information and derive conclusions based on data presented.
36.03	Show ability to interpret and make predictions based on data that changes over time.
36.04	Interpret data representations accurately; identify potential bias and missing data; accurately connect position statements with data sets that support them.
36.05	Decode, analyze and interpret data describing meaningful patterns, separate factual information from inferences.
36.06	Analyze and interpret data and identify and describe meaningful patterns in data.
36.07	Make quantitative and qualitative comparisons of data; communicate scientific information/tell a story with data.
36.08	Separate factual information from inferences,
36.09	Use data, math, and statistics to develop and/or support claims that address specific scientific questions.

Florida Department of Education
Student Performance Standards

Course Title: **Procedural Programming**
Course Number: **9007220**
Course Credit: **1**

Course Description:

This course continues the study of computer programming concepts with a focus on the creation of software applications employing procedural programming techniques.

CTE Standards and Benchmarks	
37.0	Design a computer program to meet specific physical, operational and interaction criteria. The student will be able to:
37.01	Choose appropriate data types depending on the needs of the program.
37.02	Define appropriate user prompts for clarity and usability (e.g., user guidance for data ranges, data types).
37.03	Design and develop program for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
37.04	Compare techniques for analyzing massive data collections.
37.05	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
37.06	Create mobile computing applications and/or dynamic webpages using a variety of design and development tools, programming languages and mobile devices/emulators.
37.07	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.
37.08	Identify the tools required to develop a program *(*e.g., editors, compilers, linkers, integrated development environments, APIs, libraries).
38.0	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:
38.01	Use appropriate naming conventions to define program variables and methods.
38.02	Use a program editor to write the source code for a program.
38.03	Write programs that use selection structures.
38.04	Write programs that use repetition structures.

CTE Standards and Benchmarks	
	38.05 Write programs that use nested structures.
	38.06 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.
	38.07 Compile, run, test and debug programs.
	38.08 Write programs that use standard arithmetic operators with different numerical data types.
	38.09 Write programs that use standard logic operators.
	38.10 Write programs that use a variety of common data types.
	38.11 Write programs that perform data conversion between standard data types.
	38.12 Write programs that define, use, search, and sort arrays.
	38.13 Write programs that use user-defined data types.
	38.14 Demonstrate understanding and use of appropriate variable scope.
	38.15 Use global and local scope appropriately in program implementation.
	38.16 Distinguish between binary and sequential searches.
39.0	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:
	39.01 Determine the results of code segments.
	39.02 Write programs that perform user input and output.
	39.03 Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
	39.04 Write program modules such as functions, subroutines, or methods.
	39.05 Write program modules that accept arguments.
	39.06 Write program modules that return values.
	39.07 Write program modules that validate arguments and return error codes.
	39.08 Design and implement a simple simulation algorithm to analyze, represent and understand natural phenomena.
	39.09 Use APIs and libraries to facilitate programming solutions.

CTE Standards and Benchmarks	
	39.10 Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common programming standards.
	39.11 Explain how abstraction manages complexity.
40.0	Effectively communicate and collaborate. The student will be able to:
	40.01 Evaluate modes of communication and collaboration.
	40.02 Select appropriate tools within a project environment to communicate with project team members.
	40.03 Utilize project collaboration tools (such as version control systems and integrated development environments) while working on a collaborative software project.
	40.04 Generate, evaluate, and prioritize questions that can be researched through digital resources and online tool.
	40.05 Perform advanced searches to locate information and/or design a data-collection approach to gather original data.
	40.06 Communicate and publish key ideas and details to a variety of audiences using digital tools and media-rich resources.
41.0	Demonstrate responsible use of technology and information. The student will be able to:
	41.01 Implement an encryption, digital signature, or authentication method.
	41.02 Describe computer security vulnerabilities and methods of attack and evaluate their social and economic impact on computer systems and people (e.g., phishing, keylogging, virus, malware, intercepting data over public networks).
	41.03 Identify and explain the existence of biases in computer programming.
	41.04 Explain how computing can play a role in social and political issues.
42.0	Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages. The student will be able to:
	42.01 Differentiate between multiple levels of operating system, translation, and interpretation that support program execution.
	42.02 Explain the program execution process (by an interpreter and in CPU hardware).
	42.03 Describe object-oriented concepts.
	42.04 Explain the characteristics of procedural and object-oriented programming languages
	42.05 Compare and contrast programming languages that are compiled, interpreted, and translated.

Florida Department of Education
Student Performance Standards

Course Title: **Foundations of Machine Learning**
Course Number: **9401040**
Course Credit: **1**

Course Description:

The purpose of this course is to provide students with core foundational knowledge to deepen understanding of machine learning (ML) practices and applications. This course builds understanding of the mathematical foundation needed to create algorithms for use in artificial intelligence and machine learning. The content includes but is not limited to foundational knowledge and skills related to computer coding and software development. Instruction and learning activities are provided in a laboratory setting using hands-on experiences with the equipment, materials and technology appropriate to the course content and in accordance with current practices.

CTE Standards and Benchmarks	
43.0	Explain the nature of representations and their importance in AI. The student will be able to:
43.01	Identify examples of abstractions used in everyday life, describe the characteristics of abstractions, and explain how they are different than their real-world counterparts.
43.02	Describe the two major types of knowledge representations (i.e., symboli and numerical representations), identify examples of each type, and explain when each is used in AI solutions.
43.03	Explain how and when data structures (e.g., trees, graphs, arrays, schema) are used to represent data in AI (e.g., search trees, decision trees, maps, 1D Arrays -feature vectors. 2D-Arrays – tables, matrices).
43.04	Construct a representation of data, game, map, or real-world object/scenario/problem using a data structure (e.g., graph – map or game board, tree – classification and moves in a game, array – feature vector, schema – description of a concept), identify the parts of the representation and explain how to reason with them.
43.05	Evaluate and use the appropriate data structure for programming a specific machine learning algorithm.
43.06	Explain how representations work with reasoning to solve problems.
43.07	Research the different kinds of symbolic representations used to encode information about the world (e.g., symbols, relationships, properties, etc.) in ways a computer can reason with to solve complex tasks (i.e., diagnosing a medical condition or having a dialog in a natural language).
43.08	Construct a feature vector representation for a set of objects or word embeddings and explain how distance is used to determine the similarity and difference between objects or words in the feature space.
44.0	Use search algorithms to reason with symbolic representations. The student will be able to:
44.01	Identify types of real-world problems that are search problems and describe their states and operators.

CTE Standards and Benchmarks	
	44.02 Illustrate how a computer can represent the playing of a game (e.g., tic-tac-toe) by drawing the sequence of board positions produced by the players' moves.
	44.03 Describe the search space for graph and tree search algorithms and explain legal and illegal moves.
	44.04 Model the process of solving a graph search problem (e.g., games, mazes, maps, reason about concepts) using breadth-first, depth-first, and best-first search to draw a search tree.
	44.05 Compare and contrast the advantages and disadvantages (e.g., cost, space, time complexity) of using breadth-first, depth-first, and best-first search to solve a problem.
45.0	Explain the relationship between representation and reasoning. The student will be able to:
	45.01 Describe the ways in which AI uses computer science concepts such as data structures (representations) and algorithms (reasoning methods) to solve problems.
	45.02 Describe the mutual dependence between representation and reasoning-representations support reasoning; reasoning methods operate on representations.
	45.03 Describe how reasoning with symbolic representations is performed using logical inference rules.
	45.04 Describe how reasoning with numerical representations utilizes complex mathematical functions such as neural networks.
46.0	Explain the nature of machine learning. The student will be able to:
	46.01 Define machine learning as a set of techniques (algorithms) that allow a computer to learn behaviors without explicit programming.
	46.02 Explain that machine learning algorithms are learning "patterns" in data to construct internal representations that encode the relationship between inputs and outputs and result in a model for reasoning (e.g., reasoner).
	46.03 Model and explain how machines learn new behaviors due to changes/adjustments the learning algorithm makes to internal representations of a decision tree or a neural network reasoning model.
	46.04 Illustrate and compare how supervised, unsupervised, and reinforcement learning algorithms adjust internal representations to learn for classification or prediction.
	46.05 Explain the similarities and differences between how humans and machine learning algorithms learn.
47.0	Use and evaluate supervised learning techniques to classify or predict outputs. The student will be able to:
	47.01 Research and present real-world problems and applications of supervised learning.
	47.02 Describe how supervised learning algorithms find relationships between feature values and class labels in labeled data to create classification or prediction models.
	47.03 Explain how supervised learning models use features to predict or label new data.
	47.04 Describe how supervised learning algorithms adjust the parameters of a mathematical model (selected in advance by a human) to create models that make correct classifications or predictions.

CTE Standards and Benchmarks	
	47.05 Evaluate the results of a supervised learning model by measuring the percent of items in a test set that are labeled correctly.
	47.06 Describe the types of algorithms that are used for classification (e.g., decision trees, NN, logistic regression).
	47.07 Describe the types of algorithms that are used for regression (e.g., decision trees, NN, linear regression).
	47.08 Evaluate the accuracy of a classification model using root mean squared error.
	47.09 Describe the benefits and limitations of supervised learning algorithms for solving problems.
48.0	Use and evaluate unsupervised learning techniques to solve problems. The student will be able to:
	48.01 Research and present real-world problems and applications of unsupervised learning (e.g., anomaly detection in fraud and medical images, groups of customers who buy similar products, recommender systems).
	48.02 Describe how an unsupervised learning algorithm finds patterns in unlabeled data by looking for data grouped into clusters.
	48.03 Explain how an unsupervised learning model is trained to assign each input to a cluster of similar inputs.
	48.04 Explain how unsupervised learning differs from supervised learning and how this difference allows unsupervised learning algorithms to solve more complex problems than supervised learning algorithms.
	48.05 Distinguish between data that are appropriate for supervised versus unsupervised learning based on its structure, particularly the presence and roles of inputs and outputs.
	48.06 Explain how clustering works and the types of problem clustering algorithms solve.
	48.07 Use clustering algorithms (e.g., K-Means, hierarchical clustering, principal component analysis) to solve a problem.
	48.08 Use an unsupervised learning algorithm to generate a decision tree to predict numerical outcomes using 1 or 2 features/variables. Fit and interpret a regression tree using software.
	48.09 Evaluate the results of an unsupervised learning model by examining the clusters to see if they capture useful distinctions in the dataset (e.g., If the clustering algorithm separates dissimilar observations apart and similar observations together, then it has performed well).
	48.10 Describe the limitations of clustering algorithms (e.g., identification of clusters even if the data does not contain any clusters, unable to understand why elements are clustered together).
49.0	Use and evaluate reinforcement learning techniques to solve problems. The student will be able to:
	49.01 Research and present real-world problems and applications of reinforcement learning (e.g., self-driving cars, walking, learning a new skill, video games, question answering, machine translation, medical diagnosis, sequential decision-making problems).
	49.02 Explain that reinforcement learning models focus on how machines can learn to act in a particular way (e.g., robots learning to walk, or chatbots learning to better answer customer problems).
	49.03 Describe how reinforcement learning generally works: the learning algorithm uses trial and error to find a policy for choosing actions that maximizes the reinforcement signal.

CTE Standards and Benchmarks	
	49.04 Model the ways that reinforcement learners update value predictions or policies (e.g., internal representations).
	49.05 Use reinforcement algorithms to solve a problem (e.g., Deep Adversarial Networks, Q-learning).
	49.06 Describe the benefits and limitations of reinforcement learning.
50.0	Use and evaluate different types of neural network architectures and their applications. The student will be able to:
	50.01 Illustrate the two main components of a Generative Adversarial Network's (GAN) architecture (i.e., generator and discriminator models) and explain how each component works to create realistic images and audio.
	50.02 Illustrate the architecture of a convolutional neural network (CNN) and explain the motivation for the model and how it is optimized for computer vision tasks (e.g., image processing, natural language processing, and recommendation systems).
	50.03 Illustrate the architecture of a recurrent neural network (RNN) and explain how it is optimized for time-series forecasting (e.g., weather prediction, stock predictions, etc.).
	50.04 Describe the purpose of ensemble learning methods and how they are used to improve the performance of machine learning models and identify examples in the real-world.
	50.05 Describe the purpose of transfer learning methods and how it is used to decrease the amount of training time for new tasks and identify examples in the real-world.
51.0	Illustrate Neural Networks and their components. The student will be able to:
	51.01 Describe and illustrate the fundamental components of a neural network (e.g., input, hidden layers, output) and their purpose.
	51.02 Explain the roles hyperparameters, activation functions, learning rules, and transfer functions play in the development of a machine learning model.
	51.03 Illustrate and explain how backpropagation works to improve how machines learn.
	51.04 Illustrate and explain how stochastic gradient descent works.
	51.05 Research and explain how deep neural networks work.
	51.06 Illustrate and explain how Feedforward multi-layer work.
	51.07 Illustrate and explain how a perceptron work.
52.0	Recognize and identify mathematical principles upon which machine learning and AI are built such as calculus, linear algebra, probability, statistics, and optimization partial derivatives. The student will be able to:
	52.01 Explain how machine learning uses statistics to find patterns in data to make predictions about future values, identify the relationship between features, and make improvements.
	52.02 Identify the type of mathematical functions machine learning models use (e.g., a simple linear equation, a high-degree polynomial, or an even more complex nonlinear equation such as a deep neural network).
	52.03 Recognize that neural networks are non-convex functions composed of many multi-variable functions.

CTE Standards and Benchmarks	
	52.04 Illustrate and explain the role of gradient based algorithms for training neural networks and related issues.
	52.05 Use a linear regression model and then adjust its parameters to fit a set of data points and use the model to predict a y value for any x value.
	52.06 Model polynomial or logistic regression by using tools to manually adjust the parameters to reach what they perceive as a best fit to the data.
	52.07 Evaluate the quality of fit of a machine learning model using the mean squared error to determine if they have been over-fitted or under-fitted and explain the implications for future predictions or classifications made by the model.
	52.08 Utilize visual reporting and statistical tools to perform, understand, and interpret statistics such as regression analysis, ANOVA, hypothesis testing, and sampling distributions.
53.0	Use the most common machine learning algorithms to solve a problem. The student will be able to:
	53.01 Construct a decision tree to solve a classification or prediction problem and explain the pros and cons of using this approach to solve the problem.
	53.02 Construct a neural network to solve a classification or prediction problem and explain the pros and cons of using this approach to solve the problem.
	53.03 Construct a linear regression model to predict a time-series value and explain the pros and cons of using this approach to solve the problem.
	53.04 Use K nearest neighbor algorithm to solve classification and regression problems and explain the pros and cons of using this approach to solve the problem.
	53.05 Construct machine learning using a naïve Bayes algorithm to solve a classification problem and explain the pros and cons of using this approach to solve the problem.
	53.06 Construct machine learning using support vector machines (SVM) algorithm to solve a classification or regression problem and explain the pros and cons of using this approach to solve the problem.
54.0	Identify the types of problems that can be solved with machine learning algorithms. The student will be able to:
	54.01 Describe the kinds of reasoning problems machine learning algorithms can solve (e.g., classification, prediction, sequential decision making, regression, search, heuristic search, logical deduction, statistical inference).
	54.02 Categorize real-world problems as classification, prediction, sequential decision problems, combinatorial search, heuristic search, adversarial search, logical deduction, or statistical inference.
	54.03 Describe the kinds of reasoning problems and the machine learning algorithms that can be used to solve them (e.g., supervised learning, used for classification and prediction; unsupervised learning, used for clustering; and reinforcement learning, used for sequential decision making.
	54.04 Select the appropriate type of machine learning algorithm (supervised, unsupervised, or reinforcement learning) to solve a reasoning problem and explain why this algorithm is most appropriate for this type of problem.
	54.05 Evaluate the pros and cons between two approaches to solving a reasoning problem (e.g., decision tree vs visual classifier).
55.0	Evaluate the sources of bias in machine learning/AI and identify appropriate mitigation strategies. The student will be able to:

CTE Standards and Benchmarks	
55.01	Recognize that machine learning models and AI systems are inherently socio-technical system that have requirements spanning hardware, software, personal, and community aspects. Thus, an incident in a socio-technical system is not just a technical problem but also a social problem between humans that requires coordination.
55.02	Examine the role and importance of taking a human-in-the-loop approach to the training of machine learning models and deployment and use of AI-driven automation of systems.
55.03	Identify the critical points of machine learning model and AI system design (e.g., goals, purposes, and risks) that are not easily identified by automation itself and require human-in-the-loop decision making.
55.04	Identify and address bias in the machine learning and AI system development lifecycle.
55.05	Evaluate flaws in the model of the world due to sample bias, prejudicial bias, and measurement bias.
55.06	Examine the ways in which biases and preferences of those who are designing, building, or testing the system may contribute to the systems behaviors or decisions.
55.07	Evaluate how the system is used in decision making and by whom.
55.08	Evaluate the role the motivation and purpose for the system or model to be developed influences the system design and behavior.
55.09	Research proxies in data for race, ethnicity, socio-economic status, gender, or context that can lead to disparate accuracy and impacts on different people groups.
55.10	Identify characteristics that indicate a problem is framed in a fundamentally problematic way.
55.11	Determine whether characteristics of dataset (e.g., incomplete, imbalance, and selected inappropriately) are contributing bias to a machine learning model.
55.12	Evaluate machine learning model for characteristics of measurement bias as a result from faulty measurement (e.g., sources sensors such as camera color filters and distance, data collection instruments, data labeling).
55.13	Argue for and against the accuracy of the claim that AI can produce more fair results than human.
55.14	Recognize the many roles that humans play in development of AI models, algorithms, data collection and preparation, model training and use, and decision making.
55.15	Investigate the ways that prejudice and stereotyping can make their way into data and strategies for mitigating prejudicial bias.
55.16	Evaluate the goals and acceptable behavior of a particular AI application.
55.17	Research the ethical, security, and privacy issues that affect data gathering and quality that can contribute to bias in a model.
55.18	Explain the need for models to be regularly evaluated and updated to best represent the model of current world.
55.19	Explain the concerns that designers and users of AI systems should have AI is being used in context where there is no objective answer.
55.20	Explain how accuracy and impact of algorithms cause algorithmic bias.

CTE Standards and Benchmarks	
56.0	Program machine learning algorithms to train a model on real world data, then evaluate the results. The student will be able to:
56.01	Identify real world data sets that are appropriate to solve a problem of interest.
56.02	Use either a supervised or unsupervised learning algorithm to train a model on real world data, then evaluate the results.
56.03	Quantitatively measure the performance of a trained model on a nontrivial test set.
56.04	Learning an assortment of machine learning algorithms and understand how to implement them in real-world scenarios.
56.05	Explain the importance of considering the nature of your dataset when deciding which algorithm to use.
56.06	Explain and model the use of a cross-validation data sets to evaluate the best model for a problem that avoids overfitting and under-fitting.
56.07	Describe the role of training data in determining the accuracy and margin of error of the model
56.08	Evaluate the bias-variance trade-off as an estimation of error of a model and explain the implications for future predictions or classifications made by the model.
57.0	Identify different kinds of data, sources, and how they might be used in decision making. The student will be able to:
57.01	Explain why data is the fuel of machine learning and the importance of quality data for gaining insights.
57.02	Identify and describe sources of company data such as basic information (search trends), economic information, technology information (e.g., website traffic and trends), and reviews-based information (e.g., business rating and reviews).
57.03	Identify and describe sources of people data such as Internet behavior: web presence score, social networks and social mentions, search engine results, proxy usage, economic information, interests and, spending.
57.04	Identify and describe sources of geospatial data such as location-specific alternative data such as demographic information, property information, purchasing behavior, business information.
57.05	Identify and describe sources of time-based data such as real-time information surrounding events, politics, internet trends behavior (e.g., trending keywords and subjects, foot traffic, web traffic), and financial trends: Company share price, GDP, debt history, unemployment trends.).
57.06	Explain how different kinds of data can be used in decision-making and the form/type (text, numerical, time series, image, categorical) data may be represented in.
58.0	Explain the characteristics, collection, storage, and uses of datasets in AI. The student will be able to:
58.01	Explain the relationship between the size of a data set needed and the type of problem it is trying to solve.
58.02	Identify and utilize existing datasets from reliable sources (e.g., Kaggle) to train machine learning models.
58.03	Collect data from APIs, RSSs, and web scraping

CTE Standards and Benchmarks	
	58.04 Use SQL and NoSQL databases to store and retrieve data and to work with large datasets
	58.05 Explore data wrangling methods such as data inspection and cleaning to prepare data for processing.
	58.06 Use excel or spreadsheet software to view, organize, filter, and clean or separate data.
	58.07 Use programming tools and processes to clean and transform data (e.g., Pandas, Spark, Dask, SQL, Spark SQL, and/or ScrappingHub).
	58.08 Develop an understanding of data management issues in the context of the data science learning cycle.
59.0	Work with datasets to gain insight, using data analysis and visualization tools. The student will be able to:
	59.01 Use good practices for statistical sampling and testing and incorporation of uncertainties in estimation using margins of error or interval estimates to accurately analyze data.
	59.02 Uses statistics to find patterns in data and create a computer algorithm that improves the more it is implemented.
	59.03 Use data analysis techniques to useful discover new or information, guide decision-making, power an application, or be used to tell a story.
	59.04 Explore and utilize packages from a data analysis and manipulation tool when training a machine learning model (e.g., Pandas).
	59.05 Use basic techniques for exploration and analysis of single, pair, and multi-feature models.
	59.06 Build a ML model based on a dataset that trains the computer on how to make decisions.
	59.07 Tell a data story using appropriate visualizations that are clear, compelling and accessible for the audience (e.g., interactive dashboards, static infographics, charts, graphs, etc.).
60.0	Critique data and data-based claims to avoid being misled by data through identifying bias, confounding and random error. The student will be able to:
	60.01 Provide examples of the social and personal consequences of predictions derived from models built on data.
	60.02 Identify and describe errors in decisions and predictions owing to faulty use of data.
	60.03 Describe issues of privacy and security with respect to data collection, storage, analysis, and insights.
	60.04 Discuss how and when data can support making decisions.
61.0	Apply the machine learning life cycle in the development and use of a machine learning model. The student will be able to:
	61.01 Identify a problem to solve and write a problem definition.
	61.02 Evaluate the problem and identify the data needed to solve the problem.

CTE Standards and Benchmarks	
	61.03 Find, convert, clean, and prepare the data for use in constructing a machine learning model.
	61.04 Evaluate, select, and test an appropriate model using the hold-out dataset method.
	61.05 Select and justify the appropriateness of the learning algorithm for your problem and data.
	61.06 Experiment by adjusting hyper-parameters to tune the model.
	61.07 Use a cross-validation set to determine when training should stop to avoid overfitting.
	61.08 Use a test set to measure performance of the machine learning model.
	61.09 Evaluating success of model: setting criteria, what to do when it fails in lab; fails in field. This can be done by an independent group for high-stakes applications.
	61.10 Use appropriate tools to deploy and use the machine learning model.
	61.11 Monitor model use over a span to time to evaluate its effectiveness on unseen data and make improvements.
62.0	Design and develop AI systems to solve a problem or design solutions for social and ethical issues. The student will be able to:
	62.01 Define and research a real social or ethical problem in the community that could be enhanced or solved with AI.
	62.02 Use a problem-solving process (e.g., design thinking) to collaboratively investigate the identified problem and identify requirements.
	62.03 Analyze the requirements and translate the vision to build complete end-to-end AI solutions.
	62.04 Define and apply a team-based software development process to collaboratively design a solution that uses AI for the problem.
	62.05 Identify and use IDEs, APIs, and packages in program development to build and train machine learning models.
	62.06 Design and develop an AI software solution that addresses a researched interest or problem that could be enhanced or solved with AI.
63.0	Understand how machine learning is applied to solve problems. The student will be able to:
	63.01 Name common computer vision tasks (e.g., image classification, object detection, semantic segmentation, image analysis, face detection, analysis, and recognition; optical character recognition (OCR)) and how they might be used to solve problems.
	63.02 Understand the ways natural language processing can be used to create software to solve a wide range of problems related to written and spoken language.
	63.03 Research the current applications of machine learning in innovations in science, medicine, healthcare, banking and investment, engineering, building and construction, education, and criminal justice.
	63.04 Evaluate an AI systems and identify all the forms of machine learning or AI sub-systems contribute to the systems behavior(s).

CTE Standards and Benchmarks	
64.0	Describe the limitations of machine learning and the decisions that can be made with data. The student will be able to:
64.01	Describe the principle of garbage in/garbage out in relationship to data used to train and evaluate the machine learning model and its accuracy and impact.
64.02	Demonstrate and understanding of the inverse relationship between model complexity and transparency and the impact this has on decision making.
64.03	Research and evaluate the limitations of machine learning and AI and the impact this has on decision-making with AI.
64.04	Research the security vulnerabilities of a machine learning model and ways to mitigate them.
64.05	Research the potential failure modes of AI and evaluate how, when, and why things can go wrong.
64.06	Research and evaluate the sensitivity of machine learning models to understand how and why it is likely to break.
65.0	Evaluate societal impacts of AI on individuals, society, and the environment. The student will be able to:
65.01	Explain the implications of Amara's Law in our ability to, which observes that we over-estimate the impact of any given technology in the short term, and under-estimate it in the long term.
65.02	Evaluate the beneficial and harmful effects of AI and machine learning on the environment.
65.03	Evaluate all the ways that you interact with AI directly and indirectly (e.g., use AI-enable system, contribute data to a dataset, trade privacy and security for access to an AI-tool).
65.04	Research and identify the different ways AI impacts individuals, people groups, and communities in different ways.
65.05	Research and identify the policies and laws companies and government adhere to when developing and using AI systems.
65.06	Research and identify the characteristics of jobs/careers that are created and eliminated by AI.
65.07	Research and evaluate the need for continuing education for all careers and age groups impacted by AI.
65.08	Research and evaluate the security issues relevant to machine learning model creation, storage, and usage.
65.09	Research and evaluate the privacy issues relevant to machine learning model creation, storage, and usage.
65.10	Research and illustrate the potential harms and benefits of a specific machine learning model or AI system.
66.0	Evaluate AI applications to ensure they provide solutions to difficult problems without any unintended negative consequences. The student will be able to:
66.01	Use machine learning tools to evaluate the level of fairness a machine learning model has by quantifying the extent to which each feature of the data influences the model's prediction.
66.02	Research and explain the importance of reliability and safety metrics and procedures used in evaluating the level of risk an AI system may pose to human life.

CTE Standards and Benchmarks	
	66.03 Research and evaluate the security issues relevant to machine learning model creation, storage, and usage.
	66.04 Evaluate the level of Inclusiveness an AI system demonstrates through investigating the degree to which it empowers and engages people, and bring benefits to all parts of society, regardless of physical ability, gender, sexual orientation, ethnicity, or other factors.
	66.05 Evaluate the level of transparency an AI system demonstrates through investigating the degree to which users are made fully aware of the purpose of the system, how it works, and what limitations may be expected.
	66.06 Research and identify the strategies individuals, companies, and governments use to demonstrate accountability in AI.
67.0	Research and explain the advancements in computing hardware that make AI possible. The student will be able to:
	67.01 Explain the original purpose of Graphical Processing Units (GPUs) and their role in advancing the field of deep learning.
	67.02 Explain the purpose and function of GPUs in decreasing the training time of machine learning and identify applications that use this approach in the real world.
	67.03 Explain the purpose and function of Tensor Processing Unit (TPU) as an AI accelerator application-specific integrated circuit (ASIC) for neural network machine learning and identify applications that use this approach in the real world.
	67.04 Explain why CPUs are not sufficient for training most machine learning models.
	67.05 Compare and contrast the pros and cons of using GPUs, TPUs, and FPGAs in data processing and performance improvements of AI-based applications.
68.0	Create a portfolio of AI projects that demonstrate the ability to program machine learning models using a wide range of AI algorithms. The student will be able to:
	68.01 Identify common vendors and range of AI, cognitive services, machine learning, and knowledge mining available to architect and implement AI systems involving natural language processing, speech, computer vision, and conversational AI.
	68.02 Analyze requirements for AI solutions, recommending the appropriate tools and technologies to solve a problem.
	68.03 Develop and explain the development process and architecture of a chatbot.
	68.04 Develop and explain the development process and architecture of a recommender system.
	68.05 Develop and explain the development process and architecture of an application that uses natural language processing.
	68.06 Develop and explain the development process and architecture of an application that uses computer vison.
	68.07 Use regression modeling with linear and logistical regression to make a time series prediction model.
	68.08 Use naive bayes, k-nearest neighbor, and support vector machines to develop a classification model.
	68.09 Use random forest and the accompanying boosting algorithms such as XGBoost and CatBoost to develop a Decision tree model.
	68.10 Use isolated forests, PCA or K-Means clustering to develop an Anomaly detection model.

CTE Standards and Benchmarks	
	68.11 Demonstrate the ability to use regularization, dimension reduction, and cross-validation in the processes of model selection, evaluation, and interpretation.
	68.12 Engage in continuous learning to upgrade skills and adapt to change to complete portfolio projects.
	68.13 Execute projects that demand critical and creative thinking, planning and problem-solving using research and investigation skills.
	68.14 Apply multiple literacies (data, information, historical, etc.) to identify and understand problems; ask appropriate questions; and design an appropriate solution.
	68.15 Explain the usefulness of the AI models they create to a wide range of stakeholders.
69.0	Research and evaluate various AI careers involved in AI system usage, design, development, deployment, and maintenance. The student will be able to:
	69.01 Explain the roles, responsibilities, tools, skills, expertise, and education needed for AI researchers to develop new machine learning algorithms, architectures, applications, and approaches to solve challenging problems.
	69.02 Explain the roles, responsibilities, tools, skills, expertise, and education needed for AI or machine learning engineers to architect and implement AI algorithms, models, and systems.
	69.03 Explain the roles, responsibilities, tools, skills, expertise, and education needed for AI solutions architect to design AI systems that meet the business needs for customers.
	69.04 Explain the tools, skills, expertise, and education needed for data scientists to train machine learning models that can make predictions and inferences based on the relationships they find in the data.
	69.05 Explain the roles, responsibilities, tools, skills, expertise, and education needed for data engineers to design and implement the management, monitoring, security, and privacy of data solutions.
	69.06 Explain the roles, responsibilities, tools, skills, expertise, and education needed for database administrators to implement and manage cloud and on premises databases that work with AI-base data services.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Applied Robotics**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	9410100
CIP Number	0615030330
Grade Level	9-12
Program Length	4 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of the principles and applications of robotics engineering and its effect upon our lives and the choosing of an occupation. The content and activities will also include the study of entrepreneurship, safety, and leadership skills. This program focuses on transferable skills and stresses understanding and demonstration of science and mathematics knowledge, technological tools, machines, instruments, materials, processes and systems related to robotics.

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 credits.

It is recommended (but not required) that students complete or be concurrently enrolled in advanced science (physics) and mathematics courses (e.g., trigonometry, calculus).

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
9410110	Foundations of Robotics	ENG 7G ENG TEC 7G ROBOTICS 7G TEC ED 1 @2 ENG&TEC ED1@2	1 credit	3	CT
9410120	Robotic Design Essentials		1 credit	3	CT
9410130	Robotic Systems		1 credit	3	CT
9410140*	Robotic Applications Capstone		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

** Note: Course 9410140 is intended to serve as a capstone course.*

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 robotics, its history, applications, and evolution.
02.0 Describe programming concepts and the forms of applied logic.
03.0 Describe the role of sensors in the field of robotics.
04.0 Demonstrate an understanding of the foundations of electronics.
05.0 Describe the operation of DC motors and servos used in robotics.
06.0 Demonstrate an understanding of engineering design principles.
07.0 Explain fundamental physics concepts applicable to the field of robotics.
08.0 Demonstrate the safe and proper use of electronic and other lab equipment, tools, and materials.
09.0 Build, program, and configure a robot to perform predefined tasks.
10.0 Solve problems using critical thinking skills, creativity, and innovation.
11.0 Correlate elements of artificial intelligence to their functions in robotics.
12.0 Describe the various classification schemes of sensors applicable to robotics.
13.0 Explain how electronic devices are used in the operation of a robotic assembly.
14.0 Demonstrate an understanding of various technologies used in the design of robotic assemblies.
15.0 Demonstrate an understanding of advanced mathematics and physics associated with the design of a robotic assembly.
16.0 Create a program to control a robotic mechanism.
17.0 Describe the operation and use of various forms of electrical motors in robotic assemblies.
18.0 Demonstrate an understanding of basic 3D modeling concepts.
19.0 Describe the approaches, challenges, and problem-solving methodologies involved with integrating artificial intelligence into robotic systems.
20.0 Describe the role of specialized sensors in the design and operation of robotic systems.
21.0 Describe the use of specialized electronic applications used in robotic systems.
22.0 Demonstrate the applicability of hybrid systems in robotics.
23.0 Demonstrate an understanding of underlying principles of environmental physics related to robotic technology.
24.0 Demonstrate an understanding of the manufacturing process and its impact on robotics.
25.0 Demonstrate an understanding of topographical and environmental considerations in robotic assembly design.
26.0 Create a program to control a robotic system.
27.0 Demonstrate an understanding of technologies for communication with and among robotic systems.
28.0 Demonstrate an understanding of static and dynamic modeling and simulation concepts related to the design of robotic systems.
29.0 Identify, define, and justify a technical design problem for resolution.
30.0 Conduct research and investigation into the stated problem.
31.0 Design a solution to the problem and create a working prototype for testing.
32.0 Create and deliver a formal presentation in a suitable form of the solution to the problem.
33.0 Perform and graphically represent an evaluation of proposed design solutions using specific criteria, including product specifications.
34.0 Evaluate and select appropriate testing methodologies for testing the product, conduct product testing, refine the design as needed, and document the process and results.

Florida Department of Education
Student Performance Standards

Course Title: **Foundations of Robotics**
Course Number: **9410110**
Course Credit: **1**

Course Description:
This course provides students with a foundation in content and skills associated with robotics and automation, including artificial intelligence, electronics, physics, and principles of engineering.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of robotics, its history, applications, and evolution. The student will be able to:
01.01	Explore robotics history through research of the industry.
01.02	Compare and contrast various applications of automation and robotics.
01.03	Describe emerging technologies and their implications on the field of robotics.
02.0	Describe programming concepts and the forms of applied logic. The student will be able to:
02.01	Describe the role of decision logic in robotics.
02.02	Understand Boolean logic, its operations and laws, as used in robotics.
02.03	Translate data specifications into truth tables and extract logical expressions.
02.04	Solve simple Boolean algebra problems.
02.05	Discuss Human Computer Interaction (HCI) and describe its role in robotics.
03.0	Describe the role of sensors in the field of robotics. The student will be able to:
03.01	Define sensor.
03.02	Describe the basic operation common to all sensors.
03.03	Describe the types of sensors and ways in which they can be categorized.
03.04	Differentiate between digital and analog sensors relative to their use in robotics.

CTE Standards and Benchmarks	
04.0	Demonstrate an understanding of the foundations of electronics. The student will be able to:
04.01	Define voltage, current, resistance, inductance, and capacitance.
04.02	Describe the difference between alternating and direct current.
04.03	Identify and describe the operation of common electronic components.
04.04	Compare and contrast series and parallel circuits.
04.05	Define Ohm’s Law and Kirchhoff’s Laws.
04.06	Perform basic soldering techniques and breadboard construction.
04.07	Analyze simple circuits using common electronic test equipment and tools.
04.08	Describe the characteristics of analog and digital signals.
04.09	Translate logical expressions into schematic or symbolic representation.
04.10	Create basic schematic drawings of electronic circuitry.
05.0	Describe the operation of DC motors and servos used in robotics. The student will be able to:
05.01	Describe how DC motors are used in robotics.
05.02	Describe how speed and torque are controlled in DC motors.
05.03	Describe how servos are used in robotics (e.g., robot arms, legs, steering, et al).
05.04	Describe how angle and torque are controlled in a servo motor.
05.05	Describe magnetics and its use and implications in robotics.
06.0	Demonstrate an understanding of engineering design principles. The student will be able to:
06.01	Describe the steps involved in the engineering design process and the activities performed in each step.
06.02	Describe the role of diagnostics and troubleshooting to the engineering design process.
07.0	Explain fundamental physics concepts applicable to the field of robotics. The student will be able to:
07.01	Describe Newton's Laws of Motion (inertia, net force, reaction) and relate their applicability to robotics.

CTE Standards and Benchmarks	
	07.02 Compare and contrast the forms of energy (e.g., thermal, solar, mechanical, kinetic, potential, et al.) employed in robotics.
	07.03 Relate the concept of time and rate to its application in robotics.
	07.04 Relate how material properties (e.g., mass, density, strength, et al) have applicability to robotics.
	07.05 Name the six simple machines (i.e., lever, inclined plane, wheel and axle, screw, wedge, and pulley) and describe their application to robotics.
	07.06 Explain and demonstrate how gear ratios are used for increasing or decreasing power or speed.
08.0	Demonstrate the safe and proper use of electronic and other lab equipment, tools, and materials. The student will be able to:
	08.01 Apply safety rules in the use of electronic instruments and demonstrate proper care and maintenance for the equipment during storage and use.
	08.02 Use testers to determine the condition of electronic components.
	08.03 Demonstrate proper soldering applications.
	08.04 Identify and use common electrical and electronics hand tools.
	08.05 Follow laboratory safety rules and procedures including use of personal protection gear.
	08.06 Demonstrate good housekeeping skills within the laboratory.
	08.07 Identify OSHA color-coding safety standards.
	08.08 Explain fire prevention and safety precautions and practices for extinguishing fires.
	08.09 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment (example: LiPo batteries).
09.0	Build, program, and configure a robot to perform predefined tasks. The student will be able to:
	09.01 Design a robot.
	09.02 Create programs as required using robotic software that will allow the robot to perform a set of tasks.
	09.03 Configure subsystems to operate the robot.
	09.04 Create and present a proposal, including drawings, flow charts, and specifications, describing the robot, the tasks and rationale, and the results.
10.0	Solve problems using critical thinking skills, creativity, and innovation. The student will be able to:

CTE Standards and Benchmarks
10.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
10.02 Employ critical thinking and interpersonal skills to resolve conflicts.
10.03 Identify and document workplace performance goals and monitor progress toward those goals.
10.04 Conduct technical research to gather information necessary for decision-making.

Florida Department of Education
Student Performance Standards

Course Title: **Robotic Design Essentials**
Course Number: **9410120**
Course Credit: **1**

Course Description:
This course provides students with content and skills essential to the design and operation of robotics, including artificial intelligence, sensors, electronic devices, engineering technologies, motion physics, electrical motors, programming, simulation and modeling, and critical thinking skills.

CTE Standards and Benchmarks	
11.0	Correlate elements of artificial intelligence to their functions in robotics. The student will be able to:
11.01	Describe the types of sensor output required for various algorithms used in robotics.
11.02	Formulate a schema (e.g., logic flow diagram.) for robotic control based on sensor data interpretation.
11.03	Explain how artificial intelligence and motion sequences are impacted by controlling sensor data and interpretation.
11.04	Describe the design implications and options for sensor data and interpretation algorithms employed for autonomous robotic applications.
12.0	Describe the various classification schemes of sensors applicable to robotics. The student will be able to:
12.01	Compare and contrast the characteristics, benefits, constraints, and cost implications of analog and digital sensors.
12.02	Differentiate between passive and active sensors relative to their applicability and suitability for various robotic applications.
12.03	Compare and contrast open and closed loop feedback/control systems.
13.0	Explain how electronic devices are used in the operation of a robotic assembly. The student will be able to:
13.01	Design and build breadboard or printed circuit boards for a robotic assembly.
13.02	Describe the advantages, limitations, and operation of electronic control and feedback systems.
13.03	Describe the operation and design considerations of electronic devices used to control robotic assemblies.
13.04	Describe the kinds of electronic devices used as input/output devices in a robotic assembly and explain the rationale for their use.
14.0	Demonstrate an understanding of various technologies used in the design of robotic assemblies. The student will be able to:

CTE Standards and Benchmarks	
14.01	Describe the underlying principles associated with pneumatic and hydraulic devices used in the design of a robotic assembly.
14.02	Describe the underlying principles of electricity and electrical components, to include power sources, consumption, and heat issues.
14.03	Interpret manufacturer's specification documentation for selected components.
14.04	Compare and contrast the operation, advantages, and constraints of wired and wireless strategies for communicating with robotic assemblies.
14.05	Identify the design considerations associated with materials used in robotic assemblies and describe how the intended operational environment plays a role in the design.
14.06	Discuss the methodologies and tools used in resolving systems integration challenges in robotic systems.
15.0	Demonstrate an understanding of advanced mathematics and physics associated with the design of a robotic assembly. The student will be able to:
15.01	Employ the concepts of acceleration and velocity as they relate to the kinematic design of robotic assemblies.
15.02	Describe the term "degrees of freedom" and relate it to the design of joints used in robotic assemblies.
15.03	Describe angular velocity/momentum and its role in the design of robotic joint motion, balance, and mobility.
15.04	Explain impulse-momentum theory and illustrate its applicability to the design of robotic assemblies.
15.05	Explain translational, rotational, and oscillatory motion in terms of their applicability to the design of robotic assemblies.
16.0	Create a program to control a robotic mechanism. The student will be able to:
16.01	Demonstrate an understanding of coding semantics, syntax, and implementation.
16.02	Apply programming best practices for commenting and documentation.
16.03	Describe how logic structures (conditional execution, loops, etc.) control the flow of a program.
16.04	Write pseudocode using logic structures to solve a problem.
16.05	Write code for evaluating a condition and performing an appropriate action using If/then statements.
16.06	Write code for performing actions within a code segment (using do/while statements) for as long as a given condition exists.
16.07	Write code that loops through a series of actions for a specified increment.
16.08	Write code that evaluates sensor data to provide feedback control.

CTE Standards and Benchmarks
17.0 Describe the operation and use of various forms of electrical motors in robotic assemblies. The student will be able to:
17.01 Explain the operation and use of stepper motors to control or limit movement of a robotic assembly.
17.02 Explain the operation and primary use of AC and DC motors in robotic assemblies.
17.03 Explain the operation, use, and advantages of brushless motors used in robotics.
17.04 Explain the types, use, and advantages of linear actuators used in robotics.
10.0 Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
10.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
10.02 Employ critical thinking and interpersonal skills to resolve conflicts.
10.03 Identify and document workplace performance goals and monitor progress toward those goals.
10.04 Conduct technical research to gather information necessary for decision-making.
18.0 Demonstrate an understanding of basic 3D modeling concepts. The student will be able to:
18.01 Compare and contrast 3D modeling software applications that offer a perspective view, an orthographic view, additive manufacturing, or a combination.
18.02 Explain how Cartesian coordinate systems are used to locate objects in three-dimensional space.
18.03 Describe basic geometric shapes available in 3D modeling software (sphere, cube, cylinder, torus, cone, plane, axis point).
18.04 Describe basic shapes available in 2D modeling software (arcs, ellipses, circles, curves, freehand curves, polygons, splines).
18.05 Define the parameters used for determining the size, placement, and orientation of a modeling object.
18.06 Describe the Boolean modeling operations of union, subtraction, and intersection.
18.07 Describe how extrusion or sweeping techniques transform 2D objects into 3D objects.
18.08 Describe the lofting technique for creating 3D objects.
18.09 Describe the revolve or lathe techniques for animating a 2D object and give examples of their application.
18.10 Describe the scale, rotate, and move actions that comprise the transformation technique for animating a 3D object.
18.11 Describe the object parameters modified using the deformation technique and provide examples of its use.

CTE Standards and Benchmarks	
	18.12 Describe the copy or clone technique.
	18.13 Describe the mirror technique.
	18.14 Compare and contrast the wire frame and solid viewing tools.
	18.15 Describe basic viewing navigation tools such as zoom, rotate, and panning.
	18.16 Define plug-in and describe how it extends the capability of the modeling program.
	18.17 Describe the export function and its value when producing visualizations.
09.0	Build, program, and configure a robot to perform predefined tasks. The student will be able to:
	09.01 Design a robot.
	09.02 Create programs as required using robotic software that will allow the robot to perform a set of tasks.
	09.03 Configure subsystems to operate the robot.
	09.04 Create and present a proposal, including drawings, flow charts, and specifications, describing the robot, the tasks and rationale, and the results.

Florida Department of Education
Student Performance Standards

Course Title: **Robotic Systems**
Course Number: **9410130**
Course Credit: **1**

Course Description:
This course provides students with extended content and skills essential to the design and operation of robotic systems, including artificial intelligence, specialized sensors, electronic applications, engineering technologies, environmental physics, manufacturing, topographical considerations, programming, communications, simulation and modeling, and critical thinking skills.

CTE Standards and Benchmarks	
19.0	Describe the approaches, challenges, and problem-solving methodologies involved with integrating artificial intelligence into robotic systems. The student will be able to:
19.01	Compare and contrast symbolic and sub-symbolic approaches to integrating artificial intelligence into robotic systems.
19.02	Describe an intelligent agent and relate its role to the operation of robotic systems.
19.03	Discuss the classes of intelligent agents and their application in the design of robotic systems.
19.04	Describe the obstacles to integration of artificial intelligence components in robotic systems.
20.0	Describe the role of specialized sensors in the design and operation of robotic systems. The student will be able to:
20.01	Explain how Global Positioning System (GPS) sensors are used in robotic systems.
20.02	Discuss the application of laser range finders to the operation of robotic systems.
20.03	Describe the types and uses of optical sensors in robotic systems.
20.04	Describe the ways in which gyroscopes are used in robotic systems.
20.05	Describe the operation of an accelerometer and the ways in which accelerometers are used in robotic systems.
20.06	Discuss the various types of pressure sensors and how they are used in robotic systems.
20.07	Discuss the various applications of vision and voice activation sensors.
21.0	Describe the use of specialized electronic applications used in robotic systems. The student will be able to:
21.01	Explain the various methods for controlling robotic systems and the form of electronic feedback system needed for the appropriate sensor (example: PWM-Pulse width modulation).

CTE Standards and Benchmarks	
	21.02 Describe the concept of Fail Safe and how such components are integrated into robotic systems.
	21.03 Describe the electronic operation and application of electrically, pneumatically, and hydraulically controlled robot systems.
	21.04 Compare and contrast various sources for powering robotic systems, including solar cells, batteries, and radioisotope thermoelectric generators (RTGs).
22.0	Demonstrate the applicability of hybrid systems in robotics. The student will be able to:
	22.01 Compare and contrast the operation of reactive, behavior-based, and deliberative robot controllers.
	22.02 Discuss real-time systems and their applicability in robotics.
	22.03 Explain the role of Hybrid Control Systems (HCS) in the design and operation of robust robotic systems.
23.0	Demonstrate an understanding of underlying principles of environmental physics related to robotic technology. The student will be able to:
	23.01 Describe thermal dynamics and discuss its practical application to robotics, particularly as it relates to motor and gear selection.
	23.02 Describe the concept of pressure and relate its implications on robotic assemblies, include methods and forms or measurement.
	23.03 Distinguish between tolerance and allowance.
	23.04 Explain dimensional and variation tolerance and their applicability to the design and operation of robotic systems.
	23.05 Describe the concept of fault-tolerance as it is related to a robotic assembly's degrees of freedom.
24.0	Demonstrate an understanding of the manufacturing process and its impact on robotics. The student will be able to:
	24.01 Describe Computer Integrated Manufacturing (CIM) and its implications on and uses of robotic technologies.
	24.02 Explain the impact of rapid prototyping on the manufacturing process to include Additive Manufacturing.
	24.03 Describe the process and methodology for creating a rapid prototype of an interactive robot.
25.0	Demonstrate an understanding of topographical and environmental considerations in robotic assembly design. The student will be able to:
	25.01 Describe various robot design considerations related to the intended operating environment or medium.
	25.02 Explain the correlation between sensor selection and a robot's operating environment, capability, and autonomy.
	25.03 Explain the term obstacle avoidance and relate its importance to the design, mobility, and autonomy of a robot.
26.0	Create a program to control a robotic system. The student will be able to:

CTE Standards and Benchmarks	
	26.01 Compare and contrast the popular programming languages used to program robots and discuss their suitability for particular environments.
	26.02 Validate selection of wired or wireless communications.
	26.03 Distinguish between holonomic and non-holonomic motion planning relative to feedback and control applications.
	26.04 Describe the process of motion planning and the variations in the underlying algorithm or approach.
27.0	Demonstrate an understanding of technologies for communication with and among robotic systems. The student will be able to:
	27.01 Compare and contrast the features, capabilities, obstacles, and suitability of wired and wireless communication technologies for communicating with a variety of robots.
	27.02 Discuss the methodologies by which static and mobile networked robots communicate with each other.
	27.03 Describe the various forms of sensor-based feedback typically obtainable from a robotic assembly and explain their application and associated challenges (e.g., EMI, bandwidth, etc.) in specific robotic applications (e.g., surgery, hazardous environment inspection, low oxygen/underwater).
	27.04 Troubleshoot an inoperable wireless robotic communication connection.
10.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
	10.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
	10.02 Employ critical thinking and interpersonal skills to resolve conflicts.
	10.03 Identify and document workplace performance goals and monitor progress toward those goals.
	10.04 Conduct technical research to gather information necessary for decision-making.
28.0	Demonstrate an understanding of static and dynamic modeling and simulation concepts related to the design of robotic systems. The student will be able to:
	28.01 Differentiate between static and dynamic modeling relative to designing robotic systems.
	28.02 Explain the role of simulation to the design of mobile and humanoid robots.
	28.03 Create a static simulation of a stationary robot featuring a single multi-segment manipulator.
	28.04 Create a simulation of a mobile robot that features obstacle avoidance.
09.0	Build, program, and configure a robot to perform predefined tasks. The student will be able to:
	09.01 Design a robot.

CTE Standards and Benchmarks	
09.02	Create programs as required using robotic software that will allow the robot to perform a set of tasks.
09.03	Configure subsystems to operate the robot.
09.04	Create and present a proposal, including drawings, flow charts, and specifications, describing the robot, the tasks and rationale, and the results.

Florida Department of Education
Student Performance Standards

Course Title: **Robotic Applications Capstone**
Course Number: **9410140**
Course Credit: **1**

Course Description:
This course provides students with extended content and skills essential to the design and operation of autonomous robotic systems in the context of a capstone project.

CTE Standards and Benchmarks	
29.0	Identify, define, and justify a technical design problem for resolution. The student will be able to:
29.01	Brainstorm and identify a specific problem for a unique robotic solution.
29.02	Write a concise problem statement using technical writing skills.
29.03	Document research that justifies using the problem statement for the robotics project.
30.0	Conduct research and investigation into the stated problem. The student will be able to:
30.01	Use a list of specifications and constraints identified in a decision matrix to develop a list of alternative solutions to the stated problem.
30.02	Conduct research to investigate and determine the merit of his or her alternative solution based on past solutions to the problem.
30.03	Explain the feasibility of his or her solution based on his or her research.
30.04	Develop research strategies for his or her solution, including the use of surveys, phone interviews, and personal contact with experts related to the field of his or her technical problem
31.0	Design a solution to the problem and create a working prototype for testing. The student will be able to:
31.01	Sketch all parts of their design solution including an isometric view of the assembled product.
31.02	Create a set of working drawings for their design solution.
31.03	Interpret and apply the feedback they receive from experts to improve their design solution.
31.04	Refine their design solution, if necessary, based upon expert feedback.
31.05	Document the project's progress in their engineering notebooks.

CTE Standards and Benchmarks	
	31.06 Create a detailed set of instructions for producing a testable prototype based on the information gained through their research.
	31.07 Identify methods and sources for obtaining materials and supplies.
	31.08 Compile a materials list that includes vendors and cost for all necessary materials and equipment to build their prototype.
	31.09 Write a step-by-step procedure for the assembly of their prototype.
	31.10 Build a working prototype that can be tested.
32.0	Create and deliver a formal presentation in a suitable form of the solution to the problem. The student will be able to:
	32.01 Create deliverables to include design brief, presentation, display (e.g., poster, three panel display), and 3D virtual model.
	32.02 Orally present an effective technical presentation on the design solution.
33.0	Perform and graphically represent an evaluation of proposed design solutions using specific criteria, including product specifications. The student will be able to:
	33.01 Create a description of the product specifications for the design solution.
	33.02 Objectively evaluate proposed design solutions using specific criteria.
	33.03 Select the best design solution option using a decision matrix.
	33.04 Graphically represent the results of the design solution evaluation.
34.0	Evaluate and select appropriate testing methodologies for testing the product, conduct product testing, refine the design as needed, and document the process and results. The student will be able to:
	34.01 Select and describe a valid testing method that will be used to accurately evaluate their design solution's ability to solve their problem.
	34.02 Prepare a description of the testing method that will be used to valid the designed solution.
	34.03 Create a valid justification for the selected testing method.
	34.04 Devise a list of testing criteria that will be used to evaluate the success or failure of their prototype testing
	34.05 Identify, define, and implement needed modifications to their testing method based on expert feedback and their ongoing research.
	34.06 Document their project's progress.
	34.07 Create a detailed set of instructions for testing the prototype that will be valid, repeatable, and reliable.

CTE Standards and Benchmarks
34.08 Evaluate and explain the effectiveness of their design at solving the problem they have defined.
34.09 Document the test results and project progress.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Advanced Aerospace Technology**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	9401200
CIP Number	0615080105
Grade Level	9-12
Program Length	4 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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 Engineering and Technology Education 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 Engineering and Technology Education career cluster.

The content includes but is not limited to principles of flight, space exploration, space policy and international space law, computer aid design software and basic concepts of robotics.

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 years.

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

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
9401210	Introduction to Space	ENG 7G PLTW PTE 7G TEC ED 1 @2	1 credit	3	CT
9401220	Space Exploration & Utilization		1 credit	3	CT
9401230	Aerospace Design, Modeling & Simulation		1 credit	3	CT
9401240	Advanced Aerospace Mechanical Design		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

National Standards (NS)

Next Generation Science Standards correspond to the standards and/or benchmarks for the Space Exploration program can be found using the following link: https://www.nextgenscience.org/

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:

Introduction to Space – 9th Grade

01.0 Explain the importance of space exploration and how it affects human life. Identify historical contributions made by space pioneers and explain the need for future space exploration.
02.0 Explain the origins of the universe and associated theory and describe what occurred between the Big Bang and the current period as well as what is expected to occur in the future.
03.0 Describe the orbits of celestial bodies as well as the different types of orbits.
04.0 Identify the planets that are in our solar system while describing the physical characteristics of individual planets.
05.0 Describe patterns of the organization, distribution and forces of matter in the universe.
06.0 Explain the seven basic systems on a spacecraft beginning with propulsion and ending with structures.
07.0 Describe how rockets work and propulsion types as well as the methods of maneuvering and stabilization.
08.0 Demonstrate an understanding of the influence of aerospace technology on history.
09.0 Describe the Skylab Program and associated challenges and achievements.
10.0 Investigate the history of the Space Shuttle Program as well as the rationale for authorizing the program.
11.0 Describe the history and design of the International Space Station (ISS).
12.0 Discuss military space history and the newly formed U.S. Space Force.
13.0 Explain the Artemis Program, what it proposes to accomplish, the use of new and innovative technologies and systems for deep space exploration.
14.0 Describe the commercial space program and explain the need for a diversification of spacecraft for the commercialization of space.

Space Exploration & Utilization – 10th Grade

15.0 Explain the evolutionary process of general space policy.
16.0 Evaluate the effectiveness of scientific space policy from the competing Superpowers during the Cold War.
17.0 Identify the historical record of space policy and law to the direction of future exploration programs.
18.0 Analyze how the major areas of space exploration and commercial space programs are shaped by legislative space policy and law.
19.0 Validate how important it is to have international law that governs space activities and space applications.
20.0 Examine the contributions of international policy and law for access to space exploration.
21.0 Differentiate the roles of national governments and international organizations in the regulation of space activities and applications.
22.0 Discuss the military and security issues that are relevant to space activities and applications.
23.0 Identify applicable regimes governing remote sensing, GIS satellite meteorology, global climate activities, satellite communications, and global navigation satellite systems.
24.0 Evualate space exploration goals and limitations that are available within international partnerships.
25.0 Develop strategic advantages and disadvantages in planning cooperative partnerships in space.
26.0 Predict if there could be legal issues in using robotic and artificial intelligence in lunar and planetary stations as well as space resource exploration.
27.0 Demonstrate an understanding of how robotics, its history, applications, and evolution had a significant impact on the evolution of space exploration and technology development.

28.0 Expalin the history and evolution of artificial intelligence (AI) used in space exploration and technology development.
29.0 Investigate examples of artificial intelligence (AI) applications utilized on Earth and for space exploration.
30.0 Justify the use of artificial intelligence and determine if space and international laws should be followed for space exploration.

Aerospace Design, Modeling & Simulation – 11th Grade

31.0 Demonstrate the use of artificial intelligence and determine if space and international laws should be followed for space exploration.
32.0 Apply knowledge of how to create and modify a sketch.
33.0 Illustrate how to create solids from sketches.
34.0 Create and manage assemblies and subassemblies.
35.0 Demonstrate how to create drawings.
36.0 Apply dimensions and annotations.
37.0 Demonstrate a full and complete understanding of the CAD software by addressing a real-world challenge provided by a Space Industry Partner.
38.0 Prepare and present the final design to the Space Industry Partner in a professional manner.
39.0 Demonstrate your understanding of essential modeling and simulation terms, careers, and uses.
40.0 Demonstrate information fluency using emerging research techniques and technology.
41.0 Demonstrate a knowledge of the information technology industry, the history of computers as they relate to modeling and simulation.
42.0 Research programming languages, different operating systems, and evolving software as they relate to modeling and simulation.
43.0 Demonstrate an understanding of how to create and texture models for use in the Modeling and Simulation (M&S) environment.
44.0 Demonstrate knowledge of basic materials and textures.
45.0 Demonstrate knowledge of basic lighting.
46.0 Explain visual and distributed simulation.
47.0 Use modeling and simulation to create a process simulation (operational, environmental, manufacturing, assembly work steps).

Advanced Aerospace Mechanical Design – 12th Grade

48.0 Demonstrate the use of CAD for Mechanical Design related to Component Modeling.
49.0 Demonstrate the use of CAD for Mechanical Design related to 3D Assembly Modeling and Management.
50.0 Demonstrate the use of CAD for Mechanical Design related to Technical Detailed Drawing Creation.
51.0 Demonstrate Advanced Aerospace Concepts.
52.0 Demonstrate an understanding of the Basics of Geometric Dimensioning & Tolerancing (GD&T)
53.0 Demonstrate an understanding of 2.5 Axis Milling in preparation for the Autodesk Certification.
54.0 Demonstrate understanding of the Manufacturing Planning Process for Autodesk Certification.
55.0 Demonstrate an understanding of CAD Modeling and model preparation for Autodesk Certification.
56.0 Demonstrate an understanding of how to create and simulate Computer Numerical Controlled (CNC) Milling Toolpaths for Autodesk Certification.
57.0 Demonstrate an understanding of propulsion systems and their performance factors.
58.0 Create a real-world design challenge provided by the customer, a Space Industry Partner.

Florida Department of Education
Student Performance Standards

Course Title: **Introduction to Space**
Course Number: **9401210**
Course Credit: **1**

Course Description:

This course is a basic study of the concepts, development, and application of space flight technology, emphasizing the U. S. role in current and future space operations. Topics include the Big Bang Theory, history of space flight, Space Shuttle operations and crew training, Commercial Space Applications, Spacecraft Systems, and the outlook for the future.

CTE Standards and Benchmarks	
01.0	Explain the importance of space exploration and how it affects human life. Identify historical contributions made by space pioneers and explain the need for future space exploration. The student will be able to
01.01	Identify the connection from early astronomy to the evolution of space flight.
01.02	Discover and paraphrase the impact of how history, beginning with classical Greek astronomy through Newton, has influenced spaceflight.
01.03	Explain critical developments beginning in 3000 BC to the present.
01.04	Examine early astronomy and the evolution of space science.
01.05	Explain the importance of space exploration.
01.06	Explain the role of early rocket clubs and demonstrate how the early rocket clubs, the NAZI's research into rocketry, and how politics and the competition between Russia and the U.S. in the Space Race effected the U.S.
01.07	Identify how the World Wars impacted the space program.
01.08	Compare the influence of socially, economically, and politically spaceflight has had on not only the U.S but the entire world.
01.09	Identify key events and players in the development and evolution of spaceflight.
02.0	Explain the origins of the universe and associated theory and describe what occurred between the Big Bang and the current period as well as what is expected to occur in the future. The student will be able to:
02.01	Identify evidence used to develop and verify the Big Bang Theory.
02.02	Explain the major evolutionary events associated with the formation of the universe.
02.03	Explain the cosmological chain of events from the beginning of the universe until the current period and beyond.
03.0	Describe the orbits of celestial bodies as well as the different types of orbits. The student will be able to:
03.01	Explain gravitational attraction as it pertains to celestial orbits.

CTE Standards and Benchmarks	
	03.02 Identify the different classifications of orbits.
	03.03 Explain orbit precession.
	03.04 Describe and apply the coordinate system used to locate objects in the sky.
	03.05 Explain the physical aspects of space flight.
	03.06 Describe the key concepts, relationships, and ideas behind spaceflight.
04.0	Identify the planets that are in our solar system while describing the physical characteristics of individual planets. The student will be able to:
	04.01 Explain the formation, composition, and function of the Sun.
	04.02 Describe the Sun and its purpose within the Solar System.
	04.03 Identify characteristics of planets in the Solar System.
	04.04 Describe the Solar System and the associated planets, such as, the physical characteristics of planets, core, surface composition, rings, moon(s), etc.
	04.05 Investigate important historical contributions to space flight made by space pioneers.
	04.06 Examine and discuss the formation of the planets and dwarf planets.
05.0	Describe patterns of the organization, distribution and forces of matter in the universe. The student will be able to:
	05.01 Identify the multiple galaxies, stars, moon, asteroids, etc., that exist in space.
	05.02 Describe the formation process the various stars.
	05.03 Describe black holes and their origin.
	05.04 Describe and explain the creation and behavior of constellations.
	05.05 Illustrate the difference between planets and dwarf planets.
	05.06 Differentiate terrestrial and Jovian planets.
	05.07 Discuss the creation of the Kuiper Belt and its relation to an asteroid belt.
06.0	Explain the seven basic systems on a spacecraft beginning with propulsion and ending with structures. The student will be able to:
	06.01 Describe the uniqueness of spacecraft systems designs.
	06.02 Explain spacecraft project planning.
	06.03 Describe launch vehicles.
	06.04 Explain satellite systems.
	06.05 Explain NASA’s Deep Space Network.

CTE Standards and Benchmarks	
07.0	Describe how rockets work and propulsion types as well as methods of maneuvering and stabilization. The student will be able to:
07.01	Describe Isaac Newton's third law, action-reaction, and how it pertains to rocket propulsion.
07.02	Identify the five types of rocket propulsion and the advantages / disadvantages of each one.
07.03	Explain how a rocket maneuvers in flight.
07.04	Explain static and dynamic rocket stability to describe the condition of remaining upright, or in the direction of flight.
07.05	Describe the three primary measures of propulsion system performance and the associated factors for each one.
07.06	Explain how propulsion system performance is measured.
07.07	Identify early missiles and explain their propulsion methodologies.
08.0	Demonstrate an understanding of the influence of aerospace technology on history. The student will be able to:
08.01	Describe Manned and Unmanned Spacecraft.
08.02	Explain the importance of Mercury, Gemini and Apollo Programs to the U.S. Space Exploration Program.
08.03	Outline the contributions of Mercury, Gemini and Apollo Programs have made to future space exploration.
08.04	Explain why Mercury, Gemini and Apollo Programs remain the greatest contribution to the space race.
08.05	Evaluate the NASA rocket program was a key factor in the development of the U.S. rockets.
08.06	Explain the critical importance of Von Braun and why he was part of Operation Paperclip.
08.07	Summarize the creation of NASA.
08.08	Investigate the importance of the Soviet's first manned launch in 1961.
08.09	Demonstrate an understanding of the development and function of the various rockets.
08.10	Discuss the flight modes.
08.11	Describe and explain the assorted types of Space flight hardware.
08.12	Explain the development and versatility of the Space Lunar Module.
08.13	Explain the criticality of Apollo 13.
08.14	Discuss the value of studying Moon rocks.
09.0	Explain the Skylab Program and associated challenges and achievements. The student will be able to:
09.01	Explain the history of space stations, beginning with Skylab.
09.02	Explain and connect the actions of the people and countries that initiated the first space stations.

CTE Standards and Benchmarks	
	09.03 Analyze the hardware and people that contributed to the program.
	09.04 Describe the hardware functions and contributions to future space exploration designs.
	09.05 Describe the Skylab missions and how they have impacted current space travel.
	09.06 Evaluate the multiple levels of the original stations and demonstrate what their functions were.
	09.07 Explain on the amount of cargo needed to sustain a crewed mission.
	09.08 Validate the importance of the Skylab missions and their contributions to the development of the ISS.
	09.09 Explain the criticality of the delays in the Space Shuttle and the impact it had on Skylab.
10.0	Investigate the history of the Space Shuttle Program as well as the rationale for authorizing the program. The student will be able to:
	10.01 Describe the rationale for establishing the Space Shuttle Program.
	10.02 Identify some of the important dates and events in the Space Shuttle Program.
	10.03 Identify and describe the major hardware elements of the Space Shuttle Vehicle.
	10.04 Describe the function of some of the Space Shuttle Vehicle major hardware element subsystems.
	10.05 Describe the purpose of each of the major hardware elements of the Space Shuttle Vehicle.
	10.06 Identify the phases of a Space Shuttle mission.
11.0	Describe the history and design of the International Space Station (ISS). The student will be able to:
	11.01 Describe and discuss the history, present and future of the ISS.
	11.02 Describe the earliest imagining of a spaceship/space station from 1983.
	11.03 Discuss the people and countries that are involved in the evolution of the ISS.
	11.04 Explain which hardware was designed and contributed to the program by the various countries.
	11.05 Explain the functions of the hardware and how they have contributed to the designs for future space exploration.
	11.06 Analyze the ISS missions and how they have impacted current life on Earth, life in the ISS itself, and space travel.
	11.07 Identify the multiple levels and functions of the ISS modules and how they have evolved over the years.
	11.08 Describe the assembly process of the ISS and identify the contributions of the various countries.
	11.09 Explain the political impact the multiple countries created during the manufacturing process.
	11.10 Analyze the types and ways research can be conducted on the ISS.
12.0	Discuss military space history and the newly formed U.S. Space Force. The student will be able to:

CTE Standards and Benchmarks	
	12.01 Describe Military Reconnaissance Satellites (U.S. and Soviet).
	12.02 Explain Electronic Intelligence Satellite.
	12.03 Describe Defense Early Warning Satellites.
	12.04 Describe Department of Defense (DOD) Weather Satellites.
	12.05 Describe Nuclear Weapons Test Detection.
13.0	Explain the Artemis Program, what it proposes to accomplish, the use of new and innovative technologies and systems for deep space exploration. The student will be able to:
	13.01 Explain how the Artemis Lunar Exploration program will use innovative new technologies and systems in deep space exploration.
	13.02 Explain and discuss the Gateway as a transfer system.
	13.03 Define how Artemis will allow astronauts to explore more of the moon than has been previously discovered.
	13.04 Demonstrate American leadership and strategic presence in space.
	13.05 Explain why commercial and international partnerships are essential to the space race.
	13.06 Analyze how Artemis will inspire new generations.
	13.07 Identify and examine the multiple iterations of Artemis.
	13.08 Describe the Deep Space Network.
	13.09 Demonstrate how the technology and research garnered from Artemis and Gateway will lead to the first crewed mission to Mars.
	13.10 Identify how history will be made by the U.S. with Artemis III.
14.0	Describe the commercial space program and explain the need for a diversification of spacecraft for the commercialization of space. The student will be able to:
	14.01 Describe the innovative approach to government and commercial partnerships in advancing space exploration.
	14.02 Explain why commercial companies are concentrating on providing human transportation for the foreseeable future.
	14.03 Analyze how commercial companies advancing near Earth space travel will leave NASA free to focus on deep space missions.
	14.04 Discuss the various spacecraft being created commercially, and the companies that are committed to space exploration.
	14.05 Analyze how the commercial companies are being so successful in developing new technologies and spacecraft.
	14.06 Evaluate the laws that had to be adjusted and developed to maintain peaceful co-existence for the U.S. and all other nations.
	14.07 Explain and discuss the process NASA uses to achieve the most optimal results in finding the best spacecraft, overall design, and commercial company that can oversee the program.
	14.08 Analyze the evolution of SpaceX from unknown company to a major player in space exploration.

CTE Standards and Benchmarks	
14.09	Demonstrate knowledge on the innovative and extraordinarily successful vertical takeoff and landing for an orbital rocket SpaceX has designed.
14.10	Explain the differences between the proposed crew capsules that are currently included in the commercial program.
14.11	Explain the Space Act Agreement.
14.12	Discuss the future of commercial space and the role NASA will play in it.

Florida Department of Education
Student Performance Standards

Course Title: **Space Exploration & Utilization**
Course Number: **9401220**
Course Credit: **1**

Course Description:

Students will expand their knowledge of artificial intelligence and robotics with the emphasis on the application for future space exploration. Focus area includes space law as it applies to all national and international space agencies as well as commercial space corporations.

CTE Standards and Benchmarks	
15.0	Explain the evolutionary process of general space policy. The student will be able to:
15.01	Determine if space law is a branch of international space law.
15.02	Compare and contrast space law and internal law.
15.03	Identify regional, bilateral and national sources of that follow space law and international space law.
15.04	Identify international organizations that follow space law and international space law.
16.0	Evaluate the effectiveness of scientific space policy from the competing Superpowers during the Cold War. The student will be able to
16.01	Determine the historical context for space technologies.
16.02	Identify geopolitical climate and national agenda post WWII, Cold War along with their Ideologies.
17.0	Identify the historical record of space policy and law to the direction of future exploration programs. The student will be able to:
17.01	Justify why future space exploration is critical for the future of humanity.
17.02	Explain the importance of continued technology development.
18.0	Analyze how the major areas of space exploration and commercial space programs are shaped by legislative space policy and law. The student will be able to:
18.01	Determine there are a limited number of existing laws governing space, and when dealing with space junk, it is currently under FAA rules. As more and more satellites, rockets, stations, etc., are launched into space, there will need to be more oversight on how to deal with the junk.
18.02	Develop regulations to be adhered to by all space agencies dealing with the proliferation of space junk.
18.03	Identify what exactly is space junk and develop a system to determine the level of danger it poses to the planet, satellites, rockets, stations, etc.
18.04	Describe the growth of commercial space programs through space policy records.

CTE Standards and Benchmarks	
19.0	Validate how important it is to have international law that governs space activities and space applications. The student will be able to:
19.01	Identify the main structure and elements of international space law.
19.02	Determine how various international agencies and corporations provide varied skill sets that can be blended into a program that will benefit the entire world.
20.0	Examine the contributions of international policy and law for access to space exploration. The student will be able to:
20.01	Determine if it is foreseeable there will be political issues that will be problematic within the international agencies and/or the space corporations.
21.0	Differentiate the roles of national governments and international organizations in the regulation of space activities and applications. The student will be able to:
21.01	Explain common missions, technologies and best practices between the national government space agencies and international space corporations.
21.02	Compare the differences in technology approaches and business practices between the national government space agencies and international space corporations.
21.03	Determine the legal, environmental, and logistical agreements that agencies have entered as a group.
22.0	Discuss the military and security issues that are relevant to space activities and applications. The student will be able to:
22.01	Define non-aggressive use of space.
22.02	Determine who was in favor of non-militarization of space vs. non-aggressive use.
22.03	Explain proposals of de-weaponization of space.
22.04	Discuss prohibit of destroying or physically damaging space objects.
23.0	Identify applicable regimes governing remote sensing, GIS satellite meteorology, global climate activities, satellite communications, and global navigation satellite systems. The student will be able to:
23.01	Define Geostationary orbits and specific uses.
23.02	Describe use of remote sensing.
24.0	Evaluate space exploration goals and limitations that are available within international partnerships. The student will be able to:
24.01	Identify how various international agencies and corporations provide varied skill sets that can be blended into a program that will benefit the entire world.
24.02	Discuss if it is foreseeable there will be political issues that will be problematic within the international agencies and/or the space corporations.
25.0	Develop strategic advantages and disadvantages in planning cooperative partnerships in space. The student will be able to:
25.01	Using statistics, analyze whether these partnerships have experienced an increase or decrease in the level of income based on the partnerships of space corporations.
25.02	Describe economic and cultural benefits of these partnerships.

CTE Standards and Benchmarks	
	25.03 Discuss how the presence of these partnerships provide a geopolitical influence for space programs.
26.0	Predict if there could be legal issues in using robotic and artificial intelligence in lunar and planetary stations as well as space resource exploration. The student will be able to:
	26.01 Discuss the benefits of robotic and artificial intelligence usage in space exploration.
	26.02 Determine if there could be a negative impact using robotic and artificial intelligence usage in space exploration.
27.0	Demonstrate an understanding of how robotics, its history, applications, and evolution had a significant impact on the evolution of space exploration and technology development. The student will be able to:
	27.01 Explain how the history of robotics impacted the space industry.
	27.02 Discuss emerging space technologies and the implications on the field of robotics in use for outer space.
28.0	Explain the history and evolution of artificial intelligence (AI) used in space exploration and technology development. The student will be able to:
	28.01 Identify early examples of AI and the contributions utilized in AI development for space exploration and technology development.
	28.02 Explore artificial intelligence and provide examples of how AI is used in space.
	28.03 Critique how AI is used for problem solving, in historical, current and future aspects.
	28.04 Identify international organizations that follow space law and international space law.
29.0	Investigate examples of artificial intelligence (AI) applications utilized on Earth and for space exploration. The student will be able to:
	29.01 Compare current examples of AI used on Earth and in space.
	29.02 Provide an overview if humans use AI in everyday use.
	29.03 Question if AI impacted by humans could be utilized in space.
	29.04 Discuss if AI could solve problems in areas for real-world issues, business needs, and future work in space exploration and technology development.
30.0	Justify the use of artificial intelligence and determine if space and international laws should be followed for space exploration. The student will be able to:
	30.01 Examine the legal personality of AI and its autonomy.
	30.02 Determine if there are legal and liability risks/issues concerning the deployment and use of AI in space.
	30.03 Discuss if data privacy and human rights issues are related to the use of AI in space.

Florida Department of Education
Student Performance Standards

Course Title: **Aerospace Design, Modeling & Simulation**
Course Number: **9401230**
Course Credit: **1**

Course Description:

This course provides students with instruction in the characteristics and evolution of technology, underlying principles of design, and fundamental knowledge and skills in the use of illustration and drafting software. Students will build Computer-aided Design (CAD) skills in 3D design and modelling using 3D design software that unifies design, engineering, electronics, and manufacturing into a single platform. These skills are needed to prepare for further education and careers in the Space Industry, Information Technology and Engineering specialties.

This course also provides students with instruction in aerospace engineering through a series of module projects designed to expose students to the use of CAD software in the aerospace industry. Students will have the opportunity to apply skills learned in class to a series of projects designed by aviation/aerospace industry partners.

In addition, this course provides practical experiences in modeling and simulation concepts, design, storyboarding, development methodologies, essential programming techniques, prototype development, production/operational processes an overview of the development and expansion of the field of Modeling and Simulation and its impact on society and industry. Strategies, processes and methods for conceptualizing modeling and simulation are introduced to serve as a foundation to cultivate interest and introduce technology skills and knowledge necessary for careers in modeling and simulation. Hands-on activities using an entry-level modeling and simulation development tool (e.g., Auto Desk, Solid Works or other comparable software) will be integrated into the curriculum. To further enrich the experience, it is recommended that students take a sequence of electives in some of the following areas: digital art, computer programming, CAD drafting/modeling, 3D printing, web design, gaming and animation, robotics and/or geospatial/geographic information systems.

CTE Standards and Benchmarks	
31.0	Demonstrate an understanding of Computer Aided Design (CAD) Software Workspace and Navigation features. The student will be able to:
31.01	Demonstrate how to navigate the Data panel.
31.02	Describe how to orient a model view.
31.03	Demonstrate how to use the CAD Software Browser.
31.04	Explain how to set grid, units, and snaps.
31.05	Demonstrate how to select objects.
31.06	Demonstrate how to use the timeline.
31.07	Explain how to adjust the visual properties of a model and design workspace.

CTE Standards and Benchmarks	
	31.08 Create a sketch on an origin plane or planar face.
	31.09 Create construction planes, axis, and points.
32.0	Apply knowledge of how to create and modify a sketch. The student will be able to:
	32.01 Select an appropriate sketch tool for the task.
	32.02 Create a sketch.
	32.03 Modify sketch element type and sketch display properties.
	32.04 Generate geometry from an existing body onto a sketch.
	32.05 Demonstrate how to edit a sketch.
	32.06 Identify which sketch constraints apply.
	32.07 Apply and edit dimensions to sketch geometry.
	32.08 Use design parameters to create a parametric model.
33.0	Illustrate how to create solids from sketches. The student will be able to:
	33.01 Create primitive shapes.
	33.02 Create a 3D shape from 2d geometry.
	33.03 Create hole features.
	33.04 Create pattern features.
	33.05 Demonstrate how to modify features.
	33.06 Demonstrate how to use inspect tools.
	33.07 Demonstrate how to use insert tools.
	33.08 Demonstrate how to create a form.
	33.09 Demonstrate how to modify a form.
34.0	Create and manage assemblies and subassemblies. The student will be able to:
	34.01 Describe how to activate a component or subassembly to edit.
	34.02 Demonstrate how to update a component to the most recent version.
	34.03 Demonstrate how to create a component from a body.
	34.04 Demonstrate how to align and/or position components with joints.

CTE Standards and Benchmarks	
	34.05 Demonstrate how to apply joints to components.
	34.06 Demonstrate how to drive joints.
	34.07 Demonstrate how to manipulate components.
	34.08 Demonstrate how to check for interference between components.
35.0	Demonstrate how to create drawings. The student will be able to:
	35.01 Demonstrate how to create drawing sheets.
	35.02 Demonstrate how to place and edit drawing views.
36.0	Apply dimensions and annotations. The student will be able to:
	36.01 Demonstrate how to add and edit dimensions.
	36.02 Demonstrate how to add and edit annotations.
37.0	Demonstrate a full and complete understanding of the CAD software by addressing a real-world challenge provided by a Space Industry Partner. The student will be able to:
	37.01 Describe the challenge to address that was provided by a space industry partner.
	37.02 Create the initial draft of the design to address the challenge in CAD.
	37.03 Demonstrate and present the draft design formally to the Space Industry Partner.
	37.04 Revise the design, based on the Space Industry Partner's comments.
38.0	Prepare and present the final design to the Space Industry Partner in a professional manner. The student will be able to:
	38.01 Demonstrate Space Industry level professionalism by presenting the final design to the Space Industry Partner.
	38.02 Demonstrate industry level product delivery by providing the Space Industry Partner with the agreed upon articles, to include handouts and materials, to signify primary task completion.
39.0	Demonstrate your understanding of essential modeling and simulation terms, careers, and uses. The student will be able to:
	39.01 Define and explain essential modeling and simulation terms and concepts.
	39.02 Explain the difference between Modeling and Simulation and animations or gaming software (SW).
	39.03 Identify disciplines which use modeling and simulation tools and discuss their real-world applications.
	39.04 Identify modeling and simulation related careers and the educational and professional requirements for various fields.
	39.05 Explain the past, present, and future importance of modeling and simulation and its evolution.
	39.06 Compare and Contrast applications of models and analysis across a spectrum of applications in addition to human in the loop.

CTE Standards and Benchmarks	
40.0	Demonstrate information fluency using emerging research techniques and technology. The student will be able to:
40.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, cell phones, portables/handhelds, smart appliances, apps, home networks, augmented reality, networking).
40.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.
40.03	Use technology tools to collaborate and generate a deliverable product.
40.04	Develop and display an electronic portfolio.
40.05	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.
40.06	Correlate the use of social media in the field of modeling and simulation for a variety of purposes.
40.07	Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, import CAD file, file formats).
41.0	Demonstrate a knowledge of the information technology industry, the history of computers as they relate to modeling and simulation. The student will be able to:
41.01	Explain how information technology and modeling and simulation impact the operation and management of industry and society.
41.02	Explain the use of intelligent systems as they pertain to Modeling and Simulation.
41.03	Analyze physical models and organize them conceptually based on their development and historical relevance.
41.04	Create a graphic/visual presentation of a historic simulator or synthetic environment that has evolved over time.
41.05	Describe the evolution of the digital computer as it relates to modeling and simulation.
41.06	Explain the need for and use of input devices and displays to design and create models and simulations.
41.07	Demonstrate an understanding of storage management (e.g., RAM, internal hard drive, external storage, transfer speeds, product lifecycle management (PLM), cloud storage) as it relates to creating and storing digital models and simulations.
41.08	Identify the advantages and limitations of computer-generated models and simulations.
42.0	Research programming languages, different operating systems, and evolving software as they relate to modeling and simulation. The student will be able to:
42.01	Research and understand the history of programming languages and their evolution.
42.02	Demonstrate the three types of programming design approaches (e.g., top-down, structured, and object-oriented).
42.03	Explain the history and purpose of various operating systems (e.g., DOS, Windows, Mac, and Unix/Linux).
42.04	Research and explain various over the counter (OTC) modeling and simulation software products, do a comparison, and present the pros and cons of the various products.
42.05	Explain the factors that can limit the simulation capabilities of personal computers.
42.06	Demonstrate an understanding of the basic concepts of computer maintenance, upgrades, and life cycle support.

CTE Standards and Benchmarks	
43.0	Demonstrate an understanding of how to create and texture models for use in the Modeling and Simulation (M&S) environment. The student will be able to:
43.01	Define the visual modeling process as it pertains to M&S.
43.02	Explain the role of a modeler.
43.03	Demonstrate the application of a texture or image map on a model or part of a model
43.04	Explain the texturing process as it pertains to M&S.
43.05	Explain how realistic texturing and image mapping is achieved and why it is important.
43.06	Explain the simulation production pipeline as it relates to modeling.
43.07	Identify job titles associated with model creation and texturing.
44.0	Demonstrate knowledge of basic materials and textures. The student will be able to:
44.01	Demonstrate an understanding of material and texture storage.
44.02	Demonstrate an understanding of UV mapping.
44.03	Apply textures, CAD color or image mapping to an object.
44.04	Demonstrate an understanding of procedural shaders.
44.05	Demonstrate an understanding of channels.
44.06	Adjust the transparency, luminance, and reflection of a material.
44.07	Demonstrate an understanding of bump and displacement maps.
44.08	Demonstrate knowledge of material projections.
44.09	Understand how light affects the look of materials.
44.10	Understand how camera angles can affect the look of materials.
45.0	Demonstrate knowledge of basic lighting. The student will be able to:
45.01	Compare and contrast real lighting with 3D lighting (sun, environmental, spots, flares, time of day, bright/white/soft).
45.02	Demonstrate an understanding of 3-point lighting (key, fill, back).
45.03	Use include/exclude commands to target light on objects.
45.04	Demonstrate use of negative intensity, specular settings, reflectivity, and others.
46.0	Explain visual and distributed simulation. The student will be able to:
46.01	Explain the difference between visual and distributed simulation.

CTE Standards and Benchmarks	
	46.02 Define and explain the uses for the different types of simulations.
	46.03 Explain the use of visual simulation in distributed simulation.
	46.04 Research and explain distributed simulation protocols as you understand them.
	46.05 Explain the major components in a networked simulation or model.
47.0	Use modeling and simulation to create a process simulation (operational, environmental, manufacturing, assembly work steps). The student will be able to:
	47.01 Demonstrate information fluency by conducting research needed to create a process.
	47.02 Use modeling techniques and software to create a basic operational, manufacturing, assembly work step model/simulation.
	47.03 Communicate the relevance of the model and its impact on the real world.
	47.04 Demonstrate understanding file formats and storage options.
	47.05 Identify and explain parts of the software interface (menus/palettes).
	47.06 Demonstrate ability to use each of the basic tool sets.
	47.07 Demonstrate ability to import, export and save models and images.
	47.08 Demonstrate understanding of layers and channels if supported by the SW.
	47.09 Demonstrate understanding of filters, effects, and plug-ins.
	47.10 Demonstrate understanding of file presets.
	47.11 Demonstrate ability to select a model or texture in the simulation and manipulate it in real-time.
	47.12 Demonstrate ability to transform or correct selections and images (crop, scale, brightness, hue, contrast).
	47.13 Have at least one preset movement programmed into your environment and show how it works (door opening, wrench turn, etc.)
	47.14 Demonstrate non-destructive operations such as hide-show, screen perspective, color to wireframe, view presets, etc.
	47.15 Demonstrate the ability to import, manipulate and export 3D objects.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Aerospace Mechanical Design**
Course Number: **9401240**
Course Credit: **1**

Course Description:

Advanced Aerospace Mechanical Design follows the 11th grade course, Aerospace Design, Modeling & Simulation. This Capstone Project course focuses on Aerospace Mechanical Design Projects provided by Space Industry partners. This course is intended to teach the student advanced Computer-Aided Design (CAD) and further honing their skills to be more beneficial for college and/or more marketable as an after high school career choice in the aerospace industry, specifically for Space Applications. Students will utilize the skills that they acquired in Aerospace Design, Modeling & Simulation and carry them forth to refine the aerospace problem from the 11th grade course, in addition to learning 2.5-axis milling for Computer-Aided Machining in the spring semester. Industry Certification suggestion: Autodesk Certified Associate in CAD for Mechanical Design.

CTE Standards and Benchmarks	
48.0	Demonstrate the use of CAD for Mechanical Design related to Component Modeling. The student will be able to:
48.01	Create and modify sketches.
48.02	Create construction planes and axes.
48.03	Create 3D solid features.
48.04	Inspect and analyze models.
48.05	Use direct modeling features.
48.06	Create and modify freeform parts.
49.0	Demonstrate the use of CAD for Mechanical Design related to 3D Assembly Modeling and Management. The student will be able to:
49.01	Create and organize assembly components.
49.02	Create motion with assembly joints.
49.03	Create and manage motion links.
49.04	Apply assembly interference inspection tools.
50.0	Demonstrate the use of CAD for Mechanical Design related to Technical Detailed Drawing Creation. The student will be able to:
50.01	Create a basic technical drawing.
50.02	Create a basic detailed drawing.

CTE Standards and Benchmarks	
51.0	Demonstrate Advanced Aerospace Concepts. The student will be able to:
51.01	Arrange envelopes, performance, and center-of-gravity envelopes.
51.02	Identify alternative powerplants to fossil fuel combustion.
52.0	Demonstrate an understanding of the Basics of Geometric Dimensioning & Tolerancing (GD&T). The student will be able to:
52.01	Identify the four fundamental elements of GD&T.
52.02	Create a design using GD&T symbology.
52.03	Identify and utilize required tool type, size, and projection.
52.04	Identify and apply required surface finish.
53.0	Demonstrate an understanding of 2.5 Axis Milling in preparation for the Autodesk Certification. The student will be able to:
53.01	Demonstrate how the Dana Panel works to create new projects, folders, and house files.
53.02	Demonstrate an understanding of the Browser Tree and what information is found there.
53.03	Order detailed steps in order to complete a task in chronological order.
53.04	Complete a dialogue box based on the provided features.
53.05	Identify several well-used construction planes and axes based on only an icon or a description of the desired construction element.
53.06	Demonstrate understanding of how the timeline operates.
53.07	Demonstrate how forms are created and edited.
54.0	Demonstrate understanding of the Manufacturing Planning Process for Autodesk Certification. The student will be able to:
54.01	Review detailed drawings.
54.02	Identify machine and work holding requirements.
54.03	Create a tool list.
54.04	Calculate appropriate feeds and speeds.
54.05	Populate a process plan form.
55.0	Demonstrate an understanding of CAD Modeling and model preparation for Autodesk Certification. The student will be able to:
55.01	Create and define sketches.
55.02	Create and modify solid and surface features.
55.03	Apply direct modeling tools.

CTE Standards and Benchmarks	
	55.04 Create and manage assemblies.
56.0	Demonstrate an understanding of how to create and simulate Computer Numerical Controlled (CNC) Milling Toolpaths for Autodesk Certification. The student will be able to:
	56.01 Create and manage a digital tool library.
	56.02 Identify a digital CNC setup.
	56.03 Demonstrate how to import and locate work holding devices.
	56.04 Create toolpaths to rough cut parts.
	56.05 Create toolpaths to finish cut parts.
	56.06 Simulate toolpaths and operations.
57.0	Demonstrate an understanding of how to create required documents to setup and run a CNC Mill for Autodesk Certification. The student will be able to:
	57.01 Create supporting documentation.
	57.02 Export CNC Code for a CNC Mill.
58.0	Complete a real-world design challenge provided by the customer, a Space Industry Partner. The student will be able to:
	58.01 Demonstrate a complete understanding of the challenge provided by the customer.
	58.02 Create the preliminary mechanical design by industry standards.
	58.03 Conduct a Preliminary Design Review (PDR) with the customer and present the design to the customer in a professional manner.
	58.04 Incorporate corporate comments from the PDR into the design.
	58.05 Conduct a Critical Design Review (CDR) with the customer and present the design to the customer in a professional manner.
	58.06 Incorporate comments from the CDR into the design.
	58.07 Finalize the design and present it to the customer in a professional manner.
	58.08 Provide the design per the customer’s process.

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.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Career and Technical Student Organization (CTSO)

The Florida Technology Student Association (FL-TSA) and SkillsUSA are the co-curricular 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.

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.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

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. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.