Course Title: **Machining Technology 1**
Course Number: **9202110**
Course Credit: **1**

Course Description:
The Machining Technology 1 course prepares students for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes beginning skills key to the success of working in the machining industry. Students study workplace safety and organization, job-related mathematics, basic blueprint information, basic measuring operations, benchwork skills, and the history of manufacturing.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
04.0	Demonstrate an understanding of workplace safety and workplace organization--The student will be able to:		SC.912.P.8.1
04.01	Identify safety requirements for manual, electrical-powered, and pneumatic tools.		
04.02	Demonstrate, apply, and provide evidence of safely using manual, electrical-powered, and pneumatic tools.		
04.03	Identify safety requirements for operation of automated machines and equipment.		
04.04	Demonstrate, apply, and provide evidence of safely operating automated machines and equipment.		
04.05	Demonstrate, apply, and provide evidence of properly storing equipment and tools.		
04.06	Demonstrate, apply, and provide evidence of properly storing precision measuring tools.		
04.07	Identify, demonstrate, apply, and provide evidence of understanding of shop safety rules on an ongoing basis.		
04.08	Research and characterize class A, B, and C type fires.		
04.09	Demonstrate and apply the proper procedures for extinguishing class A, B, and C type fires.		
04.10	Identify various workplace injuries related to the machining industry.		
04.11	Demonstrate and practice knowledge of first aid and first response procedures appropriate for this course.		
04.12	Identify and apply safety procedures in case of smoke or chemical inhalation.		
04.13	Demonstrate and apply material handling techniques to safely move materials.		
04.14	Demonstrate and apply proper techniques for lifting loads.		
04.15	Research Occupational Safety Health Administration (OSHA) safety standards.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
04.16	Demonstrate, apply, and provide evidence of understanding Occupational Safety Health Administration (OSHA) safety standards.		
04.17	Locate Material Safety Data Sheets (MSDS).		
04.18	Demonstrate understanding and knowledge of using and applying the information located on Material Safety Data Sheets (MSDS).		
04.19	Proactively respond to a safety concern and then document occurrences.		
04.20	Demonstrate knowledge of emergency exits and signage.		
04.21	Develop safety checklists.		
04.22	Identify and report unsafe conditions.		
04.23	Determine the appropriate corrective action after an unsafe condition is identified.		
04.24	Demonstrate knowledge of various emergency alarms and procedures.		
04.25	Perform emergency drills and participate in emergency teams.		
04.26	Demonstrate knowledge and apply clean-up procedures for spills.		
04.27	Explain Lock Out/Tag Out requirements and procedures.		
04.28	Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.		
04.29	Identify and apply procedures for handling hazardous material.		
04.30	Perform safety and environmental inspections.		
04.31	Perform leak checks to determine if toxic or hazardous material is escaping from a piece of equipment.		
04.32	Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists, and regulations.		
04.33	Demonstrate and apply proper equipment shutdown procedures.		
04.34	Identify safety related maintenance procedures.		
04.35	Select lubricants for machining operations.		
04.36	Lubricate equipment parts.		
04.37	Inspect and maintain machine cutting fluids.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
04.38 Inspect drive pulleys and belts; perform necessary action.		
04.39 Properly dispose of scrap-metal chips, shavings, trash, and waste.		
04.40 Identify, select, and use personal protective equipment (PPE).		
04.41 Explain the safety benefits of 6S work environment.		
04.42 Identify, demonstrate, and apply ergonomic work techniques.		
04.43 Train other students to use and apply safety skills outlined in this standard.		
05.0 Solve basic job-related math problems--The student will be able to:		SC.912.L.17.16
05.01 Solve job-related problems by adding, subtracting, multiplying, and dividing whole numbers, decimals, and common fractions.		
05.02 Measure a workpiece and compare measurements with blueprint specifications, including tolerances.		
05.03 Calculate the amount of material that should be removed to obtain correct limits for secondary operations.		
05.04 Solve job-related problems using mathematical handbooks, charts, and tables.		
05.05 Calculate machine speed and feed by using appropriate formulas.		
05.06 Calculate chip load per tooth on milling operations.		
06.0 Interpret basic blueprint information--The student will be able to:		
06.01 Interpret view concepts.		
06.02 Interpret lines.		
06.03 Read and interpret title blocks.		
06.04 Read and interpret change orders on working and assembly prints.		
06.05 Read and interpret abbreviations.		
07.0 Perform basic measuring operations--The student will be able to:		
07.01 Comply with safe and efficient work practices.		
07.02 Read and measure with rules and calipers.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	07.03 Read and measure with micrometers.		
	07.04 Read and measure with vernier tools.		
	07.05 Use surface-plate techniques.		
08.0	Perform benchwork skills--The student will be able to:		
	08.01 Comply with safe and efficient work practices.		
	08.02 Cut materials by using appropriate hand saws.		
	08.03 Cut threads by using hand taps.		
	08.04 Cut threads by using dies.		
	08.05 Deburr workpiece.		
	08.06 Demonstrate or identify filing techniques.		
09.0	Demonstrate basic knowledge of manufacturing history and primary manufacturing processes--The student will be able to:		
	09.01 Demonstrate knowledge of how manufacturing processes have evolved throughout history.		
	09.02 Demonstrate knowledge of obtaining raw materials through harvesting and extracting.		
	09.03 Explain the difference between primary and secondary manufacturing processes.		
	09.04 Demonstrate knowledge of primary processes (e.g., thermal, chemical, mechanical, etc.)		

Course Title: **Machining Technology 2**
Course Number: **9202120**
Course Credit: **1**

Course Description:
The Machining Technology 2 course is designed to build on the skills and knowledge students learned in Machining Technology 1for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes knowledge of manufacturing processes and systems, generating and interpreting computer-aided design drawings, basic precision measurement, sharpening tools, operating power saws, pedestal grinders, drill presses, and understanding the importance of employability and entrepreneurship skills.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
10.0	Demonstrate basic knowledge of secondary manufacturing processes and manufacturing systems--The student will be able to:		
10.01	Demonstrate knowledge of secondary processes. (e.g., casting and molding, separating, forming, conditioning, assembling, and finishing)		
10.02	Demonstrate knowledge of the various materials used in manufacturing. (e.g., metallic, polymeric, ceramic, composite)		
10.03	Demonstrate knowledge of the various material properties. (e.g., physical, mechanical, chemical, thermal, acoustic, optical, electrical and magnetic)		
10.04	Demonstrate knowledge of the technological or universal systems model. (inputs, process, outputs, feedback)		
10.05	Demonstrate knowledge of the various manufacturing/production systems. (e.g., custom, intermittent, continuous, flexible, automated)		
10.06	Demonstrate knowledge of the use of current manufacturing processes.		
10.07	Demonstrate knowledge of quality assurance.		
11.0	Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings--The student will be able to:		
11.01	Create a sketch of an object.		
11.02	Sketch a multiview drawing with dimensions given an isometric drawing.		
11.03	Select the front view of an object.		
11.04	Use a CAD System to open and change the views of CAD drawings.		
11.05	Use a CAD system to identify points in Absolute, Relative, and Polar coordinates.		
11.06	Use standard CAD commands (such as Grid, Snap, Array, Erase, Trim Break, Hatch) in the editing of a drawing.		
11.07	Create a drawing with a title block using CAD drawing commands.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
11.08	Plot (Print) a CAD System drawing to a specific scale.		
11.09	Use CAD software to create a single view drawing.		
11.10	Use CAD software to create a multiview drawing.		
11.11	Use CAD software to dimension a drawing.		
11.12	Print a CAD drawing to a specific scale.		
11.13	Use a CAD system to create an electrical schematic of a process.		
11.14	Use a CAD system to create a piping schematic of a process.		
11.15	Use a CAD system to create a schematic symbol library.		
11.16	Use CAD to create a full sectional view for an object.		
11.17	Use CAD to create a bent sectional view for an object.		
11.18	Use CAD to create an offset sectional view for an object.		
11.19	Sketch an internal thread using the simplified method of thread representation.		
11.20	Sketch an external thread using the simplified method of thread representation.		
11.21	Use a CAD system to draw a thread representation.		
11.22	Use the UCS command to create a custom 3D coordinate system orientation.		
11.23	Create a 3D object using 3D drawing commands.		
11.24	Open and change the view of a solid model.		
11.25	Add features (such as: extruded cut, fillet, chamfer, revolved boss/base, revolved cut) to a solid model.		
12.0	Perform basic precision measuring operations--The student will be able to:		SC.912.N.4.1
12.01	Use appropriate measurement tools. (e.g., machinist's rule, tape measure, calipers, micrometers, vernier and dial indicator.		
12.02	Convert between common fraction inches and decimal inches.		
12.03	Calibrate a dial caliper.		
12.04	Master a dial indicator.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
12.05	Read and interpret gage blocks and adjustable gages.		
12.06	Implement appropriate testing regimes.		
12.07	Use appropriate safety monitoring and testing equipment.		
12.08	Use multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.		
12.09	Research measurement tools for non-mechanical systems and products. (i.e. pH, °Brix)		
13.0	Sharpen machining tools--The student will be able to:		
13.01	Comply with safe and efficient work practices.		
13.02	Hand sharpens cutting tools by using abrasive stones.		
13.03	Grind lathe tools to required angles.		
13.04	Sharpen drills.		
14.0	Set up and operate power saws--The student will be able to:		SC.912.N.1.1, 4, 7
14.01	Comply with safe and efficient work practices.		
14.02	Remove and replace saw blades.		
14.03	Select appropriate blades to perform given sawing operations.		
14.04	Select and set speeds and feeds for given sawing operations.		
14.05	Measure and cut material using a power saw.		
14.06	Saw to scribed lines by using a metal band saw.		
14.07	Cut and weld band-saw blades for contour sawing.		
14.08	Set up and operate saws for angular cutting.		
15.0	Set up and operate pedestal grinders--The student will be able to:		SC.912.N.3.1
15.01	Comply with safe and efficient work practices.		
15.02	Identify the parts of the machine and explain their uses.		
15.03	Set up support rests.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	15.04 Dress grinding wheels.		
16.0	Set up and operate drill presses--The student will be able to:		SC.912.N.4.1
	16.01 Identify the parts of a drill press and explain their uses.		
	16.02 Identify and set the machine controls.		
	16.03 Comply with safe and efficient work practices.		
	16.04 Select the proper tooling.		
	16.05 Set up and operate drill press for hole work, center drill, drill, ream, countersink, and counterbore.		
	16.06 Set drill presses for proper feed and speed for specified operations.		
17.0	Explain the importance of employability and entrepreneurship skills--The students will be able to:		
	17.01 Identify and demonstrate positive work behaviors needed to be employable.		
	17.02 Develop personal career plan that includes goals, objectives, and strategies.		
	17.03 Examine licensing, certification, and industry credentialing requirements.		
	17.04 Maintain a career portfolio to document knowledge, skills, and experience.		
	17.05 Evaluate and compare employment opportunities that match career goals.		
	17.06 Identify and exhibit traits for retaining employment.		
	17.07 Identify opportunities and research requirements for career advancement.		
	17.08 Research the benefits of ongoing professional development.		
	17.09 Examine and describe entrepreneurship opportunities as a career planning option.		

Course Title: **Machining Technology 3**
Course Number: **9202130**
Course Credit: **1**

Course Description:
The Machining Technology 3 course is designed to build on the skills and knowledge students learned in Machining Technology 1 & 2 for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes knowledge of working in the machining industry. Students study the skills necessary to work in teams, using critical thinking skill to solve complex problems, advance mathematics, quality control and inspection methods, plan machining operations using a lathe, use CAD/CAM processes for lathe operations, and set-up and program a CNC machine for lathe operations.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
21.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives--The students will be able to:		
21.01	Employ leadership skills to accomplish organizational goals and objectives.		
21.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.		
21.03	Conduct and participate in meetings to accomplish work tasks.		
21.04	Employ mentoring skills to inspire and teach others.		
22.0	Solve problems using critical thinking skills, creativity and innovation--The students will be able to:		SC.912.N.1.1, 4, 7 SC.912.N.4.1
22.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.		
22.02	Employ critical thinking and interpersonal skills to resolve conflicts.		
22.03	Identify and document workplace performance goals and monitor progress toward those goal.		
22.04	Conduct technical research to gather information necessary for decision-making.		
23.0	Solve advanced job-related math problems--The student will be able to:		
23.01	Solve job-related problems using basic formulas, geometry, and trigonometry.		
23.02	Convert measurements from English to metric and from metric to English units.		
24.0	Demonstrate inspection methods--The student will be able to:		
24.01	Comply with safe and efficient work practices.		
24.02	Measure with sine bars.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
24.03 Take readings with hardness testers.		
24.04 Explain the purpose of statistical process control (SPC).		
25.0 Plan lathe machining operations--The student will be able to:		
25.01 Comply with safe and efficient work practices.		
25.02 Perform layout for precision machine work by using layout instruments.		
25.03 Describe the importance of quality assurance.		
26.0 Interpret and apply blueprint for lathe machine operations--The student will be able to:		SC.912.N.1.1, 4, 7
26.01 Create shop sketches.		
26.02 Read and interpret blueprints that include geometric tolerances.		
26.03 Determine and interpret reference information used in performing machine work.		
26.04 Comply with safe and efficient work practices.		
26.05 Lay out radial and bolt hole circles.		
26.06 Inspect, remove, and replace manufactured parts that need repair or machine work.		
26.07 Select the most productive tool and tooling for a given operation.		
26.08 Identify the costs involved in product production.		
27.0 Operate lathes--The student will be able to:		
27.01 Identify the parts of a lathe and explain their uses.		
27.02 Comply with safe and efficient work practices.		
27.03 Set up an engine lathe.		
27.04 Secure tools, tool holders, and fixtures or attachments.		
27.05 Select and set feeds and speeds.		
27.06 Set up lathes and face workpieces held in chucks.		
27.07 Rough cut and finish cut with lathes.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	27.08 Perform lathe filing to deburr parts.		
	27.09 Drill holes with lathes.		
	27.10 Countersink holes with lathes.		
	27.11 Ream holes with lathes.		
	27.12 Tap threads with lathes.		
	27.13 Die cut threads with lathes.		
	27.14 Counterbore holes with lathes.		
	27.15 Align lathe centers using accurate methods.		
	27.16 Bore holes with lathes.		
	27.17 Knurl parts with lathes.		
	27.18 Cut external threads with lathes.		
	27.19 Perform contour, angular, or radii cuts with lathes.		
	27.20 Set up the faceplate and dog.		
28.0	Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for lathe operations--The student will be able to:		
	28.01 Identify parts of the machine and explain their uses.		
	28.02 Identify CAD/CAM processes.		
	28.03 Comply with safe and efficient work practices.		
	28.04 Create a multidimensional geometry of parts.		
	28.05 Create a CNC code from parts geometry.		
	28.06 Set up and manufacture parts.		
29.0	Set up and operate a computerized-numerical-control (CNC) machine for lathe operations--The student will be able to:		
	29.01 Comply with safe and efficient work practices.		
	29.02 Set up work holding devices.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
29.03 Select proper cutting tools.		
29.04 Write a basic program and apply basic programming skills.		
29.05 Adjust appropriate cutting tools and tool offsets.		
29.06 Machine and create parts to blueprint tolerances.		

Course Title: **Machining Technology 4**
Course Number: **9212040**
Course Credit: **1**

Course Description:
The Machining Technology 4 course is designed to build on the skills and knowledge students learned in Machining Technology 1, 2, & 3 for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes knowledge of working in the machining industry. Students study the skills necessary to work in teams, using critical thinking skill to solve complex problems, advance mathematics, quality control and inspection methods, plan machining operations using a mill, use CAD/CAM processes for milling operations, and set-up and program a CNC machine for milling operations..

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
21.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives--The students will be able to:		
21.01	Employ leadership skills to accomplish organizational goals and objectives.		
21.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.		
21.03	Conduct and participate in meetings to accomplish work tasks.		
21.04	Employ mentoring skills to inspire and teach others.		
22.0	Solve problems using critical thinking skills, creativity and innovation--The students will be able to:		SC.912.N.1.1, 4, 7 SC.912.N.4.1
22.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.		
22.02	Employ critical thinking and interpersonal skills to resolve conflicts.		
22.03	Identify and document workplace performance goals and monitor progress toward those goal.		
22.04	Conduct technical research to gather information necessary for decision-making.		
23.0	Solve advanced job-related math problems--The student will be able to:		
23.01	Solve job-related problems using basic formulas, geometry, and trigonometry.		
23.02	Convert measurements from English to metric and from metric to English units.		
24.0	Demonstrate inspection methods--The student will be able to:		
24.01	Comply with safe and efficient work practices.		
24.02	Measure with sine bars.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
24.03 Take readings with hardness testers.		
24.04 Explain the purpose of statistical process control (SPC).		
30.0 Plan milling machining operations--The student will be able to:		
30.01 Comply with safe and efficient work practices.		
30.02 Perform layout for precision machine work by using layout instruments.		
30.03 Describe the importance of quality assurance.		
31.0 Interpret blueprints and milling machine operations--The student will be able to:		SC.912.N.1.1, 4, 7
31.01 Create shop sketches.		
31.02 Read and interpret blueprints that include geometric tolerances.		
31.03 Determine and interpret reference information used in performing machine work.		
31.04 Comply with safe and efficient work practices.		
31.05 Lay out radial and bolt hole circles.		
31.06 Inspect, remove, and replace manufactured parts that need repair or machine work.		
31.07 Select the most productive tool and tooling for a given operation.		
31.08 Identify the costs involved in product production.		
32.0 Operate milling machines--The student will be able to:		
32.01 Identify the parts of a vertical milling machine and explain their uses.		
32.02 Comply with safe and efficient work practices.		
32.03 True up the head and align milling fixtures.		
32.04 Select and set feeds and speeds for milling work.		
32.05 Square up workpieces with a table vise.		
32.06 Perform end milling.		
32.07 Perform fly-cutting operations.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
32.08	Drill holes with milling machines.		
32.09	Perform reaming operations.		
32.10	Perform form milling.		
32.11	Mill an external radius.		
32.12	Mill an angle.		
32.13	Use an edge finder and wiggler.		
32.14	Identify the parts of vertical and horizontal milling machines and explain their uses.		
32.15	Select the correct set up and operation for different milling machines.		
32.16	Cut external keyways.		
32.17	Bore holes with boring head.		
32.18	Mill cylindrical work.		
32.19	Set up and perform slab mill operations.		
32.20	Use digital readouts.		
32.21	Perform straddle milling operations on the horizontal mill.		
32.22	Set up and operate power tapping head.		
33.0	Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for mill operations--The student will be able to:		
33.01	Identify parts of the machine and explain their uses.		
33.02	Identify CAD/CAM processes.		
33.03	Comply with safe and efficient work practices.		
33.04	Create a multidimensional geometry of parts.		
33.05	Create a CNC code from parts geometry.		
33.06	Set up and manufacture parts.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
34.0	Set up and operate a computerized-numerical-control (CNC) machine for mill operations--The student will be able to:		
34.01	Comply with safe and efficient work practices.		
34.02	Set up work holding devices.		
34.03	Select proper cutting tools.		
34.04	Write a basic program and apply basic programming skills.		
34.05	Adjust appropriate cutting tools and tool offsets.		
34.06	Machine and create parts to blueprint tolerances.		

Course Title: **Machining Technology Capstone**
Course Number: **9202150**
Course Credit: **1**

Course Description:
This course provides students with extended content and skills essential to the planning, design, creation, and presentation of a machining capstone project.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
35.0	Conceive, design, and present a machining project(s) that encompass all the skills learned in the Machining Technology program--The student will be able to:		
35.01	Create and produce an original working drawing using CAD/CAM software.		
35.02	Create and produce a 3-D drawing using appropriate industry recognized software.		
35.03	Create and produce a toolpath.		
35.04	Create and produce a 3-D model of the project. (if applicable)		
35.05	Compose a well written design proposal and present to instructor for approval.		
35.06	Incorporate principles and practices of manufacturing processes into the design.		
36.0	Plan, organize, and carry out a project plan--The student will be able to:		
36.01	Determine the scope of a project.		
36.02	Organize tasks.		
36.03	Determine project priorities.		
36.04	Identify required resources.		
36.05	Record project progress in a process journal.		
36.06	Record and account for budget expenses during the life of the project.		
36.07	Carry out the project plan to successful completion and delivery.		
37.0	Formulate strategies to properly manage resources--The student will be able to:		
37.01	Identify required resources and associated costs for each stage of the project plan.		
37.02	Create a project budget based on the identified resources.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	37.03 Determine the methods needed to acquire needed resources.		
	37.04 Demonstrate good judgment in the use of resources.		
	37.05 Recycle and reuse resources where appropriate.		
	37.06 Demonstrate an understanding of proper legal and ethical waste disposal.		
38.0	Use tools, materials, and processes in an appropriate and safe manner--The student will be able to:		
	38.01 Identify the proper tool for a given job.		
	38.02 Use tools and machines in a safe manner.		
	38.03 Adhere to laboratory safety rules and procedures.		
	38.04 Identify the application of processes appropriate to the task at hand.		
	38.05 Identify materials appropriate to their application.		
39.0	Create a project portfolio describing the machining project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results--The student will be able to:		
	39.01 Create a Design Portfolio documenting drawings and specifications.		
	39.02 Create a Bill of Material (BOM) for your project.		
	39.03 Create and deliver a presentation to communicate project results.		