FLATE's Engineering Technology Summer Institute III: Building Florida's Manufacturing Career Pathways
47th Annual FACTE Conference & Trade Show
July 29, 2013

Activity I – Review Automation Production Technology (APT) frameworks alignment to Manufacturing Skills Standards Council (MSSC) standards
Goal: To have a better understanding of the standards-new framework and benchmarks in a Florida Dept. of Education (FLDOE) Curriculum Framework and how MSSC standards can be aligned to curriculum.
Activity description: Using the APT standards, review and align them to MSSC standards. Review the material by function of production: Safety, Quality Practices & Measurement, Manufacturing Process & Production, and Maintenance Awareness. Identify/write the alignment in the column "National Standards"-APT Standards.

Summary Report Activity I

Material compiled during FLATE – 2013 FACTE workshop by workshop attendees
Codes:
***Safety*: S**
***Quality Practices & Measurement*: QP**
***Manufacturing Processes & Production*: MP**
Maintenance Awareness: MA

Summary

Program Title: Automation and Production Technology

Secondary – Career Preparatory	
Program Number	9200100
CIP Number	0615040603
Grade Level	9-12, 30, 31
Standard Length	4 credits
Teacher Certification	AUTO PROD 7G ENG 7 G ELECTRONIC @7 G TEC ED 1 @ 2
CTSO	SkillsUSA
SOC Codes (all applicable)	51-2022 – Electrical and Electronic Equipment Assemblers
Facility Code	245 http://www.fldoe.org/edfacil/sref.asp (State Requirements for Educational Facilities)
Targeted Occupation List	http://www.labormarketinfo.com/wec/TargetOccupationList.htm
Perkins Technical Skill Attainment Inventory	http://www.fldoe.org/workforce/perkins/perkins_resources.asp
Industry Certifications	http://www.fldoe.org/workforce/fcpea/default.asp
Statewide Articulation	http://www.fldoe.org/workforce/dwdframe/artic_frame.asp

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 manufacturing 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 manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in Automation and Production positions.

The content includes but is not limited to providing students with a foundation of knowledge and technically oriented experiences in the study of automation technology, its application in manufacturing, engineering and robotics, and its effect upon our lives and the choosing of an occupation. The content and activities will also include the study of enterprise systems, safety, quality, 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.

Standards

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

01.0 Demonstrate an understanding of the core concepts of technology.
02.0 Demonstrate an understanding of the influence of technology on history as well as its cultural, social, economic, and political effects.
03.0 Demonstrate an understanding of the attributes of engineering design.
04.0 Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies.
05.0 Demonstrate an understanding of mechanisms.
06.0 Demonstrate an understanding of workplace safety and workplace organization.
07.0 Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
08.0 Demonstrate an understanding of thermal technology.
09.0 Demonstrate an understanding of communication and workplace computer skills.
10.0 Demonstrate an understanding of modern business practices and enterprise systems.
11.0 Demonstrate the ability to read and interpret blueprints and schematics.
12.0 Demonstrate proficiently in the use of quality assurance methods and quality control concepts.
13.0 Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings.
14.0 Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods.
15.0 Demonstrate a fundamental understanding of AC/DC electrical and electrical control.
16.0 Demonstrate an understanding of fluid power.
17.0 Demonstrate the abilities to use and maintain technological products and systems.
18.0 Describe the importance of professional ethics and legal responsibilities.
19.0 Demonstrate personal money-management concepts, procedures, and strategies.
20.0 Demonstrate an understanding of and be able to select production processes.
21.0 Demonstrate an understanding of industrial tools and processes inclusive of: Basic Machine Tools, CNC machines, and Welding technology.
22.0 Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control.
23.0 Demonstrate proficiency in computer control and robotics.
24.0 Demonstrate the ability to properly identify, organize, plan, allocate resources, document and produce a mass-produced product via a master project.
25.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
26.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.

Course Title: **Automation and Production Technology 1**
Course Number: **9200110**
Course Credit: **1**

Course Description:

This course includes instruction in the fundamentals of automation, manufacturing, and engineering technologies. Upon completion, the student should be prepared to take the MSSC Safety assessment.

CTE Standards and Benchmarks	National Standards
01.0 Demonstrate an understanding of the core concepts of technology--The student will be able to:	
01.01 Illustrate the nature and development of technological knowledge and processes.	Q 1.1, 1.3, 1.10
01.02 Discuss and evaluate current technological developments that are/were driven by profit motive and the market.	
01.03 Identify new technologies that create new processes.	
01.04 Identify the criteria and constraints of a product or system and determine how they affect the final design and development.	Q 1.1, 1.2, 1.4, 1.9
01.05 Identify and compare resources involving trade-offs between competing values, such as availability, cost, desirability, and waste.	
01.06 Apply systems thinking logic and creativity with appropriate compromises in complex real-life problems.	
01.07 Define a management system as the process of planning, organizing, and controlling work.	Q 1.3, 1.10, 1.11; MA 1.1
01.08 Assess technological systems, which are the building blocks of technology and are embedded within larger technological, social, and environmental systems.	Q 1.6
01.09 Outline complex systems that have many layers of controls and feedback loops to provide information.	Q 1.1 –1.11
01.10 Assess the stability of a technological system and its influence by all of the components in the system, especially those in the feedback loop.	Q 1.1, 1.10
01.11 Explain technological innovation resulting when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.	
02.0 Demonstrate an understanding of the influence of technology on history as well as its cultural, social, economic, and political effects--The student will be able to:	
02.01 Discuss the history of technology as a powerful force in reshaping the social, cultural, political, and economic landscape.	S 1.1,1.2
02.02 Define the technologies that enabled and defined the following technological "Ages": Iron Age, Middle Ages, Renaissance, Industrial Revolution, and the Information Age.	

CTE Standards and Benchmarks		National Standards
	02.03 Assess how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.	
	02.04 List trade-offs of developing technologies to reduce the use of resources.	
	02.05 Identify and discuss ethical considerations important in the development, selection, and use of technologies.	
	02.06 Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.	MA 2.1, 4.4, 4.8
	02.07 Compare and contrast the alignment of technological processes with natural processes to maximize performance and reduce negative impacts on the environment.	MA 2.1, 4.4, 4.8
	02.08 Identify and assess technologies devised to reduce the negative consequences of other technologies.	
	02.09 Make decisions about the implementation of technologies involving the weighing of trade-offs between predicted positive and negative effects on the environment.	
03.0	Demonstrate an understanding of the attributes of engineering design--The student will be able to:	
	03.01 Describe 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.	
	03.02 Restate design problems that are seldom presented in a clearly defined form.	
	03.03 Check and critique a design, and improve and revise the idea of the design as needed.	
	03.04 Analyze competing requirements of a design, such as criteria, constraints, and efficiency.	Q 1.6
	03.05 Identify design principles used to evaluate existing designs, to collect data, and to guide the design process.	
	03.06 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.	
	03.07 Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the Engineering Design process.	
	03.08 Evaluate factors taken into account in the process of engineering.	
	03.09 Apply the design process to construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.	
04.0	Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies--The student will be able to:	

CTE Standards and Benchmarks	National Standards
04.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.	Q 1.1, 1.2, 1.3, 1.8
04.02 Discuss motivation and human behavior.	
04.03 Develop a personal stress management plan.	
04.04 Demonstrate knowledge of ways to improve reading, listening and writing skills.	S 7.1
04.05 Demonstrate knowledge of techniques for making effective presentations to internal and external customers.	S 7.2; Q 1.10, 1.11
04.06 Use different forms of communication, such as e-mail, fax and phones.	S 7.3
04.07 Provide effective feedback and make suggestions.	S 7.5; Q 3.2, 3.4
04.08 Handle customer requests.	
04.09 Explain the characteristics of a high-performance team and how to assess team member personality types.	
04.10 Engage in team activities such as a team icebreaker exercise, developing a team constitution, brainstorming session, and reaching a decision by consensus.	
04.11 Demonstrate knowledge of roles and responsibilities of production team members.	S 8.2
04.12 Align team goals (that are specific, documented, measurable and achievable) to customer and business production needs.	S 8.4, 8.5; Q 1.3
04.13 Communicate production information to team members.	S 8.5, 8.6; Q 3.2
04.14 Organize a team to: construct and analyze a flow chart, construct a fishbone diagram, use a criteria screen to make a decision, use an impact/effort grid to make a decision, use multi-voting to make a decision, manually construct a Pareto chart.	Q 1.10, 1.11
05.0 Demonstrate an understanding of mechanisms--The student will be able to:	Q 6.1; MA 1.2, 1.3, 2.2, 2.3
Levers and Linkages	MA 1.2, 1.3, 2.2, 2.3
05.01 For the relation (m, w) calculate the weights (range) of objects given mass (domain) of objects.	MA 1.2, 1.3, 2.2, 2.3
05.02 Calculate the compression rate of a spring using Hooke's Law.	MA 1.2, 1.3, 2.2, 2.3
05.03 Use a spring scale to measure the weight of an object and the force on an object.	Q 6.4; MA 1.2, 1.3, 2.2, 2.3
05.04 Calculate torque given an application.	MA 1.2, 1.3, 2.2, 2.3
05.05 Calculate the moment caused by a force.	MA 1.2, 1.3, 2.2, 2.3

CTE Standards and Benchmarks	National Standards
05.06 Calculate and measure the mechanical advantage of a first-class, second-class, and third-class lever.	
05.07 Calculate the coefficient of friction given application data.	
05.08 Measure the force required to overcome friction in different applications.	
05.09 Calculate and measure the mechanical advantage of an inclined plane.	
05.10 Connect and operate a slider crank linkage.	
05.11 Connect and operate a double rocker linkage.	
05.12 Connect and operate a crank rocker linkage.	
05.13 Connect and operate a cam and cam follower.	
05.14 Measure the velocity and dwell of a cam.	
05.15 Connect and operate a turnbuckle.	
Power Transmission Systems	
05.16 Use a spirit level to determine orientation of a surface.	
05.17 Select a fastener size and type for a motor mount and correct for a soft foot condition.	
05.18 Level an electric motor.	
05.19 Select a key size for a given application.	
05.20 Measure the actual size of a key and keyseat given a sample.	
05.21 Assemble a hub to a shaft using a key fastener.	
05.22 Use a digital tachometer to measure motor speed.	
05.23 Use a prony brake to measure shaft torque.	
05.24 Calculate rotary mechanical power.	
05.25 Identify shaft size given a sample.	
05.26 Install and adjust a pillow block antifriction bearing and shaft.	

CTE Standards and Benchmarks	National Standards
05.27 Install a flexible jaw coupling.	
05.28 Align two shafts using a straight edge and feeler gage.	
Pulley Systems and Gear Drives	
05.29 Measure the mechanical advantage of a fixed pulley.	
05.30 Measure the mechanical advantage of a movable pulley.	
05.31 Calculate and measure the mechanical advantage of a pulley combination.	
05.32 Connect and operate a gear drive system.	
05.33 Calculate and measure the mechanical advantage of a gear drive.	
V-belt Drives	
05.34 Calculate pulley ratio.	MA 8.1
05.35 Calculate the shaft speed and torque of a belt drive system.	MA 8.2
05.36 Install and align a fractional HP V-belt drive with a finished bore.	
05.37 Determine the belt deflection force for a given application.	MA 8.2
05.38 Adjust belt tension using an adjustable mounting base.	MA 8.3
05.39 Use a belt tension tester to measure belt tension.	MA 8.3
Chain Drives	
05.40 Calculate sprocket ratio.	MA 8.1
05.41 Calculate the shaft speed and torque of a chain drive system.	MA 8.1
05.42 Install and align a roller chain drive system with adjustable centers.	MA 8.2
05.43 Determine allowable chain sag for a given application.	MA 8.3
05.44 Use a rule and a straight edge to measure chain sag.	MA 8.3
05.45 Adjust chain sag to a specified amount using adjustable centers.	MA 8.3

CTE Standards and Benchmarks	National Standards
05.46 Install and remove a chain with a master link.	
06.0 Demonstrate an understanding of workplace safety and workplace organization--The student will be able to:	
06.01 Locate and use Material Safety Data Sheets (MSDS).	S 2.2; Q 2.10, 2.11; MA 4.4
06.02 Demonstrate knowledge of first aid or first response procedures.	
06.03 Identify safety procedures in case of smoke or chemical inhalation.	S 2.11
06.04 Demonstrate knowledge of material handling techniques to safely move materials.	S 2.3
06.05 Demonstrate the proper techniques for lifting loads.	S 3.4; MA 4.2
06.06 Demonstrate knowledge of safety requirements for material handling equipment such as forklifts, cranes, rigging, and pry trucks.	S 3.5; Q 2.10; MA 4.2
06.07 Demonstrate knowledge of safety requirements for platforms, manlifts, and ladders.	S 3.6; Q 2.10; MA 4.2
06.08 Proactively respond to a safety concern and then document occurrences.	S 2.4
06.09 Demonstrate knowledge of emergency exits and signage.	S 2.5; MA 4.2
06.10 Demonstrate knowledge of various emergency alarms and procedures	S 2.6
06.11 Perform emergency drills and participate in emergency teams.	MA 4.2
06.12 Demonstrate knowledge of clean-up procedures for spills.	S 2.7; MA 4.2
06.13 Explain Lock Out/Tag Out requirements and procedures.	S 2.8; Q 1.6, 1.10, 1.11; MA 4.5
06.14 Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.	S 2.10; MA 4.2
06.15 Identify procedures for handling hazardous material.	S 2.12; MA 4.4
06.16 Develop safety checklists.	S 2.13; MA 4.2, 4.6, 4.7
06.17 Identify and report unsafe conditions.	S 3.1 ; MA 4.6, 4.7
06.18 Determine the appropriate corrective action after an unsafe condition is identified.	
06.19 Demonstrate knowledge of safety requirements for manual, electrical-powered, and pneumatic tools.	S 3.7
06.20 Demonstrate knowledge of safety requirements for operation of automated machines.	S 3.8

CTE Standards and Benchmarks		National Standards
06.21	Perform safety and environmental inspections.	S 4.2; MA 4.2, 4.6
06.22	Skill in performing leak checks to determine if toxic or hazardous material is escaping from a piece of equipment.	S 2.15; MA 4.4, 4.6, 4.7
06.23	Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists, and regulations.	S 2.16; MA 3.3
06.24	Demonstrate knowledge of equipment shutdown procedures.	S 2.14; MA 4.2
06.25	Identify-safety related maintenance procedures.	S 2.16
06.26	Selecting and use personal protective equipment (PPE).	S 3.2
06.27	Explain the safety benefits of 6S work environment.	
06.28	Demonstrate knowledge of ergonomic impact of work techniques.	
06.29	Train other personnel to use equipment safely.	S 3.2, 6.7

Course Title: **Automation and Production Technology 2**
Course Number: **9200120**
Course Credit: **1**

Course Description:

This course includes instruction in the fundamentals of automation, manufacturing, and engineering technologies. Upon completion, the student should be prepared to take the MSSC Quality Practices and Measurement assessment.

CTE Standards and Benchmarks	National Standards
07.0 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:	
07.01 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.	
07.02 Conduct research and development to prepare a prototype devices, product or systems for the marketplace.	
07.03 Identify and conduct research needed to solve technological problems.	
07.04 Differentiate between technological and non-technological problems, and identify which problems can be solved using technology.	
07.05 Utilize a multidisciplinary approach to solving technological problems.	
08.0 Demonstrate an understanding of thermal technology--The student will be able to:	
08.01 Measure temperature and convert between temperature scales.	
08.02 Calculate the change in length of a material given a change in temperature using the slope intercept and standard form of the equation expression this relationship.	
08.03 Calculate the change in volume of a material given a temperature change.	
08.04 Convert between Energy units.	
08.05 Calculate the change in internal energy of a substance given its temperature change.	
08.06 Calculate gas properties using the Ideal Gas Law.	
08.07 Determine the effectiveness of an insulation system.	
08.08 Analyze a system using the first law of thermodynamics.	
08.09 Measure the relative humidity and calculate the dew point of the air.	

CTE Standards and Benchmarks	National Standards
09.0 Demonstrate an understanding of communication and workplace computer skills--The student will be able to:	
09.01 Write logical and understandable statements, or phrases, to accurately complete forms commonly used in business and industry.	
09.02 Read and understand graphs, charts, diagrams, and common table formats.	
09.03 Read and follow written instructions.	
09.04 Demonstrate knowledge of technical language and technical acronyms.	
09.05 Use a spreadsheet application to open, view, enter, and format data.	
09.06 Create formulas in a spreadsheet application to manipulate data.	
09.07 Create a chart in a spreadsheet application to represent linear and quadratic equations.	
09.08 Use a sword processing application to open, view, create and save a new document.	
09.09 Create a writing sample such as a business letter, memo, or technical report.	
09.10 Create a presentation outline.	
09.11 Create and deliver a short presentation using a presentation application.	
09.12 Use a browser to go to and navigate a Web site.	
09.13 Download a file from a Web site.	
09.14 Use E-mail to send and receive a message with attachments.	
09.15 Use a search engine (i.e. "Google") to research a topic.	
10.0 Demonstrate an understanding of modern business practices and enterprise systems--The student will be able to:	
10.01 Use the Internet to find economic statistics	
10.02 Use the Internet to find commodity price data	
10.03 Use a spreadsheet application to analyze economic data	
10.04 Select materials and process for a product using cost as a factor	
10.05 Interpret a Bill of Materials.	

CTE Standards and Benchmarks	National Standards
10.06 Create a Bill of Materials for a product given a sample.	
10.07 Use a spreadsheet to create a bill of materials for a product.	
10.08 Demonstrate knowledge of the alignment of a company's business objectives with production goals.	
10.09 Describe the importance of entrepreneurship to the American economy.	
10.10 Identify the necessary personal characteristics of a successful entrepreneur.	
10.11 Identify the business skills needed to operate a small business efficiently and effectively.	
10.12 Identify the key elements of a business plan and apply them in the creation of a business plan.	
11.0 Demonstrate the ability to read and accurately interpret blueprints and schematics–The student will be able to:	
11.01 Define basic blueprint terminology such as title block, border, views, notes, revision blocks, etc. In addition, the individual will recognize the intent of the drawing and its use in manufacturing.	Q 5.10
11.02 Differentiate between dimensions of location and size. These dimensions may be represented as ordinate, base line, tabular, etc.	
11.03 Interpret Linear, Circular, and Angular dimension features on a print.	
11.04 Identify general note symbols and their applications within a manufacturing environment. Examples of symbols include finishing requirements, material specifications, machining/manufacturing specifications, assembly symbols, ANSI symbols, ISO symbols, etc.	
11.05 Locate notes on a print using industry standards, using three drawings with two minutes per note and 100% accuracy.	
11.06 Interpret commonly used abbreviations and terminology used on prints in the manufacturing environment.	
11.07 Determine tolerances associated with dimensions on a drawing.	Q 5.3
11.08 Determine if a part dimension is within tolerance using conventional tolerancing.	Q 5.3
11.09 Calculate the limits of a dimension given its tolerance.	Q 5.4
11.10 Determine a dimension of an object given an undimensioned scaled drawing.	Q 5.4
11.11 Identify types of lines within a drawing. Examples include hidden lines, object lines, extension lines, and section lines. Individuals should read various drawings and identify lines with 100% accuracy.	
11.12 Interpret the following information from a blueprint title block: company name, part name and number, material, name of designer and checker, revision history, and other important information regarding the part.	Q 5.5

CTE Standards and Benchmarks	National Standards
11.13 Recognize the changes through which the design has progressed from the original design. Interpret the meaning of the revision block symbols and notations. Match the revision block components with the actual drawing features.	
11.14 Check for revisions. Given a series of drawings, some of which contain revisions and proper notation, properly identify which ones are the most current revisions, and identify which drawings do not contain revisions.	
11.15 Identify orthographic views. Recognize the three basic views which may be represented on the drawing; front, top, right side. Identify if the print is drawn in first or third angle projection. Detect features represented in one view and find those same features in another view.	
11.16 Identify isometric views. On a drawing containing orthographic and isometric, properly identify the isometric view.	
11.17 Identify positions of views: top, front, side, auxiliary, and section. Given an orthographic drawing, identify all appropriate views according to their position or placement on print. Or, given an actual part, the individual will be able to match the views to the appropriate surfaces.	
11.18 Determine the scale of the view or section. Based on the title block information, physical scaling of view, and standard drawing scale, determine appropriate scale of view or section.	
11.19 Identify the size and type of fasteners used in an assembly drawing.	
12.0 Demonstrate proficiency in the use of quality assurance methods and quality control concepts–The student will be able to:	
12.01 Demonstrate knowledge of quality systems such as Statistical Process Control (SPC), Six Sigma, Total Quality Management (TQM), and International Standards Organization (ISO) 9000.	Q 2.1
12.02 Selecting and use quality systems to identify problems and record quality issues.	Q 2.2
12.03 Demonstrate knowledge of statistics for making accurate decisions about quality data.	Q 2.3
12.04 Demonstrate knowledge of various statistical quality tools such as histograms, Cpk, X bar and R charts, and range.	Q 2.2
12.05 Create control charts (e.g., variables and attributes) using linear relationships and properties of parallel lines Record and analyze quality issues in the production process, using tools such as Root Cause Failure Analyses (RCFA).	Q 2.5, 2.6
12.06 Use Pareto analysis to identify priorities for solving multiple sub–standard product problems.	Q 2.7
12.07 Determining accuracy and precision when using measuring equipment.	Q 2.8, 2.12
12.08 Demonstrate knowledge of performance indicators that can be readily understood by operators.	Q 2.9
12.09 Demonstrate knowledge of how to use inspection tools, equipment and procedures.	Q 2.10, 2.11

CTE Standards and Benchmarks	National Standards
12.10 Use and convert both U.S. measurement and standard international metric systems using precision measurement tools such as: a machinist's rule, tape measure, caliper, micrometer, digital gage, pH meter, and thermometer.	Q 6.1, 6.2, 6.3, 6.4, 6.5, 6.6
12.11 Demonstrate knowledge of inspection equipment calibration standards and requirements.	Q 2.11
12.12 Verify calibration of inspection equipment.	Q 2.12; MA 2.2, 2.3
12.13 Demonstrate knowledge of appropriate automated inspection system.	Q 2.13
12.14 Demonstrate knowledge of maintaining and storing inspection tools.	Q 2.15
12.15 Develop records on quality process which are maintained to appropriate standards.	Q 2.6
12.16 Chart outcomes of quality processes according to appropriate methods and standards.	Q 2.5
12.17 Demonstrate knowledge of the importance of accurate and precise data for quality process performance.	
12.18 Analyze quality process performance data to identify trends.	
12.19 Report quality process performance data to appropriate parties in a timely manner.	
12.20 Identify/report performance and training issues affecting quality.	
12.21 Examine previous documentation on similar process issues to identify possible solutions.	Q 3.5
12.22 Recommend actions that are clear, concise and supported by data.	Q 3.1
12.23 Identify follow-up activities that indicate that corrective action was taken.	Q 3.4
12.24 Document product quality following corrective action and identify documentation and records transmittal required for customers.	
12.25 Identify the circumstances for prompt corrective actions related to product quality or the health or safety of workers.	
12.26 Determine disposition of sub-standard product.	
12.27 Implement closed-loop corrective action follow-up: spot checks, quality documentation, and an audit to optimize the outcomes of the corrective steps.	
12.28 Describe and explain the concepts of Lean Manufacturing.	Q 2.1; MA 1.1
12.29 Identify and apply value stream mapping, just-in-time procedures, and techniques of continual improvement.	Q 2.1, 2.2
12.30 Describe the changes necessary in implementing waste-free manufacturing (WFM) in a lean environment.	Q 2.1

CTE Standards and Benchmarks	National Standards
12.31 Describe and explain supply chain management.	
12.32 Describe and explain the use of the 6S's, (sort, set in order, shine, standardize, sustain, safety).	

Course Title: **Automation and Production Technology 3**
Course Number: **9200130**
Course Credit: **1**

Course Description:

This course includes instruction in the fundamentals of automation, manufacturing, and engineering technologies. Upon completion, the student should be prepared to take the MSSC Maintenance Awareness assessment.

CTE Standards and Benchmarks	National Standards
13.0 Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings--The student will be able to:	
13.01 Create a sketch of an object.	
13.02 Sketch a multiview drawing with dimensions given an isometric drawing.	
13.03 Select the front view of an object.	
13.04 Use a CAD System to open and change the views of CAD drawings.	
13.05 Use a CAD system to identify points in Absolute, Relative, and Polar coordinates.	
13.06 Use standard CAD commands (such as Grid, Snap, Array, Erase, Trim Break, Hatch) in the editing of a drawing.	
13.07 Create a drawing with a title block using CAD drawing commands.	
13.08 Plot (Print) a CAD System drawing to a specific scale.	
13.09 Use CAD software to create a single view drawing.	
13.10 Use CAD software to create a multiview drawing.	
13.11 Use CAD software to dimension a drawing.	
13.12 Print a CAD drawing to a specific scale.	
13.13 Use a CAD system to create an electrical schematic of a process.	
13.14 Use a CAD system to create a piping schematic of a process.	
13.15 Use a CAD system to create a schematic symbol library.	
13.16 Use CAD to create a full sectional view for an object.	

CTE Standards and Benchmarks	National Standards
13.17 Use CAD to create a bent sectional view for an object.	
13.18 Use CAD to create an offset sectional view for an object.	
13.19 Sketch an internal thread using the simplified method of thread representation.	
13.20 Sketch an external thread using the simplified method of thread representation.	
13.21 Use a CAD system to draw a thread representation.	
13.22 Use the UCS command to create a custom 3D coordinate system orientation.	
13.23 Create a 3D object using 3D drawing commands.	
13.24 Open and change the view of a solid model.	
13.25 Add features (such as: extruded cut, fillet, chamfer, revolved boss/base, revolved cut) to a solid model.	
14.0 Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods--The student will be able to:	
14.01 Use appropriate measurement tools such as: machinist's rule, tape measure, caliper, digital caliper, outside micrometer, and dial indicator.	QP 6.2, 6.3, 6.4, 6.5, 6.
14.02 Convert between common fraction inches and decimal inches.	QP 6.2, 6.3, 6.4, 6.5, 6.
14.03 Calibrate a dial caliper.	QP 6.2, 6.3, 6.4, 6.5, 6.
14.04 Master a dial indicator.	QP 6.2, 6.3, 6.4, 6.5, 6.
14.05 Implement appropriate testing regimes.	QP 6.2, 6.3, 6.4, 6.5, 6
14.06 Use appropriate safety monitoring and testing equipment.	QP 6.2, 6.3, 6.4, 6.5, 6
14.07 Use multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.	QP 6.2, 6.3, 6.4, 6.5, 6
15.0 Demonstrate a fundamental understanding of AC/DC electrical and electrical control--The student will be able to:	
15.01 Demonstrate knowledge of AC/DC theory.	
15.02 Check electrical components for UL and CSA approval.	
15.03 Use an AC tester to check a wall outlet for electricity.	
15.04 Use appropriate grounding techniques.	

CTE Standards and Benchmarks	National Standards
15.05 Connect and operate a power supply.	
15.06 Connect and operate a circuit using some combination of the following elements: three types of manual switches, a resistor, a buzzer, a solenoid, a motor.	
15.07 Use a Digital Multi-Meter (DMM) to measure the voltage of a point referenced to ground, voltage drops in series and parallel circuits, electrical current, current in series and parallel circuits, resistance of a component, resistance in series and parallel circuits, and test the continuity of wires.	
15.08 Calculate series resistance given each load's resistance.	
15.09 Use Ohm's Law to calculate voltage, current, and resistance in a series circuit.	
15.10 Calculate the total power used by a series circuit.	
15.11 Calculate the main line current in a parallel circuit.	
15.12 Calculate the total parallel resistance.	
15.13 Calculate the total power used in a parallel circuit.	
15.14 Operate a circuit using a fuse, test and replace a fuse.	
15.15 Operate a circuit using a circuit breaker, test and reset a circuit breaker.	
15.16 Connect and operate a relay in a circuit.	
15.17 Calculate the total load on an AC circuit with inductors.	
15.18 Discharge a capacitor.	
15.19 Test a capacitor with a DMM.	
15.20 Measure the voltage across a charged capacitor.	
15.21 Calculate the total load on an AC circuit with capacitors.	
15.22 Calculate the time to charge and discharge a capacitor.	
15.23 Trace the current path in a combination circuit.	
15.24 Solve a combination circuit.	
15.25 Connect and operate a basic lighting circuit, a ceiling fan circuit, and a rheostat as a light dimmer.	

CTE Standards and Benchmarks	National Standards
15.26 Design, connect, and operate a voltage divider network.	
15.27 Locate a short circuit and an open circuit.	
15.28 Size, connect, and operate a transformer.	
15.29 Calculate the secondary coil voltage of a transformer.	
15.30 Troubleshoot a transformer by measuring continuity.	
15.31 Calculate the current load on a transformer.	
15.32 Design a control transformer circuit to provide a given output voltage.	
15.33 Read and interpret the operation of a circuit given a ladder diagram.	
15.34 Connect and operate a logic circuit given a ladder diagram.	
15.35 Design a ladder diagram using one or more logic elements.	
15.36 Design, connect, and operate a control circuit to operate a solenoid valve.	
15.37 Read and interpret a basic ladder diagram with detached symbology.	
15.38 Design, connect, and operate a relay to energize a fluid power solenoid.	
15.39 Connect and operate a relay to perform a seal-in function.	
15.40 Connect and operate an event sequencing circuit given a ladder diagram.	
15.41 Design a logic circuit that uses a limit switch to sequence an event.	
15.42 Connect and operate a single-cycle cylinder reciprocation circuit.	
15.43 Connect and operate a continuous-cycle cylinder reciprocation circuit.	
15.44 Design a continuous-cycle cylinder reciprocation circuit with a safety interlock.	
15.45 Connect and operate a control circuit with a timer relay.	
15.46 Connect and operate a control circuit to perform an unloaded start of a motor.	
15.47 Design a control circuit to perform time-driven sequencing.	

CTE Standards and Benchmarks	National Standards
15.48 Connect and operate a dual-cylinder control circuit using two limit switches.	
15.49 Design a continuous-cycle multiple-cylinder circuit.	
15.50 Connect and operate a circuit having both automatic and manual modes of operation.	
15.51 Connect and operate a control circuit to simulate a two-pushbutton jog circuit.	
16.0 Demonstrate an understanding of fluid power--The student will be able to:	
Pneumatic circuits and power systems	
16.01 Identify pneumatic symbols.	
16.02 Read a pneumatic pressure gage and flow meter.	
16.03 Calculate the extension force of a cylinder given its size and pressure.	
16.04 Determine the pressure needed to create a known output force on an extending cylinder.	
16.05 Measure the force output of an extending cylinder.	
16.06 Calculate the retraction force of a cylinder given its size and pressure.	
16.07 Convert between gage and absolute pressures.	
16.08 Use Boyle's Law to calculate changes in pressure and volume.	
16.09 Convert air volumes at pressures to free air volumes.	
16.10 Measure pressure drop (Delta P) across pneumatic components.	
16.11 Connect equipment and perform basic pneumatic operations such as: adjust a pressure regulator, drain a pneumatic filter, uses quick-connect fittings, use a tee to connect two circuit branches together, use a cross to connect three circuit branches together, operate a check valve.	
16.12 Connect a pneumatic circuit given a schematic.	
16.13 Draw a pneumatic schematic from the actual circuit connections on the machine.	
16.14 Design a multiple actuator pneumatic circuit.	

CTE Standards and Benchmarks	National Standards
16.15 Connect pneumatic speed control circuits to: operate a needle valve to control actuator speed, operate a flow control valve to control actuator speed, operate a meter-in flow control circuit, operate a meter-out flow control circuit, operate an exhaust port speed control circuit, and operate a pressure port speed control circuit.	
16.16 Design speed control circuits.	
16.17 Connect and utilize Pneumatic DCV applications such as: a pneumatic cam-operated 4/2 DCV, a pneumatic cam-operated 3/2 DCV, a single-acting pneumatic cylinder using a 3-way manually-operated DCV, a double-acting pneumatic cylinder using a 3-way manually-operated DCV, a unidirectional pneumatic motor using a 3-way manually-operated DCV, a two-way valve, a cylinder deceleration circuit using power braking, and an externally air-piloted DCV using the manual override.	
16.18 Design a rapid traverse-slow feed pneumatic circuit.	
16.19 Design a pneumatic circuit to sequence two cylinders.	
16.20 Design a pneumatic circuit that uses an externally air-piloted DCV.	
Vacuum Systems	
16.21 Convert between units of mercury and units of air pressure.	
16.22 Connect and read a vacuum gage and manometer.	
16.23 Convert between units of water column and units of water pressure.	
16.24 Connect and operate a vacuum generator.	
16.25 Calculate vacuum cup lift force.	
16.26 Connect and operate a vacuum cup.	
16.27 Design the vacuum cup portion of a handling rack.	
Hydraulic Circuits and Power Systems	
16.28 Read a hydraulic pressure gage, flow meter and the liquid level and temperature in the reservoir.	
16.29 Calculate the extension force of a cylinder given its size and pressure.	
16.30 Measure the force output of an extending cylinder.	

CTE Standards and Benchmarks	National Standards
16.31 Calculate the retraction force of a cylinder given its size and pressure.	
16.32 Measure the force output of a retracting cylinder.	
16.33 Measure the pressure drop (Delta P) across a hydraulic component.	
16.34 Convert between absolute pressure and gage hydraulic pressure.	
16.35 Calculate the extend speed, retract speed, and cylinder stroke time of a hydraulic cylinder given its size and a flow rate.	
16.36 Draw a hydraulic schematic from the actual circuit connections on a pictorial.	
16.37 Draw a hydraulic circuit given a schematic.	
16.38 Operate a hydraulic power unit.	
16.39 Connect equipment and perform basic hydraulic operations such as: connect and disconnect a hydraulic hose that uses quick-connect fittings, use a tee to connect two circuit branches together, connect a flow meter, operate a needle valve to control the speed of an actuator, control the speed of an actuator using a manually-operated DCV, operate a bi-directional hydraulic motor using a 3-position manually-operated DCV, operate a double-acting hydraulic cylinder using a 3-position manually-operated DCV.	
16.40 Design and connect hydraulic speed control circuits to: limit pressure in the system with a relief valve, provide bypass flow, control speed of an actuator by adjusting a flow control valve, operate a meter-in flow control circuit, and operate a meter-out flow control circuit.	
16.41 Design a multiple actuator hydraulic circuit, an independent speed control circuit, and a two-speed actuator circuit.	
17.0 Demonstrate the abilities to use and maintain technological products and systems–The student will be able to:	
Overall Maintenance Process	
17.01 Discuss preventive and predictive maintenance methods for manufacturing environments.	MA 1.1
17.02 Demonstrate knowledge of principles of Total Productive Maintenance (TPM).	MA 1.1
17.03 Recognize potential maintenance issues with basic production systems and determine when to inform maintenance personnel about issues.	MA 1.3
17.04 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.	MA 2.2, 2.3
17.05 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.	MA 2.3

CTE Standards and Benchmarks	National Standards
17.06 Operate systems so that they function in the way they were designed.	
17.07 Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.	
17.08 Develop and follow maintenance schedules.	MA 1.4
17.09 Identify the most common causes of failure of equipment in order to diagnosis problem quickly.	MA 1.8
17.10 Demonstrate knowledge of what different equipment alarms indicate.	MA 1.9
17.11 Make on-process adjustments during production.	MA 1.10
17.12 Examine the concept of troubleshooting within basic manufacturing maintenance areas.	MA 1.3
17.13 Identify equipment failures in manufacturing maintenance areas.	MA 1.3, 1.8
17.14 Describe root cause analysis methods.	MA 1.3
17.15 Use materials management to know what is recyclable and what is not.	MA 2.1, 4.8
17.16 Use monitoring or diagnostic devices to find out when equipment is operating correctly.	MA 2.3
17.17 Use appropriate maintenance tools to maintain machines.	MA 2.2
Documentation of Maintenance	
17.18 Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.	MA 3.2
17.19 Demonstrate knowledge of the procedures for logging repairs and work order requests.	MA 3.4, 3.5
17.20 Demonstrate knowledge of statistical method charts to ensure that equipment is producing a quality product.	MA 3.1
17.21 Demonstrate knowledge of forms and procedures for correctly documenting processes (e.g., preventative maintenance forms).	MA 3.2
17.22 Read diagrams, schematics, manuals and specifications to understand how to repair equipment.	MA 3.3
17.23 Document repairs, replacement parts, problems and corrective actions to maintain log to determine patterns of operation.	MA 3.4
17.24 Review maintenance log/checklist to ensure that recommended preventative procedures are followed.	MA 3.5

CTE Standards and Benchmarks	National Standards
Specific Maintenance Operations	
17.25 Demonstrate knowledge of proper and safe functioning of mechanical power transmission equipment. Specifically, the basic functions of bearings, shafts and couplings and how to recognize a malfunction.	
17.26 Demonstrate knowledge of lubrication procedures and requirements. Specifically, explain API Service Categories for lubricants; take and analyze oil samples; determine proper lubricants for various types of equipment; use grease guns for various types of lubrication, and demonstrate skill in safe storage and disposal of lubricants.	
17.27 Demonstrate knowledge of the selection, design, and safe functioning of belt, chain, and roller chain drive equipment.	
17.28 Demonstrate knowledge of fluid transport. Specifically, identify standard types of industrial pumps and determine the causes and maintenance procedures for: shaft seal failure, shaft misalignment, and pump cavitations.	
18.0 Describe the importance of professional ethics and legal responsibilities--The students will be able to:	
24.01 Evaluate and justify decisions based on ethical reasoning.	
24.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.	
24.03 Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.	
24.04 Interpret and explain written organizational policies and procedures.	
19.0 Demonstrate personal money-management concepts, procedures, and strategies--The students will be able to:	
19.01 Identify and describe the services and legal responsibilities of financial institutions.	
19.02 Describe the effect of money management on personal and career goals.	
19.03 Develop a personal budget and financial goals.	
19.04 Complete financial instruments for making deposits and withdrawals.	
19.05 Maintain financial records.	
19.06 Read and reconcile financial statements.	
19.07 Research, compare and contrast investment opportunities.	

Course Title: **Automation and Production Technology 4**
Course Number: **9200140**
Course Credit: **1**

Course Description:

This course includes instruction in the fundamentals of automation, manufacturing, and engineering technologies. Upon completion, the student should be prepared to take the MSSC Manufacturing Processes and Production assessment.

CTE Standards and Benchmarks	National Standards
20.0 Demonstrate an understanding of and be able to select production processes--The student will be able to:	
20.01 Identify the production characteristics of manufacturing's subindustries: Chemical, Computers and Electronics Products, Electrical and Appliances, Food and Beverage, Furniture, Machinery, Nonmetallic Minerals, Petroleum and Coal, Plastics and Rubber, Primary and Fabricated Metals, Printing, Textile and Apparel, Transportation, and Wood and Paper.	
20.02 Identify customer needs.	MP 1.3, 4.1, 4.3
20.03 Determine resources available for the production process.	MP 1.2, 1.3, 1.4, 1.5, 1.6, 1.7
20.04 Make job assignments and coordinate workflow.	MP 1.2, 1.6, 1.7, 1.8
20.05 Communicate production and material requirements to meet product specifications.	MP 1.3, 1.8, 1.10, 4.3
20.06 Establish set-up and operation procedures are available and up-to-date.	MP 1.4, 2.1-13
20.07 Read and interpret a production schedule and manufacturing work order.	MP 1.1, 1.2, 1.5
20.08 Demonstrate knowledge of production process, including flow and bottlenecks.	MP 1.5, 1.6, 1.10
20.09 Document product and process compliance with customer requirements.	MP 1.4, 4.1, 4.2, 4.3, 4.5, 4.6
21.0 Demonstrate an understanding of industrial tools and processes inclusive of: Basic Machine Tools, CNC machines, and Welding technology--The student will be able to:	MP 2.10
Introduction to Manufacturing Hand Tools	MP 2.10
21.01 Use a bench vise to hold material for a benchwork operation.	MP 2.10
21.02 Change a blade on a hacksaw.	MP 2.10
21.03 Cut a piece of stock to length using a hacksaw.	MP 2.10
21.04 Stamp letters in a part using a letter/number stamp set.	MP 2.10

CTE Standards and Benchmarks	National Standards
21.05 Deburr a part using a file.	MP 2.10
21.06 Clean and store a file.	MP 2.10
21.07 Chamfer a part using a file.	MP 2.10
21.08 Square the ends of a part using a file.	MP 2.10
21.09 Create layout lines on round stock.	MP 2.10
21.10 Drill holes in round stock.	MP 2.10
Milling Processes	MP 2.10, 2.11
21.11 Operate manual controls on a milling machine.	MP 2.10, 2.11
21.12 Use a milling machine micrometer collar to measure table movement.	MP 2.10, 2.11
21.13 Face a piece of stock to length.	MP 2.10, 2.11
21.14 Mill a step using the micrometer collars on the milling machine.	MP 2.10, 2.11
21.15 Mill a step on a part using layout lines.	MP 2.10, 2.11
21.16 Mill a slot to a specific depth.	MP 2.10, 2.11
21.17 Mill a pocket in a part.	MP 2.10, 2.11
Band Saw Operation	MP 2.10, 2.11
21.18 Determine the size of three common metal stock shapes: sheet, flat, round.	MP 2.10, 2.11
21.19 Select stock size and type given a part drawing.	MP 2.10, 2.11
21.20 Use a horizontal band saw to cut stock to a specified length.	MP 2.10, 2.11
21.21 Use a vertical band saw to cut stock to a specified length.	MP 2.10, 2.11
Drill Press Operations	MP 2.10, 2.11
21.22 Use the prick punch, center punch, and ball-peen hammer to prepare holes for drilling.	MP 2.10, 2.11
21.23 Determine the size of a drill.	MP 2.10, 2.11

CTE Standards and Benchmarks	National Standards
21.24 Select and change the spindle speeds of the floor drill press.	MP 2.10, 2.11
21.25 Install a twist drill into a drill chuck.	MP 2.10, 2.11
21.26 Mount a workpiece in a drill press vise.	MP 2.10, 2.11
21.27 Drill holes using cutting fluid.	MP 2.10, 2.11, 3.2, 3.5
21.28 Select a drill and drill a hole for reaming.	MP 2.10, 2.11
21.29 Select a reamer and ream a hole.	MP 2.10, 2.11
21.30 Drill a pilot hole to prepare a hole for countersinking.	MP 2.10, 2.11
21.31 Select a countersink and countersink a hole.	MP 2.10, 2.11
21.32 Drill the pilot hole for the counterboring operation.	MP 2.10, 2.11
21.33 Select a counterbore and counterbore a hole.	MP 2.10, 2.11
21.34 Select drill size and drill the holes for the tapping operation.	MP 2.10, 2.11
21.35 Use a countersink to chamfer a hole.	MP 2.10, 2.11
21.36 Select a tap and thread a hole using a tap and a tap wrench.	MP 2.10, 2.11
CNC Mill Programming and Operation	MP 2.10, 2.11, 3.6, 3.8
21.37 Enter and edit a CNC mill program using a text editor.	MP 2.10, 2.11
21.38 Simulate and edit a CNC mill program.	MP 2.10, 2.11
21.39 Determine the size and cutting direction of an end mill.	MP 2.10, 2.11
21.40 Mount a tool in a CNC mill.	MP 2.10, 2.11
21.41 Operate a CNC Mill.	MP 2.10, 2.11
21.42 Determine CNC program coordinates based on a dimensioned part drawing.	MP 2.10, 2.11
21.43 Select tooling for a CNC operation.	MP 2.10, 2.11
21.44 Determine the spindle speed for various machining operations.	MP 2.10, 2.11

CTE Standards and Benchmarks	National Standards
21.45 Determine the feed rate for a machining operation.	MP 2.10
21.46 Locate the PRZ of a part in a CNC mill using an edgefinder.	MP 2.10
21.47 Determine the tool offsets in a CNC mill.	MP 2.10
21.48 Create a precision part using PRZ and tool offset measurements.	MP 2.10
21.49 Convert coordinates between absolute and incremental positioning methods.	MP 2.10
21.50 Interpret a CNC mill program that uses basic G- and M-Codes (G00-G03).	MP 2.10
21.51 Design a CNC programs that use: program stop command, linear interpolation, absolute and incremental positioning, circular interpolation, spot boring cycle, counterboring cycle, pecking cycle, boring cycle, cutter compensation, mirroring and subprograms.	MP 2.10
Welding	
21.52 Identify a specified weld using a welding symbol.	MP 4.3
21.53 Draw a welding symbol using given variables.	MP 4.1, 4.3
21.54 Prepare metal for welding.	MP 1.8, 3.1, 3.7, 4.1, 4.2
21.55 Weld a project from a welding drawing.	MP 2.2, 3.1, 3.2, 3.3, 3.7, 3.8, 3.9, 4.3, 12.3
21.56 Weld round tubing in the fixed horizontal position.	MP 2.2, 2.3, 3.1, 3.2, 3.3, 3.7, 3.8, 3.9
21.57 Use a dye penetrant test and guided bend test to evaluate a weld.	MP 1.3, 3.1, 3.3, 3.8, 4.1, 4.3
21.58 Design a welded project.	
22.0 Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control--The student will be able to demonstrate:	
22.01 Skill in making job assignments and coordinating workflow.	
22.02 Skill in knowing that the appropriate resources are available to meet customer specifications.	
22.03 Skill in ensuring that set-up and operation procedures are available and up-to-date.	
22.04 Skill in correctly reading and interpreting a production schedule and manufacturing work order.	
22.05 Knowledge of production process, including flow and bottlenecks.	

CTE Standards and Benchmarks	National Standards
22.06 Knowledge of lead-time required for a production plan.	
22.07 Skill in correctly reading and interpreting bills of materials and routing sheets.	
22.08 Knowledge of methods of productivity measurement and improvement.	
22.09 Knowledge of principles and practice of Just-in-time (JIT) inventory control Skill in performing a physical inventory.	
22.10 Ability to identify manufacturing process variables that must be controlled for quality and reliability. This will include controlling quality of incoming materials, amounts of materials, operator skills, and adjustable parameters: time, temperature, pressure, speed, voltage, etc.	
23.0 Demonstrate proficiency in computer control and robotics--The student will be able to:	MP 3.6
Programmable Logic Controllers (PLC)	MP 3.6
23.01 Convert between Decimal and Binary.	MP 3.6
23.02 Wire input and output devices to a PLC.	MP 3.6
23.03 Open, download, monitor, run and stop a PLC processor file using PLC programming software.	MP 3.6
23.04 View the status of Input and Output Data Tables.	MP 3.6
23.05 Create, enter, save, and edit a PLC program using PLC programming software.	MP 3.6
23.06 Generate and print out a ladder logic report using PLC software.	MP 3.6
23.07 Design a PLC program to jog two motors.	MP 3.6
23.08 Design a PLC program to control the start/stop of two motors.	MP 3.6
23.09 Design a PLC program to interlock two motors.	MP 3.6
23.10 Design a PLC program that uses a safety interlock to control the operation of a machine.	MP 3.6
23.11 Design a reciprocating actuator sequence PLC program.	MP 3.6
23.12 Design a continuous cycle clamp and drill sequence PLC program.	MP 3.6
Basic Robot Operation	MP 3.6
23.13 Power up and shut down servo robot.	MP 3.6

CTE Standards and Benchmarks	National Standards
23.14 Jog a servo robot and adjust the fast and slow jog speed settings.	MP 3.6
23.15 Move parts using the manual jog function.	MP 3.6
23.16 Home a servo robot.	MP 3.6
23.17 Manually operate the gripper using the teach pendant.	MP 3.6
23.18 Use a teach pendant to: teach robot position points, test teach points, and edit teach points.	MP 3.6
23.19 Use a teach pendant to delete a program file.	MP 3.6
23.20 Use a teach pendant to enter a servo robot program that uses standard commands such as: PMOVE, LABEL, BRANCH, GRASP, RELEASE, SPEED, and DELAY	MP 3.6
23.21 Run a servo robot program using a teach pendant.	MP 3.6
23.22 Stop a servo robot program using any one of four different functions on a teach pendant.	MP 3.6
23.23 Design a program to perform a basic material handling task.	MP 3.6
23.24 Store and retrieve multiple programs in a robot controller.	MP 3.6
23.25 Use PC software to enter and edit a robot program offline and online.	MP 3.6
23.26 Use PC software to delete a program.	MP 3.6
23.27 Use PC software to power up, jog, home, and power down a servo robot.	MP 3.6
23.28 Use PC software to run a servo robot program.	MP 3.6
23.29 Connect digital input and output devices to a robot controller.	MP 3.6
23.30 Use PC software to enter a program that has WAITI and WRITEO commands, uses a manual operator station, and will unload an automatic machine.	MP 3.6
23.31 Design a robot program that performs a basic assembly task using linear motion and the commands LMOVE and LINEAR.	MP 3.6
23.32 Enter a robot program that uses the World Coordinate motion commands.	MP 3.6
23.33 Design and enter a robot program that uses Tool Coordinate motion commands.	MP 3.6
Application Development and Flexible Manufacturing Cells	
23.34 Construct a flow chart given a general sequence of operations.	

CTE Standards and Benchmarks	National Standards
23.35 Connect a solenoid-operated pneumatic valve to the output of a robot and operate.	
23.36 Design a robot program that will load and unload an automatic machine.	
23.37 Teach points with a double-jointed robot arm using the full range of its work envelope.	
23.38 Design a robot program that uses a robot's double-jointed design.	
23.39 Design a robot program given a general description of the application.	
23.40 Connect and configure a servo conveyor to a servo robot.	
23.41 Enter a robot program that has MON and MOFF commands.	
23.42 Design a robot program that uses a conveyor.	
23.43 Enter a robot program that has conditional commands: IFIN, ELSE, ENDIF, IF-THEN, and INP.	
23.44 Design a robot program that sorts parts.	
23.45 Enter a robot program that has subroutine commands: CALL, RETURN, and SUB.	
23.46 Design a robot application using a subroutine.	
23.47 Enter a robot program that has a DDMOVE command.	
23.48 Design a robot program that uses a servo conveyor.	
23.49 Jog a robot using four joint modes.	
23.50 Program a robot that uses a servo traverse axis.	
23.51 Enter a robot program which uses the GRWIDTH command.	
23.52 Design a robot program that uses a servo gripper.	
23.53 Develop a robot-to-solid state I/O interface wiring diagram.	
23.54 Interface a robot discrete I/O using a relay.	
23.55 Design a robot program to control an FMS workstation via discrete I/O.	
23.56 Design a robot program that will unload two or more automatic machines.	

CTE Standards and Benchmarks	National Standards
Production Control	
23.57 Enter a robot program that uses an input command.	
23.58 Enter a robot program that uses arithmetic and relational operators.	
23.59 Enter a robot program that has loop commands.	
23.60 Design a robot application using FOR-NEXT commands.	
23.61 Design and enter a robot program that uses counter commands.	
23.62 Design a robot program that stops a production process if a quality standard is not met.	
Quality Control	
23.63 View the current location of a robot in Cartesian coordinates.	
23.64 Use the MOV function with Cartesian coordinates to move a robot to a position.	
23.65 Use PC software to enter a robot program that uses points stored in Cartesian coordinates.	
23.66 Enter a robot program that has TESTI, FLAG, SET, RESET and IF FLAG commands.	
23.67 Design a robot program to perform a go no-go inspection.	
23.68 Enter a robot program that uses a variable name.	
23.69 Enter a robot program that uses the PRINT and PRINTLN commands.	
23.70 Design a program that provides an operator interface on a computer screen.	
23.71 Enter a robot program that has a MEASURE command.	
23.72 Design a robot program to inspect parts by measuring them in its gripper.	
24.0 Demonstrate the ability to properly identify, organize, plan, allocate resources, document and produce a mass-produced product via a master project--The student will be able to:	
24.01 Work in a team and use a seven step design process to design and build a prototype	
24.02 Create a Design Portfolio documenting research and student development materials including:	
a. Operation and design description	

CTE Standards and Benchmarks	National Standards
b. History research paper	
c. Current events article	
d. Individual contributor research paper	
e. Global industry analysis	
f. Local industry interview	
24.03 Create a Technology Sector Research Report containing four topics:	
a. Operation and application	
b. History and current events	
c. Impacts	
d. Individual and organization contribution	
24.04 Create an Industry Market Report that includes:	
a. Global market analysis	
b. Industry case study	
24.05 Create a Bill of Material (BOM) for your solution	
24.06 Create a prototype using specified design constraints (time, expenses, materials, safety considerations, etc.) and automated production processes	
24.07 Create and deliver a presentation to communicate project results to other teams	
25.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment--The students will be able to:	
25.01 Describe the nature and types of business organizations.	
25.02 Explain the effect of key organizational systems on performance and quality.	
25.03 List and describe quality control systems and/or practices common to the workplace.	Q 2.1
25.04 Explain the impact of the global economy on business organizations.	
26.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives--The students will be able to:	

CTE Standards and Benchmarks	National Standards
26.01 Employ leadership skills to accomplish organizational goals and objectives.	
26.02 Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.	
26.03 Conduct and participate in meetings to accomplish work tasks.	
26.04 Employ mentoring skills to inspire and teach others	