Prepared by the State Board of Education TEKS Review Committees

First Draft, August 2014

These draft proposed revisions reflect the changes to the career and technical education (CTE) Texas Essential Knowledge and Skills (TEKS) that have been recommended by State Board of Education-appointed TEKS review committees for courses in the **Manufacturing Career Cluster**. Proposed additions are shown in green font with underlines (additions) and proposed deletions are shown in red font with strikethroughs (~~deletions~~).

Comments in the right-hand column provide explanations for the proposed changes. The following notations were used as part of the explanations:

CRS—information added or changed to align with the Texas College and Career Readiness Standards (CCRS)

MV—multiple viewpoints from within the committee

VA—information added, changed, or deleted to increase vertical alignment

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§130.322. Principles of Manufacturing (One-Half ~~to One Credit~~).		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is recommended for students in Grades 9-12. Recommended prerequisite: Algebra I or Geometry.	
(b)	Introduction.	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	In Principles of Manufacturing, students are introduced to ~~gain proper knowledge and skills in the application, design, production, and assessment of products, services, and systems and how those knowledge and skills are applied to manufacturing.~~ Knowledge and skills used in the proper application of principles of manufacturing, ~~the design of technology, the efficient production of technology, and the assessment of the effects of manufacturing production technology prepare students for success in the modern world.~~ The study of manufacturing technology allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings in a manufacturing setting. In addition to general academic and technical knowledge and skills, students gain an understanding of career opportunities available in manufacturing and what employers require to gain and maintain employment in these careers.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples	
(c)	Knowledge and skills.	
(1)	Employability Skills ~~The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.~~ The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	.
(A)	~~describe how teams function~~; identify and compile with apocopate dress for the manufacturing activity	
(B)	~~use teamwork to solve problems~~; display employers expectation by being punctual to the course	
(C)	~~distinguish team roles such as team leaders and team members~~; demonstrate the ability to work in teams	

(D)	~~identify characteristics of good leaders~~ Interview preparation and etiquette	
~~(E)~~	~~identify employers' work expectations;~~	
~~(F)~~	~~discuss Equal Employment Opportunity law in the workplace;~~	
~~(G)~~	~~use time-management techniques to develop work schedules;~~	
~~(H)~~	~~describe how teams measure results; and~~	
~~(I)~~	~~develop a method to reward team performance.~~	
~~(2)~~	~~The student explores the employability characteristics of a successful worker in the global economy. The student is expected to~~	
~~(A)~~	~~explore academic knowledge and skills required for postsecondary education;~~	
~~(B)~~	~~identify employers' expectations to foster positive customer satisfaction;~~	
~~(C)~~	~~demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation~~	
~~(D)~~	~~evaluate personal career goals;~~	
~~(E)~~	~~communicate effectively with others to clarify objectives; and~~	
~~(F)~~	~~demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.~~	
~~(3)~~	~~The student describes how a systems model can be used to describe manufacturing and technological activities. The student is expected to:~~	
~~(A)~~	~~identify the manufacturing processes such as input, output, and feedback;~~	
~~(B)~~	~~describe system differences such as open and closed; and~~	
~~(C)~~	~~describe how technological systems interact to achieve common goals.~~	
~~(4)~~(2)	The student applies manufacturing concepts ~~to specific problems~~. The student is expected to:	
(A)	distinguish between disciplines such as engineering, science, manufacturing and technology;	
~~(B)~~	~~analyze engineering concepts to solve practical problems;~~	
~~(C)~~(B)	use problem-solving tools such as calculators and computers;	
~~(D)~~	~~evaluate computers for simulation tasks;~~	
~~(E)~~	~~use tools for laboratory equipment testing;~~	
~~(F)~~(C)	use ~~precision~~ measuring instruments; and	

~~(G)~~(D)	~~evaluate software to design~~ Identify quality assurance models.	
~~(5)~~	~~The student designs products or systems using appropriate processes and techniques. The student is expected to:~~	
~~(A)~~	~~improve a product that meets a specified need;~~	
~~(B)~~	~~identify system improvements such as quality, reliability, and safety;~~	
~~(C)~~	~~produce engineering drawings using standard technical communication techniques; and~~	
~~(D)~~	~~research the patenting process.~~	
~~(6)~~(3)	The student investigates emerging and innovative applications of technology in engineering. The student is expected to:	Lack of equipment and ability to demonstrate
~~(A)~~	~~report on innovative applications of technology in engineering; and~~	
~~(B)~~	~~experiment with new technologies.~~	
~~(7)~~(4)	The student describes quality and how it is measured in manufacturing. The student is expected to:	
(A)	evaluate different quality control applications in manufacturing; and	
(B)	how to measure quality of the product ~~research how the quality of products and services affects engineering decisions.~~	
~~(8)~~(5)	The student manufactures products or systems using the appropriate tools, equipment, machines, materials, and technical processes. The student is expected to:	
(A)	analyze engineering properties such as chemical, mechanical, and physical;	
(B)	analyze the processes needed to complete a project;	
(C)	use a variety of tools such as equipment and machines; and	
(D)	produce an item store materials correctly; and ms ~~that is student designed~~.	
~~(9)~~(6)	The student practices safe work habits. The student is expected to:	
(A)	master relevant safety tests based on OSHA guidelines and principals;	
(B)	Use MSDS sheets to analyze hazardous materials; ~~and~~	
(C)	safely dispose of hazardous materials. and	
(D)	Store materials correctly	
~~(10)~~(7)	The student describes the importance of maintenance. The student is expected to:	
(A)	perform maintenance on selected equipment;	
~~(B)~~	~~store materials correctly; and~~	

~~(C)~~(B)	analyze the results of improper maintenance.	
~~(11)~~(8)	The student manages a manufacturing project. The student is expected to:	
(A)	participate in the operation of a manufacturing project; and	
(B)	develop a plan for completing an individual project.	
~~(12)~~(9)	The student applies the appropriate codes, laws, standards, or regulations such as Occupational Safety and Health Administration, National Electrical Code, American Society for Testing Materials, standard symbols, and line weights. The student is expected to:	
(A)	research the importance of regulations such as codes, laws, and standards; and	
(B)	follow the appropriate regulations.	
~~(13)~~(10)	The student describes the intended and unintended effects of technological solutions to the manufacturing process. The student is expected to:	(14) covers (13)
~~(A)~~	~~evaluate an assessment strategy such as the risks and benefits of engineering activities; and~~	
~~(B)~~	~~demonstrate how engineering changes environments.~~	
~~(14)~~(11)	The student describes the factors that affect the evolution of technology. The student is expected to:	
(A)	analyze how changes in technology affect manufacturing practices;	
(B)	evaluate how the development of technology in manufacturing is influenced by past events;	
(C)	analyze the international effects of technology;	
(D)	demonstrate how advancements in technology have affected the field of engineering;	
(E)	evaluate the factors that affect the implementation of new ideas; and	
(F)	analyze how manufacturing evolves.	
~~(15)~~(12)	The student solves problems, thinks critically, and makes decisions related to manufacturing. The student is expected to:	
(A)	apply an engineering approach to problem solving to improve a manufactured product;	
(B)	apply critical-thinking strategies to the analysis of proposed solutions; and	
(C)	apply decision-making techniques to engineering solutions.	
~~(16)~~	~~The student identifies the factors that influence the cost of an item or service. The student is expected to:~~	
~~(A)~~	~~defend develop a budget for a project; and~~	
~~(B)~~	~~Identify the factors that influence that budget. determine the most effective strategies to minimize~~	

	~~costs.~~	
~~(17)~~(13)	The student applies communication, mathematics, and science knowledge and skills to manufacturing activities. The student is expected to:	
(A)	demonstrate communication techniques consistent with industry standards;	
(B)	locate relevant information needed to solve problems;	
(C)	apply mathematics concepts to solve manufacturing problems;	
(D)	analyze science principles used to solve problems; and	
(E)	use the appropriate units of measure.	
~~(18)~~(14)	The student describes the relationship between manufacturing and marketing. The student is expected to:	The students are in a beginning course and will not be producing a project to sell.
~~(A)~~	~~prepare a marketing plan for a product;~~	
~~(B)~~	~~analyze the effect of customer satisfaction on the image of a product; and~~	
~~(C)~~	~~analyze how customer demands influence the design of an object.~~	
~~(19)~~(15)	The student selects and reports on career opportunities, requirements, and expectations in manufacturing ~~engineering~~ and technology. The student is expected to:	
(A)	investigate an area of interest in manufacturing;	
(B)	analyze the various specializations in manufacturing; and	
(C)	describe the functions of engineers, technologists, and technicians.	

Manufacturing (One Credit)		
	TEKS with edits	Committee Comments
(a)	General requirements. This course is recommended for students in Grades 10 -12. Recommended prerequisites: Algebra I	
(b)	**Introduction.**	.
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	In Manufacturing, students gain knowledge and skills in the application, design, production, and assessment of products, services, and systems and how those knowledge and skills are applied to manufacturing. The study of manufacturing system allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings in a manufacturing setting. Manufacturing allows the student the opportunity to understand the process of mass production by using a variety of materials and manufacturing techniques. Knowledge about career opportunities, requirements, and expectations and the development of skills prepare students for workplace success.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples	
(c)	**Knowledge and skills:**	
(1)	The student describes the characteristics of a successful worker in the global economy The student is expected to:	
(A)	demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.	
(B)	demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;	
(C)	use teamwork to solve problem	
(D)	identify employers' work expectations	
(E)	Use time-management techniques to develop work schedules	

(2)	The student applies academic skills to the requirements of manufacturing. The student is expected to:	
(A)	demonstrate effective oral and written communication skills with individuals from varied cultures, including fellow workers, management, and customers;	
(B)	Interpret engineering drawings, charts, diagrams, and welding symbols;	
(C)	select algebraic and geometric principles and formulas required for precision measuring operations.	
(3)	The student differentiates the technical concepts that form the knowledge and skills of manufacturing. The student is expected to:	
(A)	safely use hand and power tools and equipment commonly employed in manufacturing;	
(B)	safely use hand and power tools and equipment commonly employed in manufacturing;	
(C)	demonstrate a understanding of the safety regulations of the different types of manufacturing equipment: cutting, abrasive, boring, turning, shaping, and forming tools; and	
(D)	properly execute procedures using the different types of manufacturing equipment: cutting, abrasive, boring, turning, shaping, and forming tools	
(E)	Research the modern materials used in manufacturing	
(F)	Perform varied measurements, including precision measurements	
(4)	The student investigates emerging and innovative applications of technology in engineering. The student is expected to:	
(A)	report on innovative applications of technology in engineering; and	
(B)	experiment with new technologies.	
(C)	experiment with different manufacturing materials, such as plastic, composites, fiberglass, ect	
(5)	The student manufactures products or systems using the appropriate tools, equipment, machines, materials, and technical processes. The student is expected to:	
(A)	analyze engineering properties such as chemical, mechanical, and physical;	
(B)	analyze the processes needed to complete a project;	
(C)	use a variety of tools such as equipment and machines; and	
(D)	produce an item that is student designed.	
(6)	The student practices safe work habits. The student is expected to:	
(A)	master safety tests developed from OSHA regualtions;	
(B)	analyze hazardous materials; and	
(C)	safely dispose of hazardous materials.	

(D)	store materials correctly	
(7)	The student paticapates in a mass manufacturing project. The student is expected to:	
(A)	participate in the operation of manufacturing a mass produced project; and	
(B)	develop the a method to check and maintain quality control through the manufacturing..	
(8)	The student identifies the factors that influence the cost of an item or service. The student is expected to:	
(A)	defend a budget for a project; and	
(B)	determine the most effective strategies to minimize costs.	
(9)	The student describes the relationship between manufacturing and marketing. The student is expected to:	
(A)	prepare a marketing plan for a product;	
(B)	analyze the effect of customer satisfaction on the image of a product; and	
(C)	analyze how customer demands influence the design of an object.	
(10)	The student applies communication, mathematics, and science knowledge and skills to manufacturing activities. The student is expected to:	
(A)	demonstrate communication techniques consistent with industry standards;	
(B)	locate relevant information needed to solve problems;	
(C)	apply mathematics concepts to solve manufacturing problems;	
(D)	analyze science principles used to solve problems; and	
(E)	use the appropriate units of measure.	

Advanced Manufacturing (One Credit)		
	TEKS with edits	Committee Comments
(a)	General requirements. This course is recommended for students in Grades 11 -12. Recommended prerequisites: Algebra I, Manufacturing	
(b)	Introduction.	.
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	In Manufacturing, students gain knowledge and skills in the application, design, production, and assessment of products, services, and systems and how those knowledge and skills are applied to manufacturing. The study of manufacturing system allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings in a manufacturing setting. Manufacturing allows the student the opportunity to understand the process of mass production by using a variety of materials and manufacturing techniques. Knowledge about career opportunities, requirements, and expectations and the development of skills prepare students for workplace success.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples	
(c)	Knowledge and skills:	
(1)	The student describes the characteristics of a successful worker in the global economy The student is expected to:	
(A)	demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.	
(B)	demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;	
(C)	use teamwork to solve problem	
(D)	identify employers' work expectations	
(E)	Use time-management techniques to develop work schedules	

(F)	explore advanced knowledge and skills required for postsecondary education;	
(G)	identify employers' expectations to foster positive customer satisfaction;	
(2)	The student applies academic skills to the requirements of manufacturing. The student is expected to:	
(A)	demonstrate effective oral and written communication skills with individuals from varied cultures, including fellow workers, management, and customers;	
(B)	Interpret engineering drawings, charts, diagrams, and welding symbols;	
(C)	select algebraic and geometric principles and formulas required for precision measuring operations;	
(D)	Develop the information needed to mass produce a simple project such as flow charts, schedules, equipment list, and material list; and	
(E)	Explore the use of jig and fixtures in mass production.	
(3)	The student differentiates the technical concepts that form the knowledge and skills of manufacturing. The student is expected to:	
(A)	safely use hand and power tools and equipment commonly employed in manufacturing;	
(B)	demonstrate a understanding of the safety regulations of the different types of manufacturing equipment: cutting, abrasive, boring, turning, shaping, and forming tools; and	
(C)	properly execute procedures using the different types of manufacturing equipment: cutting, abrasive, boring, turning, shaping, and forming tools	
(D)	research the modern materials used in manufacturing	
(E)	perform varied measurements, including precision measurements	
(F)	design and develop the jigs and fixtures for a simple four or less part product; and	
(G)	Participate in the production run of the project.	
(4)	The student will learn skills in production and programming of computer numerical control operations. The student is expected to:	
(A)	Develop a CNC program using CAM program	
(B)	properly execute the CNC program to machine a product or run a simulation of the program	
(5)	The student investigates emerging and innovative applications of technology in engineering. The student is expected to:	
(A)	research innovative techniques of technology in engineering; and	
(B)	Experiment with new technologies.	
(C)	experiment with different manufacturing materials, such as plastic, composites, fiberglass, ect	
(6)	The student manufactures products or systems using the appropriate tools, equipment, machines, materials, and technical processes. The student is expected to:	
(A)	analyze engineering properties such as chemical, mechanical, and physical;	

(B)	analyze the processes needed to complete a project;	
(C)	use a variety of tools such as equipment and machines; and	
(D)	produce an item that is student designed.	
(7)	The student practices safe work habits. The student is expected to:	
(A)	master safety tests developed from OSHA regualtions;	
(B)	analyze hazardous materials; and	
(C)	safely dispose of hazardous materials.	
(D)	store materials correctly	
(8)	The student participates in a mass manufacturing project. The student is expected to:	
(A)	participate in the operation of manufacturing a mass produced project; and	
(B)	develop the a method to check and maintain quality control through the manufacturing..	
(9)	The student identifies the factors that influence the cost of an item or service. The student is expected to:	
(A)	defend a budget for a project; and	
(B)	determine the most effective strategies to minimize costs.	
(10)	The student describes the relationship between manufacturing and marketing. The student is expected to:	
(A)	prepare a marketing plan for a product;	
(B)	analyze the effect of customer satisfaction on the image of a product; and	
(C)	analyze how customer demands influence the design of an object.	
(11)	The student applies communication, mathematics, and science knowledge and skills to manufacturing activities. The student is expected to:	
(A)	demonstrate communication techniques consistent with industry standards;	
(B)	locate relevant information needed to solve problems;	
(C)	apply mathematics concepts to solve manufacturing problems;	
(D)	analyze science principles used to solve problems; and	
(E)	use the appropriate units of measure.	

§130.330. Practicum in Manufacturing (~~Two to~~ Three Credits).		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is recommended for students in Grade 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the manufacturing cluster.	***Although changes have been made on here, we are tabling this until the credit issue is resolved.
(b)	**Introduction**.	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	The practicum is designed to give students supervised practical application of previously studied knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples	
(c)	**Knowledge and skills**.	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to: ~~The student demonstrates professional standards as required by business and industry. The student is expected to:~~	
(A)	adhere to standard operating procedures;	
(B)	demonstrate positive work behaviors such as attitudes, punctuality, time management, initiative, and cooperation;	
(C)	accept constructive criticism;	
(D)	apply ethical reasoning to a variety of situations in order to make ethical decisions;	
(E)	complete tasks with the highest standards such as quality products and services;	
(F)	model professional appearance such as dress, grooming, and personal protective equipment as appropriate; and	
(G)	comply with practicum setting safety rules such as regulations to maintain safe working conditions and environments.	

(2)	The student applies concepts of critical thinking and problem solving. The student is expected to:	
(A)	analyze elements of a problem to develop innovative solutions;	
(B)	critically analyze information to determine value to the problem-solving task;	
(C)	analyze a variety of problem-solving and critical-thinking skills; and	
(D)	conduct technical research to gather information necessary for decision making.	
(3)	The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	
(A)	analyze leadership characteristics such as trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation;	
(B)	demonstrate teamwork skills through working cooperatively with others to achieve tasks;	
(C)	demonstrate teamwork processes such as promoting team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution;	
(D)	demonstrate responsibility for organization tasks such as shared group and individual work tasks; and	
(E)	establish and maintain effective working relationships to accomplish objectives such as:	
(i)	demonstrating effective working relationships using interpersonal skills;	
(ii)	using positive interpersonal skills to work cooperatively with others;	
(iii)	negotiating effectively to reach decisions;	
(iv)	demonstrating respect for individuals from different cultures, genders, and backgrounds; and	
(v)	demonstrating value for diversity.	
(4)	The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	
(A)	demonstrate the use of content such as technical concepts and vocabulary when analyzing information and following directions;	
(B)	employ verbal skills when obtaining and conveying information;	
(C)	use informational texts such as Internet websites and technical materials to review and apply information sources for occupational tasks;	
(D)	evaluate the reliability of information from informational texts such as Internet websites, technical materials, and resources;	
(E)	interpret verbal and nonverbal cues and behaviors to enhance communication;	
(F)	apply active listening skills such as obtaining and clarifying the information; and	

(G)	use academic skills such as effective written and oral communication.	
(5)	The student demonstrates technical knowledge and skills required to pursue a career in the manufacturing cluster. The student is expected to:	
(A)	use information literacy skills such as accessing, evaluating, and disseminating information;	
(B)	describe information management;	
(C)	maintain records to facilitate ongoing business operations;	
(D)	develop goals;	
(E)	prioritize tasks;	
(F)	develop timelines using time-management skills;	
(G)	use project-management skills to improve workflow;	
(H)	evaluate proficiencies in technical skills; and	
(I)	accept critical feedback provided by the supervisor.	
(6)	The student documents technical knowledge and skills using a professional portfolio. The student is expected to:	
~~(A)~~	~~update a professional portfolio to include:~~	
~~(i)~~ (A)	attainment of technical skill competencies;	
~~(ii)~~ (B)	licensures or certifications;	
~~(iii)~~ (C)	recognition;	
~~(iv) /~~	~~extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations;~~	
~~(v)~~ (E)	abstract of key points of the practicum;	
~~(vi)~~ (F)	resumé;	
~~(vii)~~ (G)	samples of work; and/or	
~~(viii)~~ (H)	evaluation from the practicum supervisor; and	
~~(B)~~ (I)	present the portfolio to all interested stakeholders ~~such as in a poster presentation~~.	

§130.327. ~~Flexible~~ Metal Fabrication and Manufacturing Processes (One to Two Credits).		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is recommended for students in Grades 10-12. Recommended prerequisite: Algebra I or Geometry.	
(b)	**Introduction**	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	**3**. ~~Rapid advances in technology have created new career opportunities and demands in many industries.~~ Metal Manufacturing provides the knowledge, skills, and technologies required for equal opportunity employment in the metal working industry. ~~Students need to develop knowledge of the concepts and skills related to this system in order to apply them to personal and career development.~~ Career and technical education supports integration of academic and technical knowledge and skills. Students must have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of ~~workplace~~ skills prepare students for workplace success.	
(4)	4 Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	5 Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples	
(c)	Knowledge and skills.	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to: ~~The student describes importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills. The student is expected to:~~	
(A)	demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations. ~~describe how teams function;~~	
(B)	~~determine advanced knowledge and skills required for postsecondary education;~~ use teamwork to solve problems;	
(C)	demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation; ~~distinguish team roles such as team leaders and team~~	

	~~members;~~	
(D)	use teamwork to solve problem,	
(E)	identify characteristics of good leaders;	
(F)	identify employers' work expectations;	
(G)	distinguish team roles such as team leaders and team members:	
(H)	discuss Equal Employment Opportunity law in the workplace;	
(I)	use time-management techniques to develop work schedules;	
~~(H)~~	~~describe how teams measure results; and~~	
~~(I)~~	~~develop a method to reward team performance.~~	
~~(2)~~	~~The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:~~	
~~(A)~~	~~determine advanced knowledge and skills required for postsecondary education;~~	
~~(B)~~	~~identify employers' expectations to foster positive customer satisfaction;~~	
~~(C)~~	~~demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;~~	
~~(D)~~	~~evaluate personal career goals;~~	
~~(E)~~	~~communicate effectively with others in the workplace to clarify objectives; and~~	
~~(F)~~	~~demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.~~	
~~(3)~~(2)	The student applies academic skills to the requirements of metal manufacturing ~~materials~~. The student is expected to:	
(A)	demonstrate effective oral and written communication skills with individuals from varied cultures, including fellow workers, management, and customers;	
(B)	~~Appraise~~ Interpret engineering drawings, charts, diagrams, and welding symbols;	
(C)	select algebraic and geometric principles and formulas required for precision measuring operations.	
(4)(3)	The student differentiates the technical concepts that form the knowledge and skills of metal manufacturing ~~trades~~. The student is expected to:	

(A)	analyze the resources found in The Machinery's Handbook, ~~and various~~ American Welding Society]Canada Welding Bureau, ANSI and ASCI specifications and codes, that are recognized by the United States and Canada I reference books;	
(B)	examine the theory of shielded metal arc-welding and , Gas metal arc	
(C)	examine the sheet metal industry; and	
(D)	examine the use of abrasives.	
~~(5)~~(4)	The student differentiates the function and application of the tools, equipment, technologies, and materials used in metal manufacturing. The student is expected to:	
(A)	safely use hand and power tools and equipment commonly employed in metal manufacturing; and	
(B)	properly handle and dispose of environmentally hazardous materials used in metal manufacturing.	
~~(6)~~(5)	The student applies the technical concepts and skills of the machining industry to simulated and actual work situations. The student is expected to:	
(A)	use various work mounting procedures on all appropriate machines;	
(B)	examine the cutting operations such as drill press, lathe, saw, grinders, and milling machines;	
(C)	properly execute lathe procedures such as cutting threads, turning tapers, drilling, reaming, polishing, knurling and boring. ~~cut threads, turn tapers, drills, reams, polishes, knurls, and bores;~~	
(D)	Properly execute milling procedures such as milling flat surfaces, bevels, chamfers, grooves, and key-ways seats; ~~mill flat surfaces, bevels, chamfers, grooves, and key seats;~~ and	
(E)	~~machine~~ machining precision pieces.	
~~(7)~~(6)	The student applies the technical concepts and skills of the welding industry to simulated and actual work situations. The student is expected to:	
(A)	Properly execute ~~examine~~ the cutting processes such straight cuts, bevel cuts, and hole piercing with oxy-fuel and plasma;	
(B)	Practice using ~~of~~ the common types of electrodes with the Shield Metal Arc Welding process,	
(C)	~~use various welding machines to weld multiple joints; and~~ practice using ~~-~~Metal Inert Gas to weld in multiple position to produce groove and fillet welds	
(D)	Inspect fillet and groove welds to AWS, CWB ANSI and API codes	
~~(8)~~(7)	The student applies the technical concepts and skills of the sheet metal industry to simulate~~d and~~ actual work situations. The student is expected to:	

(A)	use mathematics in precision measuring operations; and	
(B)	interpret blueprints, engineering drawings, charts, and diagrams as related to the sheet metal industry.	
~~(9)~~(8)	The student differentiates the concepts that form the technical knowledge and skills of sheet metal manufacturing. The student is expected to:	
(A)	analyze the types, sizes, and properties of sheet metal materials;	
(B)	analyze the fundamentals of oxy-fuel processes as related to sheet metal; and	
(C)	analyze the fundamentals of shielded metal arc-welding and GMAW as related to sheet metal under various American Welding Society code.	
~~(10)~~(9)	The student understands the function and application of the tools, equipment, technologies, and materials used in sheet metal manufacturing. The student is expected to:	
(A)	Practice safely use equipment; and	
(B)	properly dispose of ~~environmentally~~ hazardous materials used in sheet metal manufacturing.	
~~(11)~~(10)	The student applies the knowledge and skills of sheet metal manufacturing in simulated and actual work situations. The student is expected to:	
(A)	draw simple metal layouts; and	
(B)	construct common sheet metal seams.	

§130.328. Advanced Flexible Manufacturing (Two to Three Credits).		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is recommended for students in Grades 11-12. Recommended prerequisites: Geometry, Algebra II, and Flexible Manufacturing.	
(b)	**Introduction**. Advanced Flexible Manufacturing builds on knowledge and skills developed in Flexible Manufacturing. Students will develop advanced concepts and skills as they relate to personal and career development. This course integrates academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems.	
(c)	**Knowledge and skills**.	
(1)	The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills. The student is expected to:	
(A)	describe how teams function;	
(B)	use teamwork to solve problems;	
(C)	distinguish team roles such as team leaders and team members;	
(D)	identify characteristics of good leaders;	
(E)	identify employers' work expectations;	
(F)	discuss Equal Employment Opportunity law in the workplace;	
(G)	use time-management techniques to develop work schedules;	
(H)	describe how teams measure results; and	
(I)	develop a method to reward team performance.	
(2)	The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:	
(A)	determine advanced knowledge and skills required for postsecondary education;	
(B)	identify employers' expectations to foster positive customer satisfaction;	
(C)	demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;	
(D)	evaluate personal career goals;	
(E)	communicate effectively with others in the workplace to clarify objectives; and	
(F)	demonstrate skills related to health and safety in the workplace, as specified by appropriate	

	government regulations.	
(3)	The student applies advanced academic skills to the requirements of metal trades. The student is expected to:	
(A)	demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;	
(B)	successfully complete work orders;	
(C)	estimate labor costs using various algebraic formulas;	
(D)	interpret advanced blueprints such as drawings, charts, diagrams, and welding symbols; and	
(E)	demonstrate calculation of precision measuring operations using algebra, geometry, and trigonometry.	
(4)	The student knows the advanced concepts that form the technical knowledge and skills of metal trades. The student is expected to:	
(A)	analyze the resources found in machinery manufacturing reference materials;	
(B)	demonstrate knowledge of the various welding theories;	
(C)	examine the sheet metal industry; and	
(D)	examine the use of advanced abrasives.	
(5)	The student knows the function and application of the tools, equipment, technologies, and materials used in metal manufacturing. The student is expected to:	
(A)	safely use equipment commonly employed in metal manufacturing;	
(B)	properly dispose of environmentally hazardous materials used in metal manufacturing;	
(C)	demonstrate knowledge of numerical control machining operations;	
(D)	demonstrate knowledge of the concepts of automated numerical control welding machines; and	
(E)	demonstrate knowledge of emerging technologies that may affect metal manufacturing.	
(6)	The student applies the advanced concepts and technical knowledge and skills of the machining industry to simulated and actual work situations. The student is expected to:	
(A)	use various work mounting procedures on all appropriate machines;	
(B)	examine the cutting operations such as drill press, lathe, saw, grinders, and milling machines;	
(C)	properly execute lathe procedures such as cut threads, turn tapers, drills, reams, polishes, knurls, and bores;	
(D)	mill flat surfaces, bevels, chamfers, grooves, and key-seats; and	

(E)	machine precision pieces.	
(7)	The student applies the advanced concepts and technical knowledge and skills of the welding industry to simulated and actual work situations. The student is expected to:	
(A)	examine the cutting processes such as oxy-fuel and plasma;	
(B)	explore the use of the common types of electrodes;	
(C)	use various welding machines to weld multiple joints; and	
(D)	inspect welds.	
(8)	The student applies the advanced concepts and technical knowledge and skills of the sheet metal industry to simulated and actual work situations. The student is expected to:	
(A)	estimate labor costs;	
(B)	use advanced mathematics in precision measuring operations; and	
(C)	interpret industrial standard blueprints, drawings, charts, and diagrams.	
(9)	The student knows the advanced concepts and technical knowledge and skills of sheet metal manufacturing. The student is expected to:	
(A)	analyze properties of sheet metal materials and fasteners;	
(B)	analyze oxy-fuel processes as related to sheet metal; and	
(C)	demonstrate knowledge of shielded metal arc-welding as related to sheet metal under American Welding Society code.	
(10)	The student knows the function and application of the tools, equipment, technologies, and materials used in sheet metal. The student is expected to:	
(A)	safely use equipment commonly employed in sheet metal;	
(B)	properly dispose of environmentally hazardous materials used in sheet metal manufacturing; and	
(C)	demonstrate knowledge of emerging technologies that may affect sheet metal.	
(11)	The student applies the advanced concepts and technical skills in simulated and actual work situations. The student is expected to:	
(A)	draw advanced sheet metal layouts;	
(B)	construct sheet metal seams;	
(C)	construct transitions and offsets;	
(D)	use the gas tungsten arc-welding process in sheet metal construction;	

(E)	apply the principles of sheet metal construction to the fabrication of duct work; and	
(F)	apply skills in sheet metal to career preparation learning experiences.	

§130.329. Manufacturing Engineering Technology(~~Two to Three~~ One Credits).		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is recommended for students in Grades 10 ~~11~~-12. Recommended prerequisites: Algebra I~~I, Computer Science I, and Physics.~~	New course to complete the pathway with the original Manufacturing Engineering changed to Advance Manufacturing Engineering
(b)	**Introduction**.	.
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	In Manufacturing Engineering, students gain knowledge and skills in the application, design, production, and assessment of products, services, and systems and how those knowledge and skills are applied to manufacturing~~. Knowledge and skills in the proper application of Manufacturing Engineering, the design of technology, efficient manufacturing technology, and the assessment of the effects of production technology~~ prepare students for success in the global economy. The study of Manufacturing Engineering allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings in a manufacturing setting.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples	
(c)	**Knowledge and skills**:	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to: ~~The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills. The student is expected to:~~	The added statement replaces and fully incorporates or implies the removed text from 1 and 2 below.
(A)	describe how teams function;	
~~(B)~~	~~use teamwork to solve problems;~~	
~~(C)~~	~~distinguish team roles such as team leaders and team members;~~	
~~(D)~~	~~identify characteristics of good leaders;~~	

~~(E)~~(B)	~~identify~~ appraise employers' work expectations;	
~~(F)~~	~~discuss Equal Employment Opportunity law in the workplace;~~	
~~(G)~~	~~use time-management techniques to develop work schedules;~~	
~~(H)~~	~~describe how teams measure results; and~~	
~~(I)~~	~~develop a method to reward team performance.~~	
~~(2)~~	~~The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:~~	
~~(A)~~	~~explore advanced knowledge and skills required for postsecondary education;~~	
~~(B)~~	~~identify employers' expectations to foster positive customer satisfaction;~~	
~~(C)~~	~~demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;~~	
~~(D)~~	~~evaluate personal career goals;~~	
~~(E)~~	~~communicate effectively with others in the workplace to clarify objectives; and~~	
~~(F)~~(C)	demonstrate knowledge of the concepts and skills related to health and safety in the workplace, as specified by appropriate government regulations.	
~~(3)~~(2)	The student applies software skills in designing for mobility. The student is expected to:	
(A)	use computer-aided design software to complete a project;	
(B)	analyze the results of product testing in a simulated modeling environment; and	
(C)	fabricate a prototype design of a mechanical part.	
~~(4)~~(3)	The student gains ~~advanced~~ skills in writing programmable logic controls so that a ~~multiple~~ robot~~s~~ can work with a machine ~~together as a team~~. The student is expected to:	
(A)	use computer-integrated manufacturing techniques to simulate a manufacturing process; and	
(B)	troubleshoot programmable logic circuit devices.	
~~(5)~~(4)	The student performs functions and solves problems in the electricity and electronics field. The student is expected to:	
(A)	~~develop solutions to~~ research the use control devices; and	
(B)	~~troubleshoot~~ demonstrate the use control devices.	
~~(6)~~(5)	The student learns skills in production and programming of computer numerical control operations. The student is expected to:	

(A)	design ~~on the~~ a product using a CAM software for production on a ~~computer numerical control~~ CNC lathe;	
(B)	produce a product on the computer numerical control lathe ; or simulation	
(C)	design ~~on the~~ a product using a CAM software for production on a ~~computer numerical control~~ CNC mill;	
(D)	produce a product on the computer numerical control mill or simulation; and	
(E)	complete data sheets for plan, do, check, and act forms and projects.	
~~(7)~~(6)	The student knows mechanical, fluid, electrical, and thermal systems. The student is expected to:	
(A)	recognize, name, and describe the use of pneumatics devices;	
(B)	recognize, name, and describe the use of hydraulics devices;	
(C)	demonstrate the use of pneumatics devices	
(D)	demonstrate the use of hydraulics devices; and	
~~(C)~~ (E)	~~analyze~~ research the effects of heat energy and temperature on products~~; and~~	
~~(D)~~	~~develop an understanding of ventilation such as heating, air conditioning, and refrigeration~~.	
~~(8)~~(7)	The student ~~analyzes~~ understand the quality control systems. The student is expected to:	
(A)	~~apply~~ research statistical process control;	
(B)	~~determine sprocket hardness values in ascending order;~~	
(C)	manually calculate resistor capability indices;	Move to Electronics
(D)	~~demonstrate~~ describe the use of software to control instruments; and	
(E)	~~analyze~~ explain attribute and Pareto charts.	

§130.329. Advanced Manufacturing Engineering (Two to Three Credits).		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is recommended for students in Grades 11-12. Recommended prerequisites: Algebra II, Manufacturing Engineering, Computer Science I, and Physics.	This is the old Manufacturing Engineering course with a course added for a complete pathway
(b)	**Introduction**.	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	In Manufacturing Engineering, students gain knowledge and skills in the application, design, production, and assessment of products, services, and systems and how those knowledge and skills are applied to manufacturing. ~~Knowledge and skills in the proper application of Manufacturing Engineering, the design of technology, efficient manufacturing technology, and the assessment of the effects of production technology~~ prepare students for success in the global economy. The study of Manufacturing Engineering allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings in a manufacturing setting.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples	
(c)	**Knowledge and skills**:	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to: ~~The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills. The student is expected to:~~	
(A)	describe how teams function;	
~~(B)~~	~~use teamwork to solve problems;~~	
~~(C)~~	~~distinguish team roles such as team leaders and team members;~~	
~~(D)~~	~~identify characteristics of good leaders;~~	
~~(E)~~(B)	~~identify~~ appraise employers' work ~~expectations;~~ ethic	

~~(F)~~	~~discuss Equal Employment Opportunity law in the workplace;~~	
~~(G)~~	~~use time-management techniques to develop work schedules;~~	
~~(H)~~	~~describe how teams measure results; and~~	
~~(I)~~	~~develop a method to reward team performance.~~	
~~(2)~~	~~The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:~~	
~~(A)~~	~~explore advanced knowledge and skills required for postsecondary education;~~	
~~(B)~~	~~identify employers' expectations to foster positive customer satisfaction;~~	
(C)	demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;	
~~(D)~~	~~evaluate personal career goals;~~	
~~(E)~~(D)	communicate effectively with others in the workplace to clarify objectives; and	
~~(F)~~(E)	~~demonstrate knowledge of the concepts and~~ apply skills related to health and safety in the workplace, as specified by appropriate government regulations.	
~~(3)~~(2)	The student applies software skills in designing for mobility. The student is expected to:	
(A)	use computer-aided design software to complete a project;	
(B)	analyze the results of product testing in a simulated modeling environment; and	
(C)	fabricate a prototype design of a mechanical part.	
~~(4)~~(3)	The student gains advanced skills in writing programmable logic controls so that multiple robots can work together as a team. The student is expected to:	
(A)	use computer-integrated manufacturing techniques to simulate a manufacturing process; and	
(B)	troubleshoot programmable logic circuit devices.	
~~(5)~~(4)	The student performs functions and solves problems in the electricity and electronics field. The student is expected to:	
(A)	develop solutions to use control devices; and	
(B)	troubleshoot control devices.	
~~(6)~~(5)	The student learns skills in production and programming of computer numerical control operations. The student is expected to:	
(A)	design a project using a CAM software for a CNC ~~on the computer numerical control~~ lathe;	

(B)	produce a product on a CNC ~~the computer numerical control~~ lathe or simulator;	
(C)	design a project using a CAM software for a CNC ~~on the computer numerical control~~ mill;	
(D)	produce a product on a CNC ~~the computer numerical control~~ mill ; or simulator and	
(E)	complete data sheets for plan, do, check, and act forms and projects.	
~~(7)~~(6)	The student knows mechanical, fluid, electrical, and thermal systems. The student is expected to:	
(A)	use pneumatics devices;	
(B)	use hydraulics devices;	
(C)	use electrical controls	
(D)	develop a simple system using electrical controls and pneumatics or hydraulics devices	
~~(C)~~(E)	analyze the effects of heat energy and temperature on products; and	
~~(D)~~(F)	develop an understanding of ventilation such as heating, air conditioning, and refrigeration.	
~~(8)~~(7)	The student analyzes quality control systems. The student is expected to:	
(A)	apply statistical process control;	
(B)	determine ~~sprocket~~ hardness values ~~in ascending order~~ of different materials;	
(C)	manually calculate ~~resistor capability indices~~ values of different electronic components;	
(D)	~~demonstrate the use of software to control instruments; and~~	
(E)	analyze attribute and Pareto charts.	

Introduction to Welding (One Credit).		
	TEKS	Committee Comments
(a)	General requirements. This course is recommended for students in Grades 9-12. Recommended prerequisite or concurrent: Algebra 1.	
(b)	**Introduction.**	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	Provides an introduction to welding technology with an emphasis on basic welding laboratory principles and operating procedures. Topics include: industrial safety and health practices, hand tool and power machine use, measurement, laboratory operating procedures, welding power sources, welding career potentials, and introduction to welding codes and standards. Introduction to Welding provides knowledge, skills, and technologies required for employment in welding industries. Students develop knowledge and skills related to this system and apply them to personal career development. This course supports integration of academic and technical knowledge and skills. Students will reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for future success.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	
(c)	**Knowledge and skills.**	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	
(A)	Oral Communication – skill in expressing ideas and messages to others in a clear, concise and effective manner, including explaining and justifying actions convincingly.	
(B)	Written Communication – skill in effectively conveying written information and messages in a socially acceptable manner that is easily understandable to others.	
(C)	Work Ethic – consistent demonstration of punctuality, dependability, reliability and responsibility in reporting for duty and performing assigned tasks as directed.	

(D)	Professionalism – knowledge of how to dress appropriately, speak politely, and conduct one's self in a manner appropriate for the profession and work site.	
(E)	Integrity – ability to be trustworthy and honest, to choose the ethical course of action, and to comply with all applicable, rules, laws and regulations.	
(F)	Attention to Detail – skill in reviewing with a critical eye the fine, detailed aspects of both quantitative and qualitative work process and end products.	
(G)	Problem Solving – ability to evaluate systems and operations, identify causes, problems, patterns or issues, and explore workable solutions or remedies to improve situations.	
(H)	Following Directions – ability to follow written and oral instructions and to adhere to established business practices, policies and procedures, including health and safety rules.	
(I)	Time Management – skill in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that uses time wisely and optimizes efficiency and results.	
(2)	The student evaluates the function and application of the tools, equipment, technologies, and materials used in welding. The student is expected to:	
(A)	employ welding equipment according to safety standards;	
(B)	identify and properly dispose of environmentally hazardous materials used in welding; and	
(C)	evaluate appropriate personal protective equipment; and	
(D)	evaluate skills related to health and safety in the workplace, as specified by appropriate government regulations.	
(3)	The student describes the characteristics of a successful worker in the global economy. The student is expected to:	
(4)	The student compares and contrasts welding joint design, material symbols, and welds. The student is expected to:	
(A)	appraise appropriate team functions;	
(B)	identify employers' work expectations;	
(C)	evaluate personal career goals;	
(5)	The student applies academic skills in relationship to welding. The student is expected to:	
(A)	demonstrate mathematical skills related to welding;	
(B)	demonstrate technical writing skills related to welding;	
(C)	apply accurate readings of measuring devices;	
(D)	accurately utilize appropriate tools to make measurements;	

(E)	calculate problems using whole numbers, fractions, mixed numbers, and decimals; and	
(F)	perform conversions between fractions and decimals;	
(6)	The student evaluates the function and application of the tools, equipment, technologies, and materials used in welding. The student is expected to:	
(A)	use welding equipment according to safety standards;	
(B)	properly dispose of environmentally hazardous materials used in welding; and	
(C)	use appropriate personal protective equipment as needed to follow safety measures.	
(7)	The student understands welding joint design, symbols, and welds. The student is expected to:	
(A)	demonstrate knowledge of welding sketches;	
(B)	identify types of welds such as fillet, groove, spot, plug, and flanged.	
(8)	The student applies the concepts and skills of welding projects. The student is expected to:	
(A)	explore careers in welding;	
(B)	Introduction to welding codes, such as American Welding Society;	
(C)	work independently to fabricate varied welded projects with minimal assistance; and	
(D)	work collaboratively with other students.	
(9)	The student performs oxy-fuel processes on carbon steels. The student is expected to:	
(A)	observe safe operating practices;	
(B)	perform safe handling of compressed gases;	
(C)	identify components of oxy-fuel gas cutting;	
(D)	demonstrate proper set-up procedures for oxy-fuel process;	
(E)	distinguish factors affecting base metals; ferrous and non-ferrous metals	
(F)	demonstrate proper cutting techniques such as piercing, straight line, and bevel;	
(10)	The student performs shielded metal arc welding principles and practices on metals. The student is expected to:	
(A)	use safe operating practices;	
(B)	demonstrate knowledge of alternating current;	
(C)	apply shielded metal arc welding principles;	
(D)	demonstrate proper set-up procedure for shielded metal arc welding;	

(E)	determine appropriate filler for base metal in shielded metal arc welding;	
(F)	perform welds in varied positions; such as techniques in fillet and groove welds;	
(G)	perform plate preparation; and	
(11)	The student performs gas metal arc welding principles and practices. The student is expected to:	
(A)	use safe operating practices;	
(B)	apply gas metal arc welding principles;	
(C)	demonstrate proper set-up procedure for gas metal arc welding;	
(D)	utilize appropriate filler for base metal in gas metal arc welding; and	
(E)	perform various gas metal arc welding techniques.	

§130.323. Welding I (Two Credits).		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is recommended for students, ~~in~~ Grades 10-12. Recommended prerequisite: Algebra 1, Principles of Manufacturing or Introduction to Precision Metal Manufacturing or Introduction to Welding.	
(b)	**Introduction**.	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	Rapid advances in technology have created new career opportunities and demands in many industries. Welding provides the knowledge, skills, and technologies required for employment in metal technology systems. Students develop knowledge and skills related to this system and apply them to personal career development. This course supports integration of academic and technical knowledge and skills. Students will reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for future success.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	
(c)	**Knowledge and skills**.	
(1)	The student describes the characteristics of a successful worker in the global economy. ~~the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.~~ The student is expected to:	
(A)	describe how teams function;	
~~(B)~~	~~use teamwork to solve problems;~~	
~~(C)~~	~~distinguish team roles such as team leaders and team members;~~	
~~(D)~~	~~identify characteristics of good leaders;~~	
~~(E)~~	~~**identify employers' work expectations;**~~	
(B)	use employers' work expectations to measure project success; evaluate employers' work expectations;	

~~(F)~~	~~discuss Equal Employment Opportunity law in the workplace;~~	
~~(G)~~	~~use time management techniques to develop work schedules;~~	
~~(H)~~	~~describe how teams measure results; and~~	
~~(I)~~	~~develop a method to reward team performance.~~	
(2)	The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:	
(A)	explore academic knowledge and skills required for postsecondary education;	
(B)	identify employers' expectations to foster positive customer satisfaction;	
(C)	demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;	
(D)	evaluate personal career goals;	
(E)	communicate effectively with others in the workplace to clarify objectives; and	
(F)	demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.	
(3)	The student applies academic skills to the requirements of welding. The student is expected to:	
(A)	demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;	
(B)	demonstrate mathematical skills to estimate costs;	
(C)	demonstrate technical writing skills related to work orders;	
(D)	apply accurate readings of measuring devices; ~~both U.S. customary and metric;~~	
(E)	accurately ~~use~~ utilize ~~an~~ appropriate tools to make measurements;	
(F)	compute measurements such as area, surface area, volume, and perimeter;	
~~(G)~~	~~determine how changes in dimension affect geometric figures;~~	
(G)	calculate problems using whole numbers, fractions, mixed numbers, and decimals;	
(H)	~~use~~ utilize various methods ~~a calculator~~ to perform computations;	
(I)	perform conversions between fractions and decimals;	
(J)	Understand and apply the functions of angles such as using the Pythagorean Theorem;	
~~(L)~~	~~apply right triangle relationships using the Pythagorean Theorem;~~	
(K)	understand the parts of a circle;	

~~(N)~~	~~identify the most reasonable mathematical solution using estimation;~~	
~~(O)~~	~~use cross-sections of three-dimensional figures to relate to plane figures;~~	
~~(P)~~	~~describe orthographic views of three-dimensional figures; and~~	
~~(Q)~~	~~describe isometric views of three-dimensional figures.~~	
(4)	The student ~~knows~~ evaluates the function and application of the tools, equipment, technologies, and materials used in welding. The student is expected to:	
(A)	use welding equipment according to safety standards;	
(B)	Identify and properly dispose of environmentally hazardous materials used in welding; and	
(C)	use appropriate personal protective equipment. ~~as needed to follow safety measures.~~	
(5)	The student understands welding joint design, symbols, and welds. The student is expected to:	
(A)	demonstrate knowledge of ~~a~~ Engineering drawings, charts, and diagrams; ~~welding blueprint~~	
(B)	Describe orthographic and isometric views of three-dimensional figures;	
~~(B)~~ (C)	interpret blueprints, drawings, charts, and diagrams;	
~~(C)~~(D)	analyze components of the welding symbol;	
~~(D)~~(E)	analyze types of welding joints;	
~~(E)~~(F)	analyze positions of welding; and	
~~(F)~~(G)	identify types of welds such as fillet, groove, spot, plug, and flanged.	
~~(6)~~	~~The student applies the concepts and skills of welding to simulate actual work situations. The student is expected to:~~	
~~(A)~~	~~explore careers in welding;~~	
~~(B)~~	~~work independently to fabricate a welded project with minimal assistance;~~	
~~(C)~~	~~work collaboratively with other students to complete a relevant project; and~~	
~~(D)~~	~~troubleshoot equipment.~~	
~~(7)~~ (6)	The student ~~knows~~ analyzes the concepts and intricacies of inspections and related codes. The student is expected to:	
(A)	evaluate weld inspection processes; and	
(B)	analyze welding codes.	

~~(8)~~ (7)	The student ~~performs~~ analyzes oxy-fuel processes on carbon steels. The student is expected to:	
(A)	observe safe operating practices;	
(B)	perform safe handling of compressed gases;	
(C)	identify components of oxy-fuel gas cutting;	
(D)	demonstrate proper set-up procedures for oxy-fuel process;	
(E)	distinguish factors affecting base metals; and	
(F)	demonstrate proper cutting techniques such as piercing, straight line, and bevel; and	
(G)	perform welding and brazing; and	
(H)	identify acceptable cuts.	
(I)	Evaluate alternative fuels, such as propane, propylene, and chemtane;	
~~(9)~~ (8)	The student ~~performs~~ analyzes plasma arc cutting on metals. The student is expected to:	
(A)	observe safe operating practices;	
(B)	demonstrate knowledge of the theories of plasma arc cutting;	
(C)	apply safe handling of compressed air supply;	
(D)	identify components of plasma arc cutting;	
(E)	demonstrate correct set-up procedure for plasma arc cutting;	
(F)	define cutting terms; and	
(G)	perform shape cutting.	
~~(10)~~ (8)	The student performs analyzes shielded metal arc welding principles and practices on metals. The student is expected to:	
(A)	use safe operating practices;	
(B)	~~demonstrate knowledge of the theories of~~ analyze electrical relationships such as alternating current and direct current, heat transfer, and polarity;	
(C)	apply shielded metal arc welding principles;	
(D)	demonstrate proper set-up procedure for shielded metal arc welding;	
(E)	determine appropriate filler for base metal in shielded metal arc welding;	
(F)	~~perform welds such as fillet and groove;~~	
(G)	perform passes such as root, hot, filler, and cover;	

~~(H)~~	~~perform plate preparation; and~~	
~~(I)~~	~~perform heating processes such as pre-heating and post-heating.~~	
~~(11)~~ (9)	The student ~~performs~~ analyzes gas metal arc welding principles and practices. The student is expected to:	
(A)	use safe operating practices;	
(B)	~~demonstrate knowledge of the theories of~~ analyze electrical relationships such as alternating current and direct current, heat transfer, and polarity;	
(C)	apply gas metal arc welding principles;	
(D)	demonstrate proper set-up procedure for gas metal arc welding;	
(E)	determine appropriate filler for base metal in gas metal arc welding; and	
(F)	perform fillet welds.	
~~(12)~~ (10)	The student ~~performs~~ analyzes flux cored arc welding principles and practices on metals. The student is expected to:	
(A)	use safe operating practices;	
(B)	~~demonstrate knowledge of the theories of~~ analyze electrical relationships such as alternating current and direct current, heat transfer, and polarity;	
(C)	apply flux cored arc welding principles;	
(D)	demonstrate proper set-up procedure for flux cored arc welding;	
(E)	determine appropriate filler for base metal in flux cored arc welding;	
(F)	perform fillet welds; and	
(G)	perform welds in all appropriate positions.	
~~(13)~~ (11)	The student ~~performs~~ analyzes gas tungsten arc welding on metals. The student is expected to:	
(A)	use safe operating practices;	
(B)	~~demonstrate knowledge of the theories of~~ analyze electrical relationships such as alternating current and direct current, heat transfer, and polarity;	
(C)	determine the common types of tungsten and filler materials;	
(D)	demonstrate proper set-up procedure for gas tungsten arc welding;	
~~(E)~~	~~perform fillet welds;~~	
(F)	perform welds in all appropriate positions; and	
(G)	perform welds on carbon steel.	

§130.324. ~~Advanced~~ Welding II (Two Credits) ~~(Two to Three Credits)~~.		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is ~~recommended~~ co-requisite ~~for~~ students, Grades 11-12; requisite of Welding I. Recommended ~~prerequisites~~: Algebra I or Geometry.	
(b)	**Introduction**.	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	~~Advanced~~ This course ~~Welding~~ builds on knowledge and skills developed in Welding. Students will develop advanced welding concepts and skills as they relate to personal and career development. This course integrates academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	
(c)	**Knowledge and skills**.	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	
(A)	Oral Communication – skill in expressing ideas and messages to others in a clear, concise and effective manner, including explaining and justifying actions convincingly.	
(B)	Written Communication – skill in effectively conveying written information and messages in a socially acceptable manner that is easily understandable to others.	
(C)	Work Ethic – consistent demonstration of punctuality, dependability, reliability and responsibility in reporting for duty and performing assigned tasks as directed.	
(D)	Professionalism – knowledge of how to dress appropriately, speak politely, and conduct one's self in a manner appropriate for the profession and work site.	
(E)	Integrity – ability to be trustworthy and honest, to choose the ethical course of action, and to comply with all applicable, rules, laws and regulations.	
(F)	Attention to Detail – skill in reviewing with a critical eye the fine, detailed aspects of both quantitative and qualitative work process and end products.	
(G)	Problem Solving – ability to evaluate systems and operations, identify causes, problems, patterns or issues,	

	and explore workable solutions or remedies to improve situations.	
(H)	Following Directions – ability to follow written and oral instructions and to adhere to established business practices, policies and procedures, including health and safety rules.	
(I)	Time Management – skill in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that uses time wisely and optimizes efficiency and results.	
~~(A)~~(J)	analyze how ~~effective~~ teams function;	
~~(B)~~	~~apply teamwork to solve advanced problems;~~	
~~(C)~~	~~distinguish team roles such as team leaders and team members;~~	
~~(D)~~	~~evaluate characteristics of good leaders;~~	
~~(E)~~(K)	use employers' work expectations to measure project success; evaluate employers' work expectations;	
~~(F)~~	~~evaluate team performance in using time management techniques to develop work schedules; and~~	
~~(G)~~	~~develop a method to evaluate team performance.~~	
(2)	The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:	
(A)	determine academic knowledge and skills required for postsecondary education;	
(B)	identify employers' expectations to foster positive customer satisfaction;	
(C)	demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;	
(D)	evaluate progress toward personal career goals;	
(E)	communicate effectively with others in the workplace to clarify objectives; and	
(F)	apply knowledge and skills related to health and safety in the workplace, as specified by appropriate government regulations.	
(3)	The student applies academic skills to the requirements of welding. The student is expected to:	
~~(A)~~	~~differentiate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;~~	
~~(B)~~(A)	demonstrate mathematical skills to estimate costs;	
~~(C)~~(B)	determine the impact of inaccurate readings of measuring devices on cost estimates;	
~~(D)~~(C)	justify the selection of a tool to make accurate measurements;	
~~(E)~~(D)	compute measurements such as area, surface area, volume, and perimeter;	

~~(F)~~(E)	calculate problems using whole numbers, fractions, mixed numbers, and decimals;	
~~(G)~~	~~use a calculator to perform advanced computations;~~	
~~(H)~~(F)	apply right triangle relationships using the Pythagorean Theorem; and	
~~(I)~~(G)	defend the choice of a mathematical solution using estimation.	
(4)	The student knows the function and application of the tools, equipment, technologies, and materials used in welding. The student is expected to:	
(A)	use welding equipment according to safety standards;	
(B)	dispose of environmentally hazardous materials used in welding;	
(C)	determine the performance impact of emerging technologies in welding;	
(D)	use appropriate personal protective equipment to follow safety measures; and	
(E)	investigate the use of automated welding machines such as numerical control, computer numerical control, and robotics-controlled welding machines.	
(5)	The student illustrates welding joint design, symbols, and welds. The student is expected to:	
(A)	use knowledge of ~~welding blueprints~~ engineering drawings to complete an advanced project; and	
(B)	inspect projects ~~using~~ utilizing ~~welding blueprints.~~ ~~e~~ngineering drawing specifications.	
(6)	The student applies the concepts and skills of welding to perform tasks. The student is expected to:	
(A)	work independently in fabricating welded projects;	
(B)	work collaboratively with other students to complete a real-world application item; and	
(C)	troubleshoot equipment.	
(7)	The student ~~knows~~ analyzes the concepts and intricacies of inspections ~~and~~ related to welding codes. The student is expected to:	
(A)	inspect welding projects of team members;	
(B)	~~use~~ select advanced codes for weld inspections; and	
(C)	critique and evaluate ~~welds~~ weldments of team members.	
(8)	The student performs advanced ~~oxy-fuel~~ cutting processes on carbon steels. The student is expected to:	
(A)	observe safe operating practices;	
(B)	apply safe handling of compressed gases; and	
(C)	perform advanced cutting processes according to accepted welding standards.	

~~(9)~~	~~The student performs plasma arc cutting on metals. The student is expected to:~~	
~~(A)~~	~~observe safe operating practices; and~~	
~~(B)~~	~~perform advanced shape cutting processes according to accepted welding standards.~~	
~~(10)~~ (9)	The student performs shielded metal arc welding on metals. The student is expected to:	
(A)	~~use~~ employ safe operating practices; and	
(B)	demonstrate advanced knowledge of qualified welding positions using accepted welding standards.	
~~(11)~~ (10)	The student performs ~~gas~~ Flux Core Metal Arc metal arc welding. The student is expected to:	
(A)	use safe operating practices;	
(B)	perform fillet welds;	
(C)	perform groove welds; and	
(D)	perform welds in all appropriate positions according to accepted welding standards.	
~~(12)~~	~~The student performs advanced flux cored arc welding on metals. The student is expected to:~~	
~~(A)~~	~~use safe operating practices;~~	
~~(B)~~	~~perform fillet welds;~~	
~~(C)~~	~~perform groove welds; and~~	
~~(D)~~	~~perform welds in all appropriate positions according to accepted welding standards.~~	
~~(13)~~ (11)	The student performs gas tungsten arc welding on metals. The student is expected to:	
(A)	employ safe operating practices;	
(B)	perform fillet welds;	
(C)	perform groove welds;	
(D)	perform welds in all appropriate positions according to accepted welding standards; and	
(E)	perform welds on metals such as carbon steel, stainless steel, pipe, and aluminum.	

§130.324. Welding II LAB (One Credit).		
	TEKS	Committee Comments
(a)	**General requirements**. This lab course is for students, Grades 11-12. Pre-requisite Welding I; Recommended for concurrent use in welding §130.324 Grades 11-12; Blocked recommended.	
(b)	**Introduction.**	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	This course emphasizes welding II principles and operating procedures in a laboratory format. Topics include: weldments produced according to code standards, industrial safety and health practices, hand tool and power machine use, measurement, welding power sources, welding career potentials, Welding laboratory provides knowledge, skills, and technologies required for employment in welding industries. Students develop knowledge and skills related to this system and apply them to personal career development. This course supports integration of academic and technical knowledge and skills. Students will reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for future success.	
(4)	Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples	
(c)	**Knowledge and skills**.	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	
(A)	Oral Communication – skill in expressing ideas and messages to others in a clear, concise and effective manner, including explaining and justifying actions convincingly.	
(B)	Written Communication – skill in effectively conveying written information and messages in a socially acceptable manner that is easily understandable to others.	
(C)	Work Ethic – consistent demonstration of punctuality, dependability, reliability and responsibility in reporting for duty and performing assigned tasks as directed.	
(D)	Professionalism – knowledge of how to dress appropriately, speak politely, and conduct one's self in a manner appropriate for the profession and work site.	
(E)	Integrity – ability to be trustworthy and honest, to choose the ethical course of action, and to	

	comply with all applicable, rules, laws and regulations.	
(F)	Attention to Detail – skill in reviewing with a critical eye the fine, detailed aspects of both quantitative and qualitative work process and end products.	
(G)	Problem Solving – ability to evaluate systems and operations, identify causes, problems, patterns or issues, and explore workable solutions or remedies to improve situations.	
(H)	Following Directions – ability to follow written and oral instructions and to adhere to established business practices, policies and procedures, including health and safety rules.	
(I)	Time Management – skill in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that uses time wisely and optimizes efficiency and results.	
(2)	The student demonstrates the function and application of the tools, equipment, technologies, and metals used in code welding. The student is expected to:	
(A)	use welding equipment according to safety standards;	
(B)	identify and properly dispose of environmentally hazardous materials used in welding; and	
(C)	use appropriate personal protective equipment	
(3)	The student applies the concepts and skills of welding of actual work situations. The student is expected to:	
(A)	work independently to fabricate welded projects with minimal assistance;	
(B)	work collaboratively with other students to complete relevant projects; and	
(C)	troubleshoot equipment.	
(4)	The student analyzes the concepts and intricacies of inspections and related codes. The student is expected to:	
(A)	evaluate weld inspection processes; and	
(B)	produce acceptable weldments to standards related to industry codes, such as AWS, ANSI, and CWB.	American Welding Society, American National Standards Institute, Canadian Welding Bureau.
(5)	The student performs oxy-fuel processes. The student is expected to:	
(A)	employ safe operating practices;	
(B)	perform safe handling of compressed gases;	
(C)	assemble components involved in setting up for oxy-fuel gas cutting processes;	
(D)	demonstrate proper ratios of compressed gases in cutting techniques such as piercing, straight line, bevel; and	

(E)	evaluate acceptable and unacceptable cuts.	
(6)	The student performs plasma arc cutting on metals. The student is expected to:	
(A)	Judge safe operating practices;	
(B)	differentiate between safe and unsafe handling of compressed air supply;	
(C)	employ proper set-up procedures for plasma arc cutting; and	
(D)	demonstrate shape cutting.	
(7)	The student performs shielded metal arc welding principles and practices on metals. The student is expected to:	
(A)	employ safe operating practices;	
(B)	demonstrate shielded metal arc welding principles;	
(C)	demonstrate proper set-up procedures for shielded metal arc welding;	
(D)	select appropriate filler for base metal in shielded metal arc welding;	
(E)	employ welds such as fillet and groove;	
(F)	employ passes such as root, hot, filler, and cover;	
(G)	employ plate preparation; and	
(H)	employ and evaluate heating processes such as pre-heating, post-heating.	
(8)	demonstrate proper set-up procedure for gas metal arc welding. The student is expected to:	
(A)	employ safe operating practices;	
(B)	demonstrate gas metal arc welding principles;	
(C)	demonstrate proper ratios procedures of compressed gases for proper set-up for gas metal arc welding;	
(D)	judge appropriate use of fillers for base metal in gas metal arc welding; and	
(E)	employ welds in all appropriate positions.	
(9)	The student performs flux cored arc welding principles and practices on metals. The student is expected to:	
(A)	employ safe operating practices;	
(B)	employ and appraise flux cored arc welding principles;	
(C)	demonstrate proper set-up procedures for flux cored arc welding;	

(D)	appraise appropriate filler for base metal in flux cored arc welding;	
(E)	perform fillet welds; and	
(F)	employ welds in all appropriate positions.	
(10)	The student performs gas tungsten arc welding principles and practices on metals. The student is expected to:	
(A)	employ safe operating practices;	
(B)	demonstrate gas tungsten arc welding principles;	
(C)	demonstrate proper ratios procedures of compressed gases for proper set-up for gas tungsten arc welding;	
(D)	judge appropriate use of fillers for base metal in gas tungsten arc welding; and	
(E)	employ welds in all appropriate positions.	

§130.325. Precision Metal Manufacturing (~~One to~~ Two Credits).		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is recommended for students in Grades ~~10-~~ 11-12. ~~Recommended p~~ Prerequisite: ~~Principles of Manufacturing and completed or concurrently enrolled in~~ Algebra I or Geometry. Recommended prerequisite: Principles of Manufacturing.	Average 10th grade students lack the maturity level to thoroughly grasp the safety aspect and rigorous requirements of this course.
(b)	**Introduction**.	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	Rapid advances in technology have created new career opportunities and demands in many industries. Precision Metal Manufacturing provides the knowledge, skills, and technologies required for employment in precision machining. While Precision Metal Manufacturing is designed to provide necessary skills in machining it also provides a real-world foundation for any engineering discipline. This course may also address a variety of materials in addition to metal such as plastics, ceramics, and wood. Students develop knowledge of the concepts and skills related to these systems to apply them to personal and career development. This course supports integration of academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for success. This course is designed to provide entry-level employment for the student or articulated credit integration into a community college and dual credit with a community college with completion of the advanced course. This course is part of a coherent sequence of courses.	
(4)	The students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	
(c)	**Knowledge and skills**.	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	
(A)	Oral Communication – skill in expressing ideas and messages to others in a clear, concise and effective manner, including explaining and justifying actions convincingly.	

(B)	Written Communication – skill in effectively conveying written information and messages in a socially acceptable manner that is easily understandable to others.	
(C)	Work Ethic – consistent demonstration of punctuality, dependability, reliability and responsibility in reporting for duty and performing assigned tasks as directed.	
(D)	Professionalism – knowledge of how to dress appropriately, speak politely, and conduct one's self in a manner appropriate for the profession and work site.	
(E)	Integrity – ability to be trustworthy and honest, to choose the ethical course of action, and to comply with all applicable, rules, laws and regulations.	
(F)	Attention to Detail – skill in reviewing with a critical eye the fine, detailed aspects of both quantitative and qualitative work process and end products.	
(G)	Problem Solving – ability to evaluate systems and operations, identify causes, problems, patterns or issues, and explore workable solutions or remedies to improve situations.	
(H)	Following Directions – ability to follow written and oral instructions and to adhere to established business practices, policies and procedures, including health and safety rules.	
(I)	Time Management – skill in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that uses time wisely and optimizes efficiency and results.	
~~(1)~~(2)	The student ~~knows~~ describes the characteristics of a successful worker in the global economy. ~~the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.~~ The student is expected to:	The added statement replaces and fully incorporates or implies the removed text from 1 and 2 below.
(A)	~~Describe~~ analyze ~~how~~ teams function;	
~~(B)~~	~~use teamwork to solve problems;~~	
~~(C)~~	~~distinguish team roles such as team leaders and team members;~~	
~~(D)~~	~~identify characteristics of good leaders;~~	
(E)	identify employers' work expectations;	
~~(F)~~	~~discuss Equal Employment Opportunity law in the workplace;~~	
~~(G)~~	~~use time management techniques to develop work schedules;~~	
~~(H)~~	~~describe how teams measure results; and~~	
~~(I)~~	~~develop a method to reward team performance.~~	
~~(2)~~(3)	The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:	
(A)	determine academic knowledge and skills required for postsecondary education;	

(B)	identify employers' expectations to foster positive customer satisfaction;	
(C)	demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;	
(D)	evaluate personal career goals;	
(E)	communicate effectively with others in the workplace to clarify objectives; and	
(F)	demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.	
~~(3)~~(4)	The student applies advanced academic skills to the requirements of precision metal manufacturing. The student is expected to:	
~~(A)~~	~~demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;~~	This is covered in other TEKS below
~~(B)~~(A)	~~successfully complete work orders;~~ demonstrate technical writing skills related to writing requirements found in manufacturing;	Changed for clarity and to better align with other manufacturing TEKS.
~~(C)~~(B)	demonstrate mathematical skills ~~to estimate costs~~ as they apply to machining such as algebra, geometry, trigonometry, statics and conversion;	This is the typical math used by precision metal manufacturing workers.
~~(D)~~(C)	interpret ~~blueprints such as schematics, drawings, charts, and diagrams;~~ engineering drawings including drawings using Geometric Dimensioning and Tolerancing;	Marked through terms are no longer relevant and not used in industry. GD&T is the de facto standard used in all engineering drawings worldwide and is a must know. REF: ASME Y14.5M 2009
~~(E)~~(D)	describe orthographic and isometric views of three-dimensional figures;	
~~(F)~~(E)	evaluate ~~use~~ mathematics as it applies to precision machining operations; and	Math is used in every step of the manufacturing process and requires more rigor associated with it.
(F)	discuss basic physics as it applies to machining	A machine shop is basically a working physics lab
~~(4)~~(5)	The student ~~knows~~ recognizes the concepts and skills that form the technical knowledge required in a ~~machine shop~~ precision machining. The student is expected to:	The student needs to be able to fully utilize the reference material.
(A)	examine the resources found in recognized ~~machinery~~ manufacturing reference materials such as Machinery's Handbook; and	Machinery's Handbook is the primary reference book used in manufacturing and is added as a reference.
(B)	demonstrate knowledge of the uses of ~~abrasives.~~ reference charts such as tap drill charts, drill size charts, feed-speed charts, etc.	Using abrasives is a process and does not belong in this section. Added items are commonly found in every machinist

		toolbox.
~~(5)~~(6)	The student ~~knows~~ evaluates the function and application of the tools, equipment, technologies, and materials used in a ~~machine shop~~ precision machining. The student is expected to:	
(A)	use ~~safely use~~ safety while running equipment commonly employed in machine shops;	
(B)	identify and properly dispose of environmentally hazardous materials used in machine shops;	
(C)	demonstrate knowledge of ~~numerical control~~ CNC operations;	Term was outdated.
(D)	demonstrate knowledge of emerging technologies that may affect the machine shop;	
(E)	demonstrate knowledge of heating metals such as hardening, tempering, annealing, normalizing, and case hardening steel;	Moved from 6G
(F)	apply technical knowledge and skills in a machine shop to career preparation experiences;	Moved from 6H
(G)	identify basic metallic and non-metallic materials; and	
(H)	compare various abrasives for type, structure, bond and uses.	
~~(7)~~	~~The student applies technical knowledge and skills of precision metal manufacturing to simulated and actual work situations. The student is expected to:~~	Below is lumped together and needs clarification by breaking out individual task.
~~(A)~~	~~demonstrate proficiency in cutting processes such as drilling, turning, boring, milling, and broaching;~~	
~~(B)~~	~~use various work mounting procedures on all machines;~~	
~~(C)~~	~~properly execute lathe procedures such as threads, turn tapers, polishes, knurls, and bores;~~	
~~(D)~~	~~mill flat surfaces, bevels, chamfers, grooves, and key seats using proper milling procedures;~~	
~~(E)~~	~~use proper procedures for surface grinding operations;~~	
~~(F)~~	~~accurately machine precision pieces;~~	
~~(G)~~	~~demonstrate knowledge of heating metals such as hardening, tempering, annealing, normalizing, and case hardening steel; and~~	Moved to (5)
~~(H)~~	~~apply technical knowledge and skills in a machine shop to career preparation experiences.~~	Moved to (5)
(7)	The student employs skills necessary to perform bench work and layout. The student is expected to:	Everything from here down is either required by industry, college readiness or certifying agencies.
(A)	use equipment commonly employed in bench work and layout in a safe manner;	
(B)	develop the ability to use a file to cut flats, angles and radiuses;	

(C)	employ standard layout tools to transfer a part design to the actual part;	
(D)	perform center punching and hand drilling of holes using an electric or air hand drill;	
(E)	perform hand tapping of holes;	
(F)	perform hand reaming of holes using an electric or air hand drill;	
(G)	develop a detailed layout part such as the NIMS Level 1 layout part;	NIMS is the National Institute for Metalworking Skills. This is the only agency that provides nationally recognized credentials in the industry as required by House Bill 5.
(H)	develop a detailed bench work part such as the NIMS Level 1 bench work part; and	Additional information is available at http://www.nims-skills.org
(I)	employ basic housekeeping skills as they apply in a machine shop.	
(8)	The student employs skills necessary to perform precision measurement. The student is expected to:	
(A)	use equipment commonly used during precision measurement in a safe manner;	
(B)	write an inspection plan;	
(C)	identify and select the required measuring instruments to conduct the required inspection procedure(s); and	
(D)	describe statical process control.	
(9)	The student employs skills necessary to perform manual lathe work. The student is expected to:	
(A)	use equipment such as accessories commonly implemented on and around a lathe in a safe manner;	
(B)	analyze the advantages and disadvantages between a 4-jaw independent chuck, a 3-jaw universal chuck, and a collet work holding system;	
(C)	indicate a part in a 4-jaw independent chuck within .003” tir using a standard indicator;	
(D)	identify and describe the function of the components of a lathe;	
(E)	identify and use most accessories and tooling for turning operations;	
(F)	demonstrate the following standard turning operations of boring, chamfering, cutting tapers, drilling, facing, grooving, knurling, polishing, threading, and turning on a manual lathe;	
(G)	write a detailed process plan for turning including appropriate processes such as feeds, speeds, tool selection, sequencing;	

(H)	develop a detailed turning part such as the NIMS Level 1 turning, chucking or turning between Centers part; and	
(I)	employ basic preventative maintenance on the lathe.	
(10)	The student employs skills necessary to perform manual milling work. The student is expected to:	
(A)	use equipment commonly used with a milling machine in a safe manner;	
(B)	analyze the advantages and disadvantages of various work holding methods such as vise, clamping to the table, clamping to an angle plate, etc.;	
(C)	contrast the various ancillary tools used on milling machines such as rotary table, indexing head, super-spacer, etc.;	
(D)	identify or describe the function of the components of a milling machine;	
(E)	tram in the head of a vertical milling machine;	
(F)	indicate in a milling vise employing a dial indicator;	
(G)	develop a square block in the milling machine to closr tolerances;	
(H)	demonstrates various hole making activities on the milling machine such as spot drilling, drilling, reaming, tapping, countersinking, boring, etc.;	
(I)	demonstrates various milling activities such as climb milling, conventional milling, slotting, grooving, cutting angles, chamfering, etc.;	
(J)	write a detailed process plan for milling including appropriate feeds, speeds, tool selection, work holding methods, and sequencing;	
(K)	develop a detailed milling part such as the NIMS Level 1 milling part; and	
(L)	employ basic preventative maintenance on the milling machine.	
(11)	The student employs skills necessary to perform work on various support equipment commonly found in a machine shop. The student is expected to:	
(A)	use various support equipment commonly found in a machine shop in a safe manner;	
(B)	understand basic pedestal grinder functions and requirements such as wheel selection criteria, etc.;	
(C)	understand basic sawing functions such as band type, speed and feeds for various types of material;	
(D)	understand basic drill press operations including work holding, appropriate speeds, feeds; and	
(E)	use proper, safe procedures for surface grinding operations.	

§130.326. Advanced Precision Metal Manufacturing (Two ~~to Three~~ Credits).		
	TEKS with edits	Committee Comments
(a)	**General requirements**. This course is recommended for students in Grades 11-12. ~~Recommended p~~ Prerequisites: Precision Metal Manufacturing ~~and completed or concurrently enrolled in Algebra II~~. Highly recommended co-requisite Advanced Precision Metal Manufacturing Lab	
(b)	**Introduction**.	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	Rapid advances in technology have created new career opportunities and demands in many industries. Precision Metal Manufacturing provides the knowledge, skills, and technologies required for employment in precision machining. While Precision Metal Manufacturing is designed to provide necessary skills in machining it also provides a real-world foundation for any engineering discipline. This course may also address a variety of materials in addition to metal such as plastics, ceramics, and wood. Students develop knowledge of the concepts and skills related to these systems to apply them to personal and career development. This course supports integration of academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for success. This course is designed to provide entry-level employment for the student or articulated credit integration into a community college and dual credit with a community college with completion of the advanced course. This course is part of a coherent sequence of courses.	
(4)	The students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	
(c)	**Knowledge and Skills**.	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	
(A)	Oral Communication – skill in expressing ideas and messages to others in a clear, concise and effective manner, including explaining and justifying actions convincingly.	
(B)	Written Communication – skill in effectively conveying written information and messages in a socially acceptable manner that is easily understandable to others.	

(C)	Work Ethic – consistent demonstration of punctuality, dependability, reliability and responsibility in reporting for duty and performing assigned tasks as directed.	
(D)	Professionalism – knowledge of how to dress appropriately, speak politely, and conduct one's self in a manner appropriate for the profession and work site.	
(E)	Integrity – ability to be trustworthy and honest, to choose the ethical course of action, and to comply with all applicable, rules, laws and regulations.	
(F)	Attention to Detail – skill in reviewing with a critical eye the fine, detailed aspects of both quantitative and qualitative work process and end products.	
(G)	Problem Solving – ability to evaluate systems and operations, identify causes, problems, patterns or issues, and explore workable solutions or remedies to improve situations.	
(H)	Following Directions – ability to follow written and oral instructions and to adhere to established business practices, policies and procedures, including health and safety rules.	
(I)	Time Management – skill in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that uses time wisely and optimizes efficiency and results.	
~~(1)~~(2)	The student describes the characteristics of a successful worker in the global economy. ~~the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills.~~ The student is expected to:	The added statement replaces and fully incorporates or implies the removed text from 1 and 2 below.
(A)	demonstrate how advanced teams function effectively; and	
~~(B)~~	~~apply effective teamwork strategies to solve problems;~~	
~~(C)~~	~~distinguish team roles such as team leaders and team members;~~	
~~(D)~~	~~evaluate characteristics of effective team leadership;~~	
~~(E)~~(B)	~~identify~~ appraise employers' work expectations.	Increasing rigor for an advanced class
~~(F)~~	~~discuss Equal Employment Opportunity law in the workplace;~~	
~~(G)~~	~~Evaluate team performance in using time management techniques to develop work schedules;~~	
~~(H)~~	~~develop a method to evaluate team performance.~~	
~~(2)~~(3)	The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:	
(A)	determine academic knowledge and skills required for postsecondary education;	
(B)	Identify employers' expectations to foster positive customer satisifaction;	
(C)	demonstrate the skills required in the workplace such as interviewing skills, flexibility, willingness to	

	learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;	
(D)	evaluate progress toward personal career goals;	
(E)	communicate effectively with others in the workplace to clarify objectives; and	
(F)	~~apply~~ demonstrate skills related to health and safety in the workplace, as specified by appropriate government regulations.	
~~(3)~~(4)	The student applies the technical knowledge and skills of Advanced Precision Metal Manufacturing. The student is expected to:	
(A)	apply the technical ~~knowledge and skills~~ aspects found in The Machinery's Handbook resource; and	
(B)	~~demonstrate knowledge of the uses of abrasives.~~ select appropriate resources from the internet as they apply to manufacturing.	Using abrasives is a process and does not belong in this section. Added items are commonly used by machinist.
(5)	The student builds on the manual machining skills gained in Precision Metal Manufacturing. The student is expected to:	Zero defects are required in industry.
(A)	develop a detailed turning part such as the NIMS Level 1 turning, chucking or turning between centers part with zero defects (100% to the print) in a safe manner; and	
(B)	develop a detailed milling part such as the NIMS Level 1 milling part with zero defects (100% to the print) in a safe manner.	
~~(4)~~(6)	The student learns about ~~advanced numerical control~~ standard CNC machinery. The student is expected to:	The term "numerical control" began being replaced with "CNC" in the 1980's as machine controllers became more sophisticated. CNC is the prevalent term used in industry today.
(A)	research the history of numerical control machines;	
(B)	distinguish among different types of ~~computer numerical control~~ CNC machines used in the industry;	
(C)	demonstrate safety rules for ~~numerical control~~ CNC operation;	
~~(D)~~	~~demonstrate the use of binary numbers to control computer numerical control machines;~~	No longer relevant.
~~(E)~~(D)	demonstrate the methods by which programs can be entered into a controller; and	
~~(F)~~(E)	use appropriate machining terminology to enhance computer numerical control vocabulary.	
~~(5)~~(7)	The student ~~experiences advanced numerical control~~ appraises various CNC systems to differentiate the development and implementation of those systems. The student is expected to:	

(A)	~~demonstrate~~ examine the types of drive motors used on ~~numerical control~~ CNC machinery;	
(B)	~~display~~ compare the types of loop systems;	
(C)	explain the Cartesian coordinate system;	
(D)	differentiate between absolute and incremental positioning; and	
(E)	illustrate the difference between datum and delta dimensioning.	
~~(6)~~(8)	The student learns the process planning and tool selection within a ~~computer numerical control~~ CNC lab environment. The student is expected to:	
(A)	develop a detailed process plan including proper tool selection, proper feeds and speeds for the material being cut and finish specifications on the engineering drawing, logical sequence of operations and appropriate inspection points.	
(B)	develop a logical sequence of operations and appropriate inspection points.	
~~(C)~~	~~demonstrate use of tools for hole operations;~~	C through H are rewritten below for clarity.
~~(D)~~	~~perform milling operations;~~	
~~(E)~~	~~apply the proper grade of carbide insert for a given material;~~	
~~(F)~~	~~use common numerical control turning tool types;~~	
~~(G)~~	~~determine the proper spindle revolutions per minute; and~~	
~~(H)~~	~~execute proper feed rates on a product.~~	
~~(7)~~(9)	The student evaluates tool changing and tool offset registers in the ~~computer numerical control~~ CNC lab environment. The student is expected to:	
(A)	perform various types of tool changes;	
(B)	demonstrate quick change tooling used on ~~computer numerical control~~ CNC ~~mills~~ milling machines;	
(C)	demonstrate appropriate tool storage;	
(D)	demonstrate the proper use of tool offset registers;	
(E)	determine tool offset length; and	
(F)	enter tool offsets for a set up.	
~~(8)~~	~~The student learns to program coordinates for all computer numerical control machinery in the computer control lab environment. The student is expected to:~~	8, 9, 10, 11 and 12 need rewritten for clarity.
~~(A)~~	~~explain the program coordinates for hole operations such as drilling, reaming, boring, and tapping;~~	

~~(B)~~	~~program hole operation coordinates such as absolute and incremental positioning; and~~	
~~(C)~~	~~program milling coordinates such as absolute and incremental positioning.~~	
~~(9)~~	~~The student learns two-axis programming for all computer numerical control machinery in the computer numerical control lab environment. The student is expected to:~~	
~~(A)~~	~~identify the parts of the computer numerical control program;~~	
~~(B)~~	~~describe the word address code format;~~	
~~(C)~~	~~write a simple two-axis program using word addresses to perform hole operations; and~~	
~~(D)~~	~~write a simple two-axis program using word addresses to perform hole operations and milling operations combined.~~	
~~(10)~~	~~The student learns three-axis programming for all computer numerical control machinery in the computer numerical control lab environment. The student is expected to:~~	
~~(A)~~	~~write a simple program to perform hole operations using a three-axis machine;~~	
~~(B)~~	~~explain an example of a canned cycle;~~	
~~(C)~~	~~explain the difference between a modal and non-modal command; and~~	
~~(D)~~	~~write a simple program to perform milling operations using a three-axis machine.~~	
~~(11)~~	~~The student demonstrates appropriate mathematics for numerical control programming to be used in the computer numerical control lab environment. The student is expected to:~~	
~~(A)~~	~~use trigonometry to determine coordinates from technical drawings to cut arcs and angles;~~	
~~(B)~~	~~use trigonometry for determining cutter offsets; and~~	
~~(C)~~	~~use appropriate mathematical skills to solve problems such as milling and lathe issues.~~	
~~(12)~~	~~The student performs cutter radius and diameter compensation for numerical control programming to be used in the computer numerical control lab environment. The student is expected to:~~	
~~(A)~~	~~define cutter radius and cutter diameter compensation;~~	
~~(B)~~	~~describe ramp-on and ramp-off moves;~~	
~~(C)~~	~~identify precautions dealing with the use of cutter compensation; and~~	
~~(D)~~	~~write a program that includes the use of cutter compensation.~~	
(10)	The student operates a CNC lathe. The student is expected to:	Everything from here down is either required by industry, college readiness or certifying agencies.
(A)	use equipment commonly associated with a CNC lathe in a safe manner;	

(B)	recognize, name, and describe the function of the primary components of a CNC lathe;	
(C)	perform preventative maintenance checks on a CNC lathe such as checking all fluid levels, system pressure, tooling wear, component lubrication, and cleaning;	
(D)	test the coolant for proper density and adjust accordingly in order to reach the correct mixture;	
(E)	perform a power up on a standard CNC lathe;	
(F)	demonstrate the use of the jog controls on the operator panel to jog the lathe's axes;	
(G)	demonstrate the ability to locate, assemble, and measure tooling, according to work instructions and job documentation	
(H)	install in the automatic tool changer locations, tools and tool holders, according to work instructions and job documentation;	
(I)	locate and set workpiece zero on a CNC lathe;	
(J)	set any required work offsets for the part to be machined after a basic tool setting process has been completed;	
(K)	set the proper geometry/tool offsets for each tool in a standard tool setting process;	
(L)	operates CNC lathe in automatic mode; and	
(M)	illustrate proper power down process on a CNC lathe.	
(11)	The student operates a CNC mill. The student is expected to:	
(A)	use equipment commonly found on and around a CNC mill in a safe manner;	
(B)	recognize, name, and describe the function of the primary components of a CNC mill;	
(C)	perform preventative maintenance checks on a CNC mill such as checking all fluid levels, system pressure, tooling wear, component lubrication, and cleaning;	
(D)	test the coolant for proper density and adjust accordingly in order to reach the correct mixture;	
(E)	perform a power up on a standard CNC mill;	
(F)	demonstrate the use of the jog controls on the operator panel to jog the mill's axes;	
(G)	demonstrate the ability to locate, assemble, and measure tooling using a presetter, or other means, according to work instructions and job documentation.	
(H)	install in the automatic tool changer locations, tools and tool holders, according to work instructions and job documentation;	
(I)	locate and set workpiece zero on a CNC mill;	
(J)	set any required work offsets for the part to be machined after a basic tool setting process has been	

	completed;	
(K)	set the proper geometry/tool offsets for each tool in a standard tool setting process;	
(L)	operate CNC mill in automatic mode; and	
(M)	illustrate proper power down process on a CNC mill.	
(12)	The student learns to manually (without the help of CAD or CAM) program a CNC lathe. The student is expected to:	
(A)	use trigonometry to determine coordinates from technical drawings to cut arcs and angles;	
(B)	use trigonometry for determining cutter offsets;	
(C)	use appropriate mathematical skills to solve problems while programming a CNC lathe;	
(D)	write a simple program to face and turn;	
(E)	write a simple program to cut a radius, angles, grooves and threads;	
(F)	write a program using cutter radius compensation;	
(G)	write a program utilizing canned cycles such as G71; and	
(H)	write a program and produce a complex part such as NIMS level 1 CNC lathe part with zero defects.	
(13)	The student learns to manually (without the help of CAD or CAM) program a CNC mill. The student is expected to:	
(A)	use trigonometry to determine coordinates from technical drawings to cut arcs and angles;	
(B)	use trigonometry for determining cutter offsets;	
(C)	use appropriate mathematical skills to solve problems while programming a CNC lathe;	
(D)	write a simple program to perform hole operations;	
(E)	write a simple program to cut a radius and angles;	
(F)	write a program using cutter radius compensation and ramping;	
(G)	write a program and produce a complex part such as NIMS level 1 CNC milling part with zero defects.	
(14)	The student develops a deeper understanding of quality control. The student is expected to:	
(A)	evaluate engineering drawings using Geometric Dimensioning and Tolerancing;	
(B)	discuss the ASME Y14.5M standard that defines Geometric Dimensioning and Tolerancing; and	
(C)	appraise various quality control / management programs such as ISO9000, Lean, 5S, Six Sigma, Continuous Improvement, Kaizen, SPC, Kanban ,JIT, etc.	

Advanced Precision Metal Manufacturing Lab (One Credit).		
	New TEKS	Committee Comments
(a)	General requirements. This course is recommended for students in Grades 11-12. Required co-requisite Advanced Precision Metal Manufacturing. Recommend blocked.	
(b)	Introduction.	
(1)	CTE instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.	
(2)	The Manufacturing Career Cluster focuses on planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.	
(3)	Rapid advances in technology have created new career opportunities and demands in many industries. Precision Metal Manufacturing provides the knowledge, skills, and technologies required for employment in precision machining. While Precision Metal Manufacturing is designed to provide necessary skills in machining it also provides a real-world foundation for any engineering discipline. This course may also address a variety of materials in addition to metal such as plastics, ceramics, and wood. Students develop knowledge of the concepts and skills related to these systems to apply them to personal and career development. This course supports integration of academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for success. This course is designed to provide entry-level employment for the student or articulated credit integration into a community college and dual credit with a community college with completion of the advanced course. This course is part of a coherent sequence of courses.	
(4)	The students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.	
(5)	Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	
(c)	Knowledge and Skills.	
(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	
(A)	Oral Communication – skill in expressing ideas and messages to others in a clear, concise and effective manner, including explaining and justifying actions convincingly.	
(B)	Written Communication – skill in effectively conveying written information and messages in a socially acceptable manner that is easily understandable to others.	

(C)	Work Ethic – consistent demonstration of punctuality, dependability, reliability and responsibility in reporting for duty and performing assigned tasks as directed.	
(D)	Professionalism – knowledge of how to dress appropriately, speak politely, and conduct one's self in a manner appropriate for the profession and work site.	
(E)	Integrity – ability to be trustworthy and honest, to choose the ethical course of action, and to comply with all applicable, rules, laws and regulations.	
(F)	Attention to Detail – skill in reviewing with a critical eye the fine, detailed aspects of both quantitative and qualitative work process and end products.	
(G)	Problem Solving – ability to evaluate systems and operations, identify causes, problems, patterns or issues, and explore workable solutions or remedies to improve situations.	
(H)	Following Directions – ability to follow written and oral instructions and to adhere to established business practices, policies and procedures, including health and safety rules.	
(I)	Time Management – skill in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that uses time wisely and optimizes efficiency and results.	
(2)	The student builds on the manual machining skills gained in Precision Metal Manufacturing. The student is expected to:	
(A)	develop a detailed turning part such as the NIMS Level 1 turning, chucking or turning between centers part with zero defects (100% to the print) in a safe manner; and	
(B)	develop a detailed milling part such as the NIMS Level 1 milling part with zero defects (100% to the print) in a safe manner.	
(3)	The student evaluates tool changing and tool offset registers in the CNC lab environment. The student is expected to:	
(A)	perform various types of tool changes;	
(B)	demonstrate quick change tooling used on CNC milling machines;	
(C)	demonstrate appropriate tool storage;	
(D)	demonstrate the proper use of tool offset registers;	
(E)	determine tool offset length; and	
(F)	enter tool offsets for a set up.	
(4)	The student operates a CNC lathe. The student is expected to:	
(A)	use equipment commonly found on and around a CNC lathe in a safe manner;	
(B)	recognize, name, and describe the function of the primary components of a CNC lathe;	

(C)	perform preventative maintenance checks on a CNC lathe such as checking all fluid levels, system pressure, tooling wear, component lubrication, and cleaning;	
(D)	test the coolant for proper density and adjust accordingly in order to reach the correct mixture;	
(E)	perform a power up on a standard CNC lathe;	
(F)	demonstrate the use of the jog controls on the operator panel to jog the lathe's axes;	
(G)	demonstrate the ability to locate, assemble, and measure tooling, according to work instructions and job documentation	
(H)	install in the automatic tool changer locations, tools and tool holders, according to work instructions and job documentation;	
(I)	locate and set workpiece zero on a CNC lathe;	
(J)	set any required work offsets for the part to be machined after a basic tool setting process has been completed;	
(K)	set the proper geometry/tool offsets for each tool in a standard tool setting process;	
(L)	operate a CNC lathe in automatic mode; and	
(M)	illustrate proper power down process on a CNC lathe.	
(5)	The student operates a CNC mill. The student is expected to:	
(A)	use equipment commonly found on and around a CNC mill in a safe manner;	
(B)	recognize, name, and describe the function of the primary components of a CNC mill;	
(C)	perform preventative maintenance checks on a CNC mill such as checking all fluid levels, system pressure, tooling wear, component lubrication, and cleaning;	
(D)	test the coolant for proper density and adjust accordingly in order to reach the correct mixture;	
(E)	perform a power up on a standard CNC mill;	
(F)	demonstrate the use of the jog controls on the operator panel to jog the mill's axes;	
(G)	demonstrate the ability to locate, assemble, and measure tooling using a presetter, or other means, according to work instructions and job documentation.	
(H)	install in the automatic tool changer locations, tools and tool holders, according to work instructions and job documentation;	
(I)	locate and set workpiece zero on a CNC mill;	
(J)	set any required work offsets for the part to be machined after a basic tool setting process	

	has been completed;	
(K)	set the proper geometry/tool offsets for each tool in a standard tool setting process;	
(L)	operate CNC mill in automatic mode; and	
(M)	illustrate proper power down process on a CNC mill.	
(6)	The student learns to manually (without the help of CAD or CAM) program a CNC lathe. The student is expected to:	
(A)	use trigonometry to determine coordinates from technical drawings to cut arcs and angles;	
(B)	use trigonometry for determining cutter offsets;	
(C)	use appropriate mathematical skills to solve problems while programming a CNC lathe;	
(D)	write a simple program to face and turn;	
(E)	write a simple program to cut a radius, angles, grooves and threads;	
(F)	write a program using cutter radius compensation;	
(G)	write a program utilizing canned cycles such as G71; and	
(H)	write a program and produce a complex part such as NIMS level 1 CNC lathe part with zero defects.	
(7)	The student learns to manually (without the help of CAD or CAM) program a CNC mill. The student is expected to:	
(A)	use trigonometry to determine coordinates from technical drawings to cut arcs and angles;	
(B)	use trigonometry to determine cutter offsets;	
(C)	use appropriate mathematical skills to solve problems while programming a CNC lathe;	
(D)	write a simple program to perform hole operations;	
(E)	write a simple program to cut a radius and angles;	
(F)	write a program using cutter radius compensation and ramping; and	
(G)	write a program and produce a complex part such as NIMS level 1 CNC milling part with zero defects.	