Local Implementation Considerations:

Students completing two or more courses for two or more credits within a program of study earn concentrator status for Perkins V federal accountability reporting.

Proposed Indicator: Students finishing three or more courses for four or more credits with one course from a recognized TEA capstone course (in bold), within a program of study earn completer status for federal accountability reporting.
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.

Successful completion of the Advanced Manufacturing and Machinery Mechanics program of study will fulfill requirements of the Business and Industry Endorsement. Approved Statewide Program of Study - September 2019
The Advanced Manufacturing and Machinery Mechanics program of study focuses on the assembly, operation, maintenance, and repair of electromechanical equipment or devices. Students may work in a variety of mechanical fields, gaining knowledge and experience in robotics, refinery and pipeline systems, deep ocean exploration, or hazardous waste removal. CTE concentrators may work in a variety of fields of engineering.

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.

Successful completion of the Advanced Manufacturing and Machinery Mechanics program of study will fulfill requirements of the Business and Industry Endorsement. Approved Statewide Program of Study - September 2019

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### POSTSECONDARY OPTIONS

<table>
<thead>
<tr>
<th>HIGH SCHOOL/INDUSTRY CERTIFICATION</th>
<th>CERTIFICATE/LICENSE*</th>
<th>ASSOCIATE'S DEGREE</th>
<th>BACHELOR'S DEGREE</th>
<th>MASTER'S/DOCTORAL PROFESSIONAL DEGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FANUC Robot Operator 1</td>
<td>Engineer, Professional</td>
<td>Electro-mechanical Engineering/Technology</td>
<td>Electrical Engineering</td>
<td></td>
</tr>
<tr>
<td>Mastercam Associate Level Certification</td>
<td>PMMI Mechatronics: Programmable Logic Controllers 1</td>
<td>Robotics Technology/Technician</td>
<td>Engineering, General</td>
<td></td>
</tr>
<tr>
<td>NCCER Industrial Maintenance Mechanic**</td>
<td>Certified Quality Technician</td>
<td>Instrumentation Technology/Technician</td>
<td>Industrial Engineering</td>
<td></td>
</tr>
</tbody>
</table>

*Additional industry based certification information is available from the TEA CTE website.

**offered at GISD Campuses.

For more information on postsecondary options for this program of study, visit TXCTE.org.

### OCCUPATIONS

<table>
<thead>
<tr>
<th>OCCUPATIONS</th>
<th>MEDIAN WAGE</th>
<th>ANNUAL OPENINGS</th>
<th>% GROWTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electro-Mechanical Assemblers</td>
<td>$30,160</td>
<td>951</td>
<td>9%</td>
</tr>
<tr>
<td>Electro-Mechanical Technicians</td>
<td>$56,555</td>
<td>127</td>
<td>9%</td>
</tr>
<tr>
<td>Industrial Machinery Mechanics</td>
<td>$49,816</td>
<td>3,788</td>
<td>27%</td>
</tr>
</tbody>
</table>

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### WORK BASED LEARNING AND EXPANDED LEARNING OPPORTUNITIES

**Exploration Activities:** Participate in SkillsUSA and local STEM events

**Work Based Learning Activities:** Apprenticeship at a local business or industry American Welding Society

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Successful completion of the Advanced Manufacturing and Machinery Mechanics program of study will fulfill requirements of the Business and Industry Endorsement. Approved Statewide Program of Study - September 2019
## COURSE INFORMATION:
### ADVANCED MANUFACTURING & MACHINERY

<table>
<thead>
<tr>
<th>COURSE NUMBER/ COURSE NAME</th>
<th>SERVICE ID/ CREDIT</th>
<th>PREREQUISITES (PREQ)</th>
<th>RECOMMENDED PREREQUISITES (RPREQ)</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8M100 Principles of Manufacturing</td>
<td>13032200 (1 credit)</td>
<td>None</td>
<td></td>
<td>8-11</td>
</tr>
<tr>
<td>8O100 Principles of Applied Engineering</td>
<td>13036200 (1 credit)</td>
<td>None</td>
<td></td>
<td>7-11</td>
</tr>
<tr>
<td>8Q220 Robotics I</td>
<td>13037000 (1 credit)</td>
<td>None</td>
<td></td>
<td>9-11</td>
</tr>
<tr>
<td>8Q230 Engineering Design and Presentation I</td>
<td>13036500 (1 credit)</td>
<td>PREQ: Algebra I</td>
<td></td>
<td>10-12</td>
</tr>
<tr>
<td>8M940S (GRCTC) Fall Manufacturing Engineering Technology I</td>
<td>13032900 (1 credit)</td>
<td>None</td>
<td></td>
<td>11-12</td>
</tr>
<tr>
<td>8M320S (GRCTC) Spring Manufacturing Engineering Technology II</td>
<td>13032950 (1 credit)</td>
<td>PREQ: Manufacturing Engineering Technology I</td>
<td></td>
<td>11-12</td>
</tr>
<tr>
<td>8O900S (GRCTC Spring) Robotics II</td>
<td>13037050 (1 credit)</td>
<td>PREQ: Robotics I</td>
<td></td>
<td>11-12</td>
</tr>
<tr>
<td>8M470/8M474 EXT Practicum in Manufacturing</td>
<td>13033000 (2 credits) 13033005 (3 credits)</td>
<td>None</td>
<td></td>
<td>11-12</td>
</tr>
<tr>
<td>8M960/8M963 EXT(GRCTC) Practicum in Manufacturing/LAB</td>
<td>13033000 (2 credits) 13033005 (3 credits)</td>
<td>PREQ: Manufacturing Engineering I &amp; II</td>
<td></td>
<td>11-12</td>
</tr>
<tr>
<td>8M990 (GRCTC) Practicum in Manufacturing - Robotics</td>
<td>13033000 (2 credits)</td>
<td>PREQ: Robotics II</td>
<td></td>
<td>11-12</td>
</tr>
</tbody>
</table>
The Manufacturing Technology program of study focuses on the development and use of automatic and computer-controlled machines, tools, and robots that perform work on metal or plastic. Students will learn how to set up and operate a variety of machine tools to produce precision parts and instruments. Students will also learn how to modify parts to make or repair machine tools or maintain individual machines, and how to use hand-welding or flame-cutting equipment.

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.
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<tr>
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<th>RECOMMENDED PREREQUISITES (RPREQ)</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8M100 Principles of Manufacturing</td>
<td>13032200 (1 credit)</td>
<td>None</td>
<td></td>
<td>8-11</td>
</tr>
<tr>
<td>8O100 Principles of Applied Engineering</td>
<td>13036200 (1 credit)</td>
<td>None</td>
<td></td>
<td>7-11</td>
</tr>
<tr>
<td>8M220 Diversified Manufacturing I</td>
<td>13032650 (1 credit)</td>
<td>RPREQ: Algebra I</td>
<td></td>
<td>10-11</td>
</tr>
<tr>
<td>8M900 (GRCTC) Metal Fabrication and Machining I</td>
<td>13032700 (2 credits)</td>
<td>RPREQ: Algebra I</td>
<td></td>
<td>11-12</td>
</tr>
<tr>
<td>8M320 Diversified Manufacturing II</td>
<td>13032660 (1 credit)</td>
<td>PREQ: Diversified Manufacturing I RPREQ: Algebra I</td>
<td></td>
<td>11-12</td>
</tr>
<tr>
<td>8M200 Precision Metal Manufacturing I</td>
<td>13032500 (2 credits)</td>
<td>RPREQ: Principles of Manufacturing</td>
<td></td>
<td>11-12</td>
</tr>
<tr>
<td>8M300, 8M305 DC Precision Metal Manufacturing II</td>
<td>13032500 (2 credits)</td>
<td>PREQ: Precision Metal Manufacturing I</td>
<td></td>
<td>11-12</td>
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<tr>
<td>8M910 (GRCTC) Metal Fabrication and Machining II</td>
<td>13032800 (2 credits)</td>
<td>PREQ: Metal Fab I</td>
<td></td>
<td>11-12</td>
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<tr>
<td>8M470/8M474 EXT Practicum in Manufacturing</td>
<td>13033000 (2 credits) 13033005 (3 credits)</td>
<td>None</td>
<td></td>
<td>11-12</td>
</tr>
<tr>
<td>8M960(GRCTC) Practicum Manufacturing - Engineering</td>
<td>13033000 (2 credits)</td>
<td>PREQ: Manufacturing Engineering Tech II</td>
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<tr>
<td>8M920/8M925 DC (GRCTC) Practicum in Manufacturing</td>
<td>13033000 (2 credits)</td>
<td>PREQ: Metal Fab I</td>
<td></td>
<td>11-12</td>
</tr>
</tbody>
</table>
The Welding program of study focuses on the development and use of automatic and computer-controlled machines, tools, and robots that perform work on metal or plastic. Students will learn how to modify parts to make or repair machine tools or maintain individual machines, and how to use hand-welding or flame-cutting equipment.

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.

Successful completion of the Manufacturing Technology program of study will fulfill requirements of the Business and Industry Endorsement. Approved Statewide Program of Study - September 2019
<table>
<thead>
<tr>
<th>COURSE NUMBER/ COURSE NAME</th>
<th>SERVICE ID/CREDIT</th>
<th>PREREQUISITES (PREQ) RECOMMENDED PREREQUISITES (P/RREQ)</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8M130 Introduction to Welding</td>
<td>13032250 (1 credit)</td>
<td>None</td>
<td>9-12</td>
</tr>
<tr>
<td>8M230 Welding I</td>
<td>13032300 (2 credit)</td>
<td>None</td>
<td>10-12</td>
</tr>
<tr>
<td>8M330 Welding II</td>
<td>13032400 (2 credits)</td>
<td>PREQ: Welding I</td>
<td>11-12</td>
</tr>
<tr>
<td>8M470, 8M474 EXT Practicum in Manufacturing</td>
<td>13033000 (2 credits) 13033005 (3 credits)</td>
<td>None</td>
<td>11-12</td>
</tr>
</tbody>
</table>
**MANUFACTURING**

**Principles of Manufacturing**  
8M100  
TSDS PEIMS Code: 13032200 (PRINMAN)  
Grade Placement: 8–10, Credit: 1  
Prerequisite: None  
Recommended Prerequisites: Algebra I or Geometry.  
In Principles of Manufacturing, students are introduced to knowledge and skills used in the proper application of principles of manufacturing. The study of manufacturing technology allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities. Students will gain an understanding of what employers require to gain and maintain employment in manufacturing careers.

**Principles of Applied Engineering**  
8O100  
TSDS PEIMS Code: 13036200 (PRAPPENG)  
Grade Placement: 7–10, Credit: 1  
Prerequisite: None.  
Principles of Applied Engineering provides an overview of the various fields of science, technology, engineering, and mathematics and their interrelationships. Students will develop engineering communication skills, which include computer graphics, modeling, and presentations, by using a variety of computer hardware and software applications to complete assignments and projects. Upon completing this course, students will understand the various fields of engineering and will be able to make informed career decisions. Further, students will have worked on a design team to develop a product or system. Students will use multiple software applications to prepare and present course assignments.

**Robotics I**  
8O220  
TSDS PEIMS Code: 13037000 (ROBOTIC1)  
Grade Placement: 9–10, Credit: 1  
Prerequisite: None.  
Recommended Prerequisite: Principles of Applied Engineering.  
In Robotics I, students will transfer academic skills to component designs in a project-based environment through implementation of the design process. Students will build prototypes or use simulation software to test their designs. Additionally, students will explore career opportunities, employer expectations, and educational needs in the robotic and automation industry.

**Introduction to Welding**  
8M13O (SGHS)  
TSDS PEIMS Code: 13032250 (INTRWELD)  
Grade Placement: 9–12, Credit: 1  
Prerequisite: None.  
Recommended Prerequisite or Corequisite: Algebra I.  
Introduction to Welding will introduce welding technology with an emphasis on basic welding laboratory principles and operating procedures. Students will be introduced to the three basic welding processes. 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 will provide students with the knowledge, skills, and technologies required for employment in welding industries. 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 will prepare students for future success.

**Welding I**  
8M230 (SGHS)  
TSDS PEIMS Code: 13032300 (WELD1)  
Grade Placement: 10–12, Credit: 2  
Recommended Prerequisites: Algebra I, Principles of Manufacturing, Introduction to Precision Metal Manufacturing, or Introduction to Welding.  
Welding I provide the knowledge, skills, and technologies required for employment in metal technology systems. Students will 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. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems.
Engineering Design and Presentation I
8O230
TDS PEIMS Code: 13036500 (ENGDSPR1)
Grade Placement: 10–12, Credit: 1
Prerequisite: Algebra I.
Recommended Prerequisite: Principles of Applied Engineering.
Engineering Design and Presentation I is a continuation of knowledge and skills learned in Principles of Applied Engineering. Students enrolled in this course will demonstrate knowledge and skills of the design process as it applies to engineering fields using multiple software applications and tools necessary to produce and present working drawings, solid model renderings, and prototypes. Students will use a variety of computer hardware and software applications to complete assignments and projects. Through implementation of the design process, students will transfer advanced academic skills to component designs. Additionally, students explore career opportunities in engineering, technology, and drafting and what is required to gain and maintain employment in these areas.

Diversified Manufacturing I
TDS PEIMS Code: 13032650 (DIMANU1)
Grade Placement: 10–12, Credit: 1
Recommended prerequisite: Algebra I.
In Diversified Manufacturing I, 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 systems 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. Diversified Manufacturing, I allows students the opportunity to understand the process of mass production by using a wide variety of materials and manufacturing techniques. Knowledge about career opportunities, requirements, and expectations and the development of skills prepare students for workplace success.

Precision Metal Manufacturing I
8M200 (GHS)
TDS PEIMS Code: 13032500 (PREMMAN1)
Grade Placement: 10–12, Credit: 2
Recommended Prerequisites: Principles of Manufacturing and completion of or concurrent enrollment in Algebra I or Geometry. Precision Metal Manufacturing I will provide the knowledge, skills, and technologies required for employment in precision machining. While the course is designed to provide necessary skills in machining, it also provides a real-world foundation for any engineering discipline. This course may address a variety of materials such as plastics, ceramics, and wood in addition to metal. Students will develop knowledge of the concepts and skills related to precision metal manufacturing to apply them to personal and career development. This course supports integration of academic and technical knowledge and skills. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for success.

Metal Fabrication and Machining I
8M900
TDS PEIMS Code: 13032700 (MTFBMCH1)
Grade Placement: 11–12 Credit: 2
Prerequisite: None.
Recommended Prerequisite: Algebra I or Geometry.
Metal Fabrication and Machining, I provides the knowledge, skills, and certifications required for equal employment opportunities in the metal production industry. Students must have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems.

Manufacturing Engineering Technology I
8M940S (GRCTC) Fall
TDS PEIMS Code: 13032900 (MANENGT1)
Grade Placement: 11–12, Credit: 1
Prerequisite: None.
Recommended Prerequisite: Algebra I.
In Manufacturing Engineering Technology, I, students will 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. Students will prepare for success in the global economy. The study of manufacturing engineering will allow 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.
Robotics II  
8O900S (GRCTC) Spring  
TSDS PEIMS Code: 13037050 (ROBOTIC2)  
Grade Placement: 11–12, Credit: 1  
Prerequisite: Robotics I.  
In Robotics II, students will explore artificial intelligence and programming in the robotic and automation industry. Through implementation of the design process, students will transfer academic skills to component designs in a project-based environment. Students will build prototypes and use software to test their designs.

Manufacturing Engineering Technology II  
8M950S (GRCTC) Spring  
TSDS PEIMS Code: 13032950 (MANENGT2)  
Grade Placement: 11–12, Credit: 1  
Prerequisite: Manufacturing Engineering I.  
Recommended Prerequisite: Algebra II, Computer Science, or Physics.  
In Manufacturing Engineering Technology II, students will 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 Engineering Technology II will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication. Note: This course satisfies a math credit requirement for students on the Foundation High School Program.

Metal Fabrication and Machining II  
8M900S (GRCTC) Spring  
TSDS PEIMS Code: 13032800 (MTFBMCH2)  
Grade Placement: 11-12, Credit: 2  
Prerequisite: Metal Fabrication and Machining I.  
Recommended Prerequisites: Geometry and Algebra II. Metal Fabrication and Machining II builds on the knowledge, skills, and certifications students acquire in Metal Fabrication and Machining I. Students will develop advanced concepts and skills as related 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.

Diversified Manufacturing II  
TSDS PEIMS Code: 13032660 (DIMANU2)  
Grade Placement: 11–12, Credit: 1  
Prerequisite: Diversified Manufacturing I.  
Recommended Prerequisite: Algebra I.  
In Diversified Manufacturing II, students will 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 systems 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. Diversified Manufacturing II allows students the opportunity to understand the process of mass production by using a wide variety of materials and manufacturing techniques. Knowledge about career opportunities, requirements, and expectations and the development of skills prepare students for workplace success.

Welding II  
8M330  
TSDS PEIMS Code: 13032400 (WELD2)  
Grade Placement: 11–12, Credit: 2  
Prerequisites: Welding I.  
Recommended Prerequisites: Algebra I or Geometry.  
Recommended Corequisite: Welding II Lab. Welding II builds on the knowledge and skills developed in Welding I. Students will develop advanced welding concepts and skills as related to personal and career development. Students will integrate 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.
Manufacturing Engineering Technology II
8M950S (GRCTC) Spring
TSDS PEIMS Code: 13032950 (MANENGT2)
Grade Placement: 11–12, Credit: 1
Prerequisite: Manufacturing Engineering I.
Recommended Prerequisite: Algebra II, Computer Science, or Physics.
In Manufacturing Engineering Technology II, students will 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 Engineering Technology II will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication. Note: This course satisfies a math credit requirement for students on the Foundation High School Program.
Precision Metal Manufacturing II Lab  
8M300 (GHS)  
TSDS PEIMS Code: 13032610 (PRMMLAB2)  
Grade Placement: 11–12, Credit: 3  
Prerequisite: Precision Metal Manufacturing I.  
Precision Metal Manufacturing II Lab provides the knowledge, skills, and technologies required for employment in precision machining. While Precision Metal Manufacturing II Lab is designed to provide necessary skills in machining, it also provides a real-world foundation for any engineering discipline. This course may address a variety of materials such as plastics, ceramics, and wood in addition to metal. Students will 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.

Practicum in Manufacturing  
8M470/8M474 EXT  
TSDS PEIMS Code: 13033000 (PRACMAN1) Extended 13033005 (EXPRMAN1)  
Grade Placement: 11-12, Credit: 2 to 3 EXT  
Prerequisite: None.  
The Practicum in Manufacturing course 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. The Extended Practicum in Manufacturing course 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. Students shall be awarded one credit for successful completion of this course.

Practicum in Manufacturing -  
8M920/8M925 DC (Metal Manufacturing and Machining - GRCTC)  
8M960 (Manufacturing Engineering - GRCTC)  
8M990 (Robotics - GRCTC)  
TSDS PEIMS Code:13033000 (PRACMAN1)  
Grade Placement: 11-12, Credit: 2  
Prerequisite: None.  
The Practicum in Manufacturing course 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. The Extended Practicum in Manufacturing course 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. Students shall be awarded one credit for successful completion of this course.