ENGINEERING & INDUSTRIAL TECHNOLOGY

ENGINEERING AND INDUSTRIAL TECHNOLOGY DIVISION

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ENGINEERING AND INDUSTRIAL TECHNOLOGY DEPARTMENTS

Engineering and Industrial Technology Division

The Engineering and Industrial Technology degree and certificate programs prepare students for exciting careers as automation specialists, multi-skilled technicians, supervisors in a manufacturing environment, automotive technicians, HVAC technicians, facilities technicians, industrial maintenance technicians, designers, CNC programmers, welders, or engineering technicians. The skills learned here can be used on the job in manufacturing, residential and commercial construction, facilities maintenance, facilities management, automotive service centers, energy producing facilities, and more. With increasing technology, companies need more and more workers with advanced training and skills. The highly qualified faculty provide real-world experience through project-based learning. Day, evening, online, and hybrid courses are available to accommodate busy schedules.

Students may receive credit toward a certificate or degree based on prior educational experience, work experience, and military experience. Students interested in obtaining advanced standing for course work should contact their academic advisor. More information is available under "Advanced Standing" in this Catalog.

The Engineering and Industrial Technology Division provides rigorous, hands-on learning experiences that require the regular participation of the student. As such, the Engineering and Industrial Technology Division has a more rigorous attendance policy than the College. Any student who accumulates more absences during the term than the class is scheduled to meet in a two-week period is subject to being withdrawn from the class. The number of allowable absences during the summer term or other sessions of varying length will be 10% of the total number of class meetings. Students who arrive late may, at the discretion of the instructor, be marked absent for that class. Students who continually arrive late to class are subject to being withdrawn from the class. In extenuating circumstances, a student may request re-admittance to class by meeting with the instructor and explaining the circumstances of the absences. If the instructor agrees to re-admit the student, the student will be informed of the requirements which must be met to successfully complete the course. Individual departments or programs may have a more rigid attendance policy. Those policies must be communicated in writing to students on the first day of class.

Automotive Technology

Program Information

The Automotive Technology program trains students in the testing, diagnosis and service of motor vehicles. Graduates may find employment in automotive dealerships, working for themselves, or at independent service centers.

The Automotive Technology program offers an associate degree and four certificate options. Credit for courses in the certificates also can be applied toward the associate degree.

Scheduling and Entry Options

Day classes are available. Although a student may enter in any term, starting in the Fall semester is highly suggested because automotive courses are only offered in the semester indicated and are subject to prerequisites. Full-time students usually complete requirements in five semesters. Part-time students should allow nine to eleven consecutive semesters to earn the degree. General Education course requirements can be completed at any time during the program. Students entering

the Automotive Program are strongly recommended to have a personal laptop for classes.

www.tctc.edu/auto

AUTOMOTIVE TECHNOLOGY, A.A.S.

Description

This program is designed to prepare students to become proficient, entry-level automotive technicians. Students entering the Automotive Program are strongly recommended to have a personal laptop for classes.

Program Outcomes

Upon completion, students will be able to:

- Service the components of steering, suspension, and alignment systems
- Service the components of drum braking systems and disc braking systems
- Service the components of automotive engines
- Service the components of automotive air conditioning systems
- Service the components of an automatic transmission system and a transaxle system
- Perform overall vehicle diagnosis and repair

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**15**
AUT 100	Introduction to Automotive Hazardous Materials	1
AUT 109	Engine Fundamentals and Basic Diagnostics	4
AUT 111	Brakes	3
AUT 132	Automotive Electricity	4
HSS 295	Leadership Through the Humanities	3
SECOND SEMESTER		**13**
AUT 145	Engine Performance	3
AUT 211	Advanced Brakes	3
AUT 231	Automotive Electronics	4
ENG 165	Professional Communication	3
THIRD SEMESTER		**14**
AUT 156	Automotive Diagnosis and Repair	4
AUT 241	Automotive Air Conditioning	4
AUT 275	Alternate Technology Vehicles	3
PSY 120	Organizational Psychology	3
FOURTH SEMESTER		**14**
AUT 124	Steering, Suspension and Alignment	4
AUT 152	Automatic Transmission	4
MAT 170	Algebra, Geometry and Trigonometry I	3
	General Electives	3
FIFTH SEMESTER		**14**
AUT 116	Manual Transmission and Axle	4
AUT 262	Advanced Automotive Diagnosis and Repair	4
	General Education Elective	3
	General Elective	3
GRADUATION CREDITS REQUIRED:		**70**

AUTOMOTIVE BRAKING SYSTEMS CERTIFICATE

Description

This certificate will prepare students to work with various braking systems utilized in today's passenger vehicles. Students entering the Automotive Program are strongly encouraged to have a personal laptop for classes.

Program Outcomes

Upon completion, students will be able to:

- Service the components of drum braking systems and disc braking systems

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**8**
AUT 100	Introduction to Automotive Hazardous Materials	1
AUT 111	Brakes	3
AUT 132	Automotive Electricity	4
SECOND SEMESTER		**3**
AUT 211	Advanced Brakes	3
GRADUATION CREDITS REQUIRED:		**11**

AUTOMOTIVE ENGINE ELECTRICAL SYSTEMS CERTIFICATE

Description

This certificate will prepare students to work with various engine electrical systems utilized in today's vehicles. Students entering the Automotive Program are strongly encouraged to have a personal laptop for classes.

Program Outcomes

Upon completion, students will be able to:

- Service the components of automotive engines

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**4**
AUT 132	Automotive Electricity	4
SECOND SEMESTER		**4**
AUT 231	Automotive Electronics	4
GRADUATION CREDITS REQUIRED:		**8**

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**8**
AUT 109	Engine Fundamentals and Basic Diagnostics	4
AUT 132	Automotive Electricity	4
SECOND SEMESTER		**7**
AUT 145	Engine Performance	3
AUT 231	Automotive Electronics	4
THIRD SEMESTER		**4**
AUT 156	Automotive Diagnosis and Repair	4
FOURTH SEMESTER		**4**
AUT 262	Advanced Automotive Diagnosis and Repair	4
GRADUATION CREDITS REQUIRED:		**23**

AUTOMOTIVE ENGINE PERFORMANCE SYSTEMS CERTIFICATE

Description

This certificate will prepare students to work with various engine performance systems utilized in today's vehicles. Students entering the Automotive Program are strongly encouraged to have a personal laptop for classes.

Program Outcomes

Upon completion, students will be able to:

- Service the components of automotive engines

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**4**
AUT 132	Automotive Electricity	4
SECOND SEMESTER		**4**
AUT 231	Automotive Electronics	4
THIRD SEMESTER		**4**
AUT 152	Automatic Transmission	4
FOURTH SEMESTER		**4**
AUT 116	Manual Transmission and Axle	4
GRADUATION CREDITS REQUIRED:		**16**

AUTOMOTIVE TRANSMISSION SYSTEMS CERTIFICATE

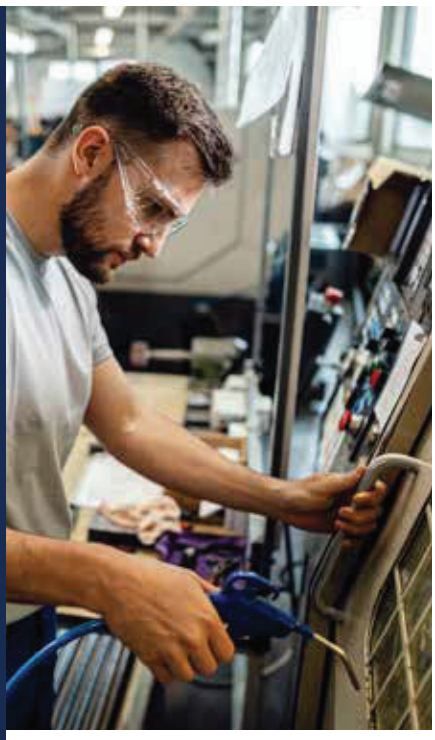
Description

This certificate will prepare students to work with various transmission systems utilized in today's passenger vehicles. Students entering the Automotive Program are strongly recommended to have a personal laptop for classes.

Program Outcomes

Upon completion, students will be able to:

- Service the components of automotive engines
- Service the components of an automatic transmission system and a transaxle system



CNC Programming and Operations

Program Information

CNC Programming and Operations prepares graduates to work as CNC programmers and operators with manufacturers requiring high production volumes or short run batches of discrete parts. The program offers an associate degree and four certificate options. Credit for courses in the certificates also can be applied toward the associate degree.

Scheduling and Entry Options

Program courses are offered during the day beginning in the Fall semester of each year and are offered at the Industrial Technology Center (ITC) in Sandy Springs. Entry during any other term will be permitted but may limit the courses that are available. Full-time day students usually complete requirements in six terms. Although courses can be completed in any order, subject to the completion of course prerequisites, students are advised to follow the recommended course sequence. General Education course requirements can be completed at any time during the program on any TCTC campus or online, as available.

www.tctc.edu/cnc

CNC PROGRAMMING AND OPERATIONS, A.A.S.

Description

In addition to writing CNC programs, students will learn CAD design and analysis applications, create precision set-ups, select tooling, and operate a variety of CNC milling and turning centers.

Program Outcomes

Upon completion, students will be able to:

- Design jigs and fixtures
- Operate manual metal-working equipment
- Program CAD/CAM software
- Operate CNC metal-working equipment
- Program CNC metal-working equipment
- Conduct heat-treating process

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**13**
EGT 106	Print Reading and Sketching	3
MAT 170	Algebra, Geometry and Trigonometry I	3
MTT 121	Machine Tool Theory I	3
MTT 122	Machine Tool Practice I	4
SECOND SEMESTER		**14**
MTT 105	Machine Tool Math Applications	3
MTT 124	Machine Tool Practice II	4
MTT 251	CNC Operations	3
MTT 252	CNC Setup and Operations	4
THIRD SEMESTER		**10**
EGT 152	Fundamentals of CAD	3
MTT 212	Tool Design	4
MTT 253	CNC Programming and Operations	3
FOURTH SEMESTER		**14**
EGT 165	Introduction to CAD/CAM	2
ENG 165	Professional Communication	3
MTT 141	Metals and Heat Treatment	3
MTT 254	CNC Programming I	3
	Social Science Requirement	3
FIFTH SEMESTER		**12**
EGT 265	CAD/CAM Applications	3
MTT 243	Advanced Dimensional Metrology for Machinists	3
	Humanities Requirement	3
	General Education Elective	3
SIXTH SEMESTER		**7**
MTT 258	Machine Tool Cam	3
MTT 261	Advanced Multi-Axis Programming and Operations II	4
GRADUATION CREDITS REQUIRED:		**70**

INTRODUCTION TO CNC CERTIFICATE

Description

The Introduction to CNC Certificate program provides students with an overview of basic CNC mill and lathe operations, setup, and programming.

Program Outcomes

Upon completion, students will be able to:

- Operate manual metal-working equipment
- Operate CNC metal-working equipment
- Program CNC metal-working equipment

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**10**
EGT 106	Print Reading and Sketching	3
MTT 121	Machine Tool Theory I	3
MTT 122	Machine Tool Practice I	4
SECOND SEMESTER		**14**
MTT 105	Machine Tool Math Applications	3
MTT 124	Machine Tool Practice II	4
MTT 251	CNC Operations	3
MTT 252	CNC Setup and Operations	4
GRADUATION CREDITS REQUIRED:		**24**

INTRODUCTION TO MACHINING CERTIFICATE

Description

The Introduction to Machining Certificate prepares students to safely operate drill presses, metal-cutting saws, lathes, milling machines, and grinders to produce precision parts; to utilize appropriate speeds, feeds, and tooling; and to use precision measuring instruments.

Program Outcomes

Upon completion, students will be able to:

- Operate manual metal-working equipment

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**10**
EGT 106	Print Reading and Sketching	3
MTT 121	Machine Tool Theory I	3
MTT 122	Machine Tool Practice I	4
GRADUATION CREDITS REQUIRED:		**10**

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**10**
EGT 106	Print Reading and Sketching	3
MTT 121	Machine Tool Theory I	3
MTT 122	Machine Tool Practice I	4
SECOND SEMESTER		**14**
MTT 105	Machine Tool Math Applications	3
MTT 124	Machine Tool Practice II	4
MTT 251	CNC Operations	3
MTT 252	CNC Setup and Operations	4
THIRD SEMESTER		**3**
MTT 253	CNC Programming and Operations	3
FOURTH SEMESTER		**5**
EGT 165	Introduction to CAD/CAM	2
MTT 254	CNC Programming I	3
FIFTH SEMESTER		**3**
EGT 265	CAD/CAM Applications	3
GRADUATION CREDITS REQUIRED:		**35**

MANUAL AND CNC FUNDAMENTALS CERTIFICATE

Description

The Manual and CNC Fundamentals Certificate provides participants with the knowledge of manual machines, blueprint sketching, and advanced techniques on operating CNC machines. Participants will learn advanced CNC machines, multi-axis machining, CAD/CAM drawing and programming, and precision measuring instruments.

Program Outcomes

Upon completion, students will be able to:

- Operate manual metal-working equipment
- Program CAD/CAM software
- Operate CNC metal-working equipment
- Program CNC metal-working equipment

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**10**
EGT 106	Print Reading and Sketching	3
MTT 121	Machine Tool Theory I	3
MTT 122	Machine Tool Practice I	4
SECOND SEMESTER		**7**
MTT 105	Machine Tool Math Applications	3
MTT 124	Machine Tool Practice II	4
GRADUATION CREDITS REQUIRED:		**17**

MANUAL MACHINING CERTIFICATE

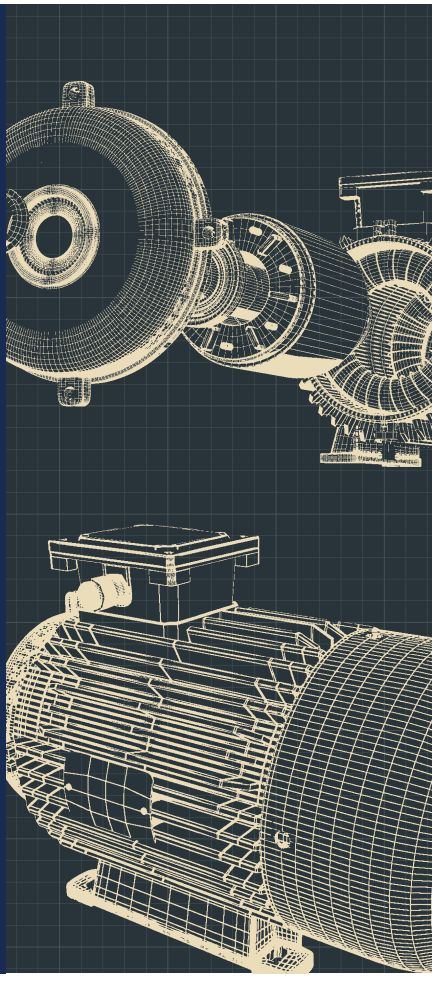
Description

The Manual Machining Certificate allows students to further their knowledge in operating manual machines. Students will be introduced to tighter tolerance parts, different techniques of operations and interpreting and sketching of blueprints using machine mathematics in order to produce high quality parts.

Program Outcomes

Upon completion, students will be able to:

- Operate manual metal-working equipment



Engineering Design Technology

Program Information

The Engineering Design Technology program prepares students to work in a collaborative manner with design teams to translate ideas and solutions into 2-D CAD drawings and 3-D CAD models. Students develop skills and techniques by using modern software such as AutoCAD, Catia, and SolidWorks. Students will be creating 3D models using CAD software and from these computer-generated models, students use 3D printers to produce physical prototypes and industrial parts. Students will be using CAD software to create 2D engineering documentation such as shop drawings, P&IDs, and plant layouts. Graduates are typically employed as part of a design team by manufacturing, engineering, and mechanical companies.

The Engineering Design Technology program offers an associate degree.

Scheduling and Entry Options

Program courses are offered during the day beginning in the Fall semester of each year. Entry during any other term will be permitted but may limit the courses that are available. Full-time day students usually complete degree requirements in five terms. General Education course requirements can be completed at any time during the program. Courses can be completed in any order subject to the completion of course prerequisites.

www.tctc.edu/edt

ENGINEERING DESIGN TECHNOLOGY, A.A.S.

Description

This program prepares students to translate product ideas into 3D models using computer aided design (CAD) software. From these computer generated models, students will use 3D printers to produce physical prototypes and industrial parts. In addition, students will also use CAD software to create 2D engineering documentation, such as shop drawing, P&IDs, and plant layouts.

Program Outcomes

Upon completion, students will be able to:

- Use industry recognized software to create mechanical drawings
- Prepare detail and/or assembly drawings for documentation of mechanical components and products
- Solve engineering design problems
- Deliver an effective technical presentation
- Analyze mechanical components for stresses and flexions

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**15**
EGT 106	Print Reading and Sketching	3
EGT 152	Fundamentals of CAD	3
ENG 165	Professional Communication	3
MAT 170	Algebra, Geometry and Trigonometry I	3
	Social Science Requirement	3
SECOND SEMESTER		**13**
EGT 115	Engineering Graphics II	4
EGT 119	Geometrics	3
MAT 171	Algebra, Geometry and Trigonometry II	3
PHY 101	Survey of Physics	3
THIRD SEMESTER		**12**
EGT 156	Intermediate CAD Applications	3
EGT 251	Principles of CAD	3
	Humanities Requirement	3
	General Electives	3
FOURTH SEMESTER		**15**
EET 113	Electrical Circuits I	4
EGR 175	Manufacturing Processes	3
EGR 194	Statics and Strength of Materials	4
EGT 210	Engineering Graphics III	4
FIFTH SEMESTER		**13**
EGR 130	Engineering Technology Applications and Programming	3
EGT 215	Mechanical Drawing Applications	4
EGT 245	Principles of Parametric CAD	3
EGT 252	Advanced CAD	3
GRADUATION CREDITS REQUIRED:		**68**

Engineering Systems Technology

Program Information

The Engineering Systems Technology program will prepare students to design, prototype, build, and troubleshoot the types of control systems that are used in today's high-tech industries and businesses. Students will gain knowledge in electricity, electronics, digital circuits, computer controlled devices, system programming, programmable logic controllers (PLC), human machine interfaces (HMI), industrial networking, pneumatics, robots, computer aided design (2D & 3D CAD), problem solving, and critical thinking. This program prepares students to pursue a career as an engineering technician in a variety of settings such as manufacturing, design labs, quality labs, supply chains, and other businesses that utilize current smart technology control strategies.

The Engineering Systems Technology program offers an associate degree and one certificate. Credit for courses in the certificate may also be applied toward the associate degree.

Scheduling and Entry Options

The Engineering Systems Technology program is located on the Pendleton Campus. Program courses are offered during the day beginning in the Fall semester of each year. Entry during any other term will be permitted but may limit the courses that are available. Full-time students usually complete the program requirements in five semesters. Part-time students should allow at least nine consecutive semesters to earn the degree. Although courses can be completed in any order, subject to the completion of course prerequisites, students are advised to follow the recommended course sequence. General Education

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**13**
EET 113	Electrical Circuits I	4
EGR 130	Engineering Technology Applications and Programming	3
ENG 165	Professional Communication	3
MAT 170	Algebra, Geometry and Trigonometry I	3
SECOND SEMESTER		**16**
EET 145	Digital Circuits	4
EET 235	Programmable Controllers	3
EGR 275	Introduction to Engineering/ Computer	3
MAT 171	Algebra, Geometry and Trigonometry II	3
PHY 101	Survey of Physics	3
THIRD SEMESTER		**7**
AMT 102	Computer-Controlled Machinery	4
AMT 103	Sensors	3
FOURTH SEMESTER		**17**
EET 131	Active Devices	4
EGR 175	Manufacturing Processes	3
MET 224	Hydraulics and Pneumatics	3
MET 238	Lean Manufacturing	4
	Humanities Requirement	3
FIFTH SEMESTER		**16**
EET 212	Industrial Robotics	3
EET 274	Selected Topics in Electrical/ Electronics Engineering Technology	3
EGR 184	Problem Based Integrated Technology I	3
EGR 194	Statics and Strength of Materials	4
PSY 120	Organizational Psychology	3
GRADUATION CREDITS REQUIRED:		**69**

*** Note**

1. HSS 295 is the preferred course for the Humanities Requirement.

course requirements can be completed on any TCTC campus or online, as available.

www.tctc.edu/est

ENGINEERING SYSTEMS TECHNOLOGY, A.A.S.

Description

The A.A.S. in Engineering Systems Technology will prepare students to design, prototype, build, and troubleshoot the types of control systems that are used in today's high-tech industries and businesses. This degree prepares students to pursue a career as an engineering technician in a variety of settings such as manufacturing, design labs, quality labs, supply chains, and other businesses that utilize current smart technology control strategies.

Program Outcomes

Upon completion, students will be able to:

- Design engineering systems
- Create engineering system prototypes
- Program micro-controllers (including PLCs and robotics)
- Build engineering systems
- Troubleshoot engineering systems
- Demonstrate employability skills

Heating, Ventilation & Air Conditioning Technology

Program Information

The Heating, Ventilation, and Air Conditioning Technology program offers an associate degree and two certificate options. Graduates service equipment in homes, businesses, and industries. Graduates may choose to work independently or for equipment distributors, for small companies or large ones, in building automation systems or facilities maintenance.

Scheduling and Entry Options

Day and evening classes are available. Full-time day students can expect to complete the program in five terms. Evening students should allow eight to ten terms to complete the degree. General Education course requirements can be completed at any time during the program.

www.tctc.edu/hvac

HEATING, VENTILATION, AND AIR-CONDITIONING TECHNOLOGY, A.A.S.

Description

Students learn the fundamentals of heating and air systems, from building and installing to repairing, maintaining and operating.

Program Outcomes

Upon completion, students will be able to:

- Install, maintain, and repair gas furnaces
- Install, maintain, and repair heat pumps
- Install, maintain, and repair commercial refrigeration systems

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**16**
ACR 101	Fundamentals of Refrigeration Systems	5
ACR 105	Tools and Service Techniques I	1
ACR 106	Basic Electricity for HVAC/R	4
ACR 160	Service Customer Relations	3
PSY 120	Organizational Psychology	3
SECOND SEMESTER		**15**
ACR 110	Heating Fundamentals	4
ACR 122	Principles of Air Conditioning	5
ENG 165	Professional Communication	3
MAT 170	Algebra, Geometry and Trigonometry I	3
THIRD SEMESTER		**12**
ACR 104	Print Reading for HVAC	1
ACR 221	Residential Load Calculations	2
ACR 224	Codes and Ordinances	2
ACR 250	Duct Fabrication	3
ACR 251	SCWE in HVAC	4
FOURTH SEMESTER		**14**
ACR 111	Gas Heating Principles	3
ACR 175	EPA 608 Certification Preparation	1
ACR 201	Troubleshooting and Maintenance	3
ACR 210	Heat Pumps	4
	Humanities Requirement	3
FIFTH SEMESTER		**13**
ACR 131	Commercial Refrigeration	4
ACR 140	Automatic Controls	3
ACR 225	Industrial Air Conditioning	3
	General Education Elective	3
GRADUATION CREDITS REQUIRED:		**70**

HVAC APPRENTICE CERTIFICATE

Description

This certificate is designed to prepare students to do entry-level work in the HVAC industry. This certificate covers the fundamentals of residential HVAC equipment. Students who earn this certificate will be prepared to assist HVAC technicians with installation and/or repair of heating, ventilation, and air conditioning equipment.

Program Outcomes

Upon completion, students will be able to:

- Install, maintain, and repair gas furnaces
- Install, maintain, and repair heat pumps
- Install, maintain, and repair commercial refrigeration systems

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**13**
ACR 101	Fundamentals of Refrigeration Systems	5
ACR 105	Tools and Service Techniques I	1
ACR 106	Basic Electricity for HVAC/R	4
ACR 160	Service Customer Relations	3
SECOND SEMESTER		**9**
ACR 110	Heating Fundamentals	4
ACR 122	Principles of Air Conditioning	5
GRADUATION CREDITS REQUIRED:		**22**

HVAC INSTALLER CERTIFICATE

Description

This certificate is designed to prepare students for residential equipment sizing and installation. This certificate emphasizes proper equipment and duct work sizing with focus on understanding ACCA Manual J and ACCA Manual D requirements.

Program Outcomes

Upon completion, students will be able to:

- Install gas furnaces
- Install heat pumps
- Install commercial refrigeration systems

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**13**
ACR 101	Fundamentals of Refrigeration Systems	5
ACR 105	Tools and Service Techniques I	1
ACR 106	Basic Electricity for HVAC/R	4
ACR 160	Service Customer Relations	3
SECOND SEMESTER		**9**
ACR 110	Heating Fundamentals	4
ACR 122	Principles of Air Conditioning	5
THIRD SEMESTER		**8**
ACR 104	Print Reading for HVAC	1
ACR 221	Residential Load Calculations	2
ACR 224	Codes and Ordinances	2
ACR 250	Duct Fabrication	3
GRADUATION CREDITS REQUIRED:		**30**

Manufacturing Management and Leadership

Program Information

This degree program equips students for careers as supervisors/team leaders in manufacturing by teaching leadership and communication skills unique to an industrial environment. In addition, heavy emphasis is placed on Lean Manufacturing practices, quality principles, managerial accounting, and industrial safety. Students are required to complete technical coursework selected from any technical field in the Engineering and Industrial Division.

The Manufacturing Management and Leadership program offers two associate degrees, and six certificate options. Credit for courses in the certificates can also be applied toward the associate degree. The Production and Operations Emphasis, A.A.S., Manufacturing Operators I Certificate, Manufacturing Production I Certificate, and Manufacturing Production II Certificate are restricted for TCTC I-BEST students.

Scheduling and Entry Options

Day and evening classes are available. Although major courses start in the Fall semester, students may enter any term. Full-time day students usually complete degree requirements in five terms. Students working swing shifts can have classes arranged around their work schedules. Many of the core courses are offered online. General Education course requirements can be completed at any time during the program. Courses can be completed in any order subject to the completion of course prerequisites.

www.tctc.edu/mml

MANUFACTURING MANAGEMENT AND LEADERSHIP, A.A.S.

Description

This degree equips students for careers as supervisors/team leaders in manufacturing by teaching leadership and communication skills, Lean Manufacturing practices, production scheduling, quality principles, managerial accounting and industrial safety.

Program Outcomes

Upon completion, students will be able to:

- Describe the blend of management and leadership skills an effective manufacturing supervisor should possess
- Demonstrate how Lean Manufacturing systems are used to eliminate non-value adding activities/waste in industry
- Utilize basic quality assurance tools to analyze and improve a process
- Analyze industrial safety practices and standards

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**15**
EGR 175	Manufacturing Processes	3
ENG 165	Professional Communication	3
QAT 101	Introduction to Quality Assurance	3
	Program Elective	3
	General Electives	3
SECOND SEMESTER		**15**
ACC 115	Managerial Accounting	3
MAT 170	Algebra, Geometry and Trigonometry I	3
QAT 102	Quality Concepts and Techniques	3
	Program Elective	3
	Social Science Requirement	3
THIRD SEMESTER		**6**
IMG 115	Industrial Management Safety	3
QAT 103	Quality Management	3
FOURTH SEMESTER		**13**
IMG 233	Industrial Supervision	3
MET 238	Lean Manufacturing	4
	Program Elective	6
FIFTH SEMESTER		**13**
	General Electives	3
	Humanities Requirement	3
	Program Elective	4
	Science Requirement	3
GRADUATION CREDITS REQUIRED:		**62**

*** Note**

1. Program Electives are to be selected from any Engineering and Industrial Technology technical field.

MML - PRODUCTION AND OPERATIONS EMPHASIS, A.A.S.

Description

Students with an interest in the manufacturing environment from operations to supervision should consider this emphasis. Students will learn the basics of the manufacturing environment, culture, processes and values. This degree culminates with leadership, safety, quality, production scheduling, and Lean Manufacturing principles needed in the manufacturing work force. This degree is restricted to TCTC I-BEST students.

Program Outcomes

Upon completion, students will be able to:

- Describe the blend of management and leadership skills an effective manufacturing supervisor should possess
- Demonstrate how Lean Manufacturing systems are used to eliminate non-value adding activities/waste in industry
- Utilize basic quality assurance tools to analyze and improve a process
- Analyze industrial safety practices and standards
- Demonstrate employability skills
- Employ safe work practices in the manufacturing environment
- Apply production principles to the manufacturing environment

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**14**
COL 120	STEM College and Career Readiness	3
MFG 101	Introduction to Manufacturing	3
MFG 102	Applied Learning in Manufacturing	2
QAT 101	Introduction to Quality Assurance	3
	Program Elective	3
SECOND SEMESTER		**16**
IDS 106	Employment Skills Development	4
MAT 170	Algebra, Geometry and Trigonometry I	3
MFG 103	Principles of Manufacturing	3
MFG 104	Introduction to Continuous Improvement	3
QAT 102	Quality Concepts and Techniques	3
THIRD SEMESTER		**9**
ENG 165	Professional Communication	3
IMG 115	Industrial Management Safety	3
QAT 103	Quality Management	3
FOURTH SEMESTER		**13**
IMG 233	Industrial Supervision	3
MET 238	Lean Manufacturing	4
	Program Elective	3
	Social Science Requirement	3
FIFTH SEMESTER		**15**
ACC 115	Managerial Accounting	3
	General Electives	3
	Humanities Requirement	3
	Program Elective	3
	Science Requirement	3
GRADUATION CREDITS REQUIRED:		**67**

*** Note**

1. Program Electives are to be selected from any Engineering and Industrial Technology technical field.

INTRODUCTION TO MANUFACTURING MANAGEMENT TECHNOLOGY CERTIFICATE

Description

This certificate is designed for students interested in acquiring the skills needed to be a manager in a manufacturing environment.

Program Outcomes

Upon completion, students will be able to:

- Describe the blend of management and leadership skills an effective manufacturing supervisor should possess
- Analyze industrial safety practices and standards

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**6**
IMG 233	Industrial Supervision	3
QAT 101	Introduction to Quality Assurance	3
SECOND SEMESTER		**6**
IMG 115	Industrial Management Safety	3
	Program Elective	3
GRADUATION CREDITS REQUIRED:		**12**

*** Note**

1. Program Electives are to be selected from any Engineering and Industrial Technology technical field.

INTRODUCTION TO QUALITY ASSURANCE CERTIFICATE

Description

The purpose of this certificate is to acquire the basic skills needed by a quality assurance technician in a manufacturing environment. Completion of this certificate will prepare the student for the ASQ Certified Quality Improvement Associate exam.

Program Outcomes

Upon completion, students will be able to:

- Utilize basic quality assurance tools to analyze and improve a process

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**3**
QAT 101	Introduction to Quality Assurance	3
SECOND SEMESTER		**3**
QAT 102	Quality Concepts and Techniques	3
THIRD SEMESTER		**3**
QAT 103	Quality Management	3
GRADUATION CREDITS REQUIRED:		**9**

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**6**
EGR 175	Manufacturing Processes	3
QAT 101	Introduction to Quality Assurance	3
SECOND SEMESTER		**7**
MET 238	Lean Manufacturing	4
QAT 102	Quality Concepts and Techniques	3
THIRD SEMESTER		**3**
QAT 103	Quality Management	3
GRADUATION CREDITS REQUIRED:		**16**

MANUFACTURING AND CONTINUOUS PROCESS IMPROVEMENT CERTIFICATE

Description

This certificate is designed for the student interested in continuous improvement systems for quality, productivity, waste, and cost in a manufacturing environment. Principles of Quality Assurance, Lean Manufacturing and automated work cells are emphasized. Completion of the certificate will prepare the student for the ASQ Certified Quality Process Analyst examination.

Program Outcomes

Upon completion, students will be able to:

- Demonstrate how Lean Manufacturing systems are used to eliminate non-value adding activities/waste in industry
- Utilize basic quality assurance tools to analyze and improve a process

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**7**
MFG 101	Introduction to Manufacturing	3
	Program Elective	4
SECOND SEMESTER		**6**
MFG 103	Principles of Manufacturing	3
MFG 104	Introduction to Continuous Improvement	3
GRADUATION CREDITS REQUIRED:		**13**

*** Note**
Program Electives are to be selected from any Engineering and Industrial Technology technical field.

MANUFACTURING OPERATORS I CERTIFICATE

Description

This certificate equips students with the skills to understand the manufacturing environment, culture, processes, and values. This certificate is restricted to TCTC I-BEST students.

Program Outcomes

Upon completion, students will be able to:

- Demonstrates employability skills
- Employ safe work practices in the manufacturing environment
- Apply production principles to the manufacturing environment
- Demonstrate employability skills

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**8**
COL 120	STEM College and Career Readiness	3
MFG 101	Introduction to Manufacturing	3
MFG 102	Applied Learning in Manufacturing	2
GRADUATION CREDITS REQUIRED:		**8**

MANUFACTURING PRODUCTION I CERTIFICATE

Description

This certificate prepares students to transition from a job in non-manufacturing sectors to entry-level positions in manufacturing and to continue technical and post-secondary study needed for career growth and advancement. This certificate is restricted to TCTC I-BEST students.

Program Outcomes

Upon completion, students will be able to:

- Demonstrates employability skills
- Employ safe work practices in the manufacturing environment
- Apply production principles to the manufacturing environment

MANUFACTURING PRODUCTION II CERTIFICATE

Description

This certificate prepares students for job advancement in manufacturing through greater understanding of skills applicable to core manufacturing processes including quality monitoring, teaming and problem-solving, safety, and the basics of Lean Manufacturing strategies. This certificate emphasizes project-based learning and builds the skills and perspectives needed for success in both manufacturing and post-secondary technical study. This certificate is restricted to TCTC I-BEST students.

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**8**
COL 120	STEM College and Career Readiness	3
MFG 101	Introduction to Manufacturing	3
MFG 102	Applied Learning in Manufacturing	2
SECOND SEMESTER		**10**
IDS 106	Employment Skills Development	4
MFG 103	Principles of Manufacturing	3
MFG 104	Introduction to Continuous Improvement	3
GRADUATION CREDITS REQUIRED:		**18**

Program Outcomes

Upon completion, students will be able to:

- Demonstrates employability skills
- Employ safe work practices in the manufacturing environment
- Apply production principles to the manufacturing environment

Mechatronics Technology

Program Information

The Mechatronics program is designed for students who want to make a career out of becoming a technician in the world of automation. The program assists students in acquiring the multifunction and employability skills needed in today's manufacturing environment as an entry level technician. Today's industry relies on well-trained electromechanical technicians to reduce downtime and increase efficiency of the equipment. Students learn how to diagnose and repair a variety of automation systems such as mechanical, electrical, hydraulics, pneumatics, PLCs, and robotics. They learn the importance of how each system is integrated in the automation process. There is an extensive focus on troubleshooting and how it is applied to electromechanical systems.

The Mechatronics program offers an associate degree and two certificate options. Credit for courses in the certificates also can be applied toward the associate degree.

Scheduling and Entry Options

Day and evening classes are available. The full program is offered on the Pendleton Campus. Additionally, the first two semesters are offered on the Anderson and Oconee Campuses. Full-time day students usually complete requirements in six terms. For students taking a reduced load, a degree requires eight to ten terms. General Education course requirements can be completed at any time during the program. Courses can be completed in any order subject to the adherence of course prerequisites and corequisites.

www.tctc.edu/mech

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**12**
MEC 101	Circuit Analysis	3
MEC 102	Industrial Machining and Tools	3
MEC 103	Hydraulics and Pneumatics	3
MEC 110	DC Circuits	3
SECOND SEMESTER		**12**
IDS 114	Employability Skills	3
MAT 170	Algebra, Geometry and Trigonometry I	3
MEC 111	AC Circuits	3
MEC 120	Sensors and Instrumentation	3
THIRD SEMESTER		**12**
MEC 112	Digital Controls	4
MEC 113	Solid State Devices	4
MEC 130	Motor Controls	4
FOURTH SEMESTER		**14**
ENG 165	Professional Communication	3
MEC 150	Mechanical Systems	5
MEC 200	AC/DC Machines	3
MEC 210	Programmable Logic Controllers I	3
FIFTH SEMESTER		**12**
MEC 201	AC/DC Drives	3
MEC 211	Programmable Logic Controllers II	3
	Humanities Requirement	3
	Social Science Requirement	3
SIXTH SEMESTER		**12**
MEC 212	Robotics and Automation	3
MEC 213	Technical Troubleshooting	3
MEC 214	Reliability Centered Maintenance	3
	General Education Requirement	3
GRADUATION CREDITS REQUIRED:		**72**

*** Notes**

1. Students may substitute MAT 155 or MAT 120 for MAT 170.
2. Students may substitute ENG 101 and SPC 205, or ENG 155 for ENG 165.
3. PSY 120 is the preferred course for the Social Science Requirement.
4. HSS 295 is the preferred course for the Humanities Requirement.

MECHATRONICS TECHNOLOGY, A.A.S.

Description

Using hands-on experiences, the Mechatronics degree will prepare students to diagnose and repair a variety of automation systems such as mechanical, electrical, hydraulics, pneumatics, PLCs, and robotics. They learn the importance of how each system is integrated in the automation process. There is an extensive focus placed on troubleshooting and how it is applied to electromechanical systems.

Program Outcomes

Upon completion, students will be able to:

- Troubleshoot electro-mechanical systems
- Program automated systems
- Construct fluid power systems
- Install mechanical systems
- Install control systems
- Install electrical systems

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**12**
MEC 101	Circuit Analysis	3
MEC 102	Industrial Machining and Tools	3
MEC 103	Hydraulics and Pneumatics	3
MEC 110	DC Circuits	3
GRADUATION CREDITS REQUIRED:		**12**

TECHNICAL OPERATORS I CERTIFICATE

Description

Using hands-on experiences, this certificate gives students the opportunity to use various industrial hand tools, apply safe machining operations, develop basic knowledge about DC electrical/electronic fundamentals, and operate electrical/electronic manufacturing equipment.

Program Outcomes

Upon completion, students will be able to:

- Construct fluid power systems

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**12**
MEC 101	Circuit Analysis	3
MEC 102	Industrial Machining and Tools	3
MEC 103	Hydraulics and Pneumatics	3
MEC 110	DC Circuits	3
SECOND SEMESTER		**9**
MEC 111	AC Circuits	3
MEC 120	Sensors and Instrumentation	3
IDS 114	Employability Skills	3
GRADUATION CREDITS REQUIRED:		**21**

TECHNICAL OPERATORS II CERTIFICATE

Description

Using hands-on experiences, this certificate gives students the opportunity to develop basic knowledge about AC electrical/electronic fundamentals and electronic control systems, and apply employability skills. Satisfactory completion of Technical Operators Certificate I is required for entry into this certificate.

Program Outcomes

Upon completion, students will be able to:

- Construct fluid power systems
- Install electrical systems

Welding Technology

Program Information

The Welding Technology program utilizes hands-on, practical training in basic and advanced welding techniques for welding steel, stainless steel, and aluminum materials. Welding training emphasizes stick, MIG, and TIG welding in pipe and structural applications, along with other skills needed in the workplace such as blueprint reading, robotic welding, fabrication, and welding metallurgy. Upon successful completion, students will be prepared for a variety of employment opportunities related to welding, primarily in construction and metalworking.

The Welding Technology program offers one associate degree option and four certificate options. Credit for courses in the certificates also can be applied toward the associate degree.

Scheduling and Entry Options

Day and evening classes are available, and students may enter any term. Full-time day students usually complete requirements in six terms. For students taking a reduced load, a degree requires eight to ten terms. General Education course requirements can be completed at any time during the program. Courses can be completed in any order subject to the completion of course prerequisites.

www.tctc.edu/wld

WELDING TECHNOLOGY, A.A.S.

Description

The Welding Technology, A.A.S. degree program utilizes hands-on, practical training in basic and advanced welding techniques for welding steel, stainless steel, and aluminum materials. Welding training emphasizes stick, MIG, and TIG welding in pipe and structural applications, along with other skills needed in the workplace such as blueprint reading, robotic welding, fabrication, and welding metallurgy. Upon successful completion of this degree program, students will be prepared for a variety of employment opportunities related to welding, primarily in construction and metalworking.

Program Outcomes

Upon completion, students will be able to:

- Interpret blueprints and associated weld symbols
- Demonstrate ability to complete tasks in a metal fabrication environment including identifying/choosing proper materials, cutting materials to proper dimensions, fitting the materials together, and tack welding the materials in the proper location
- Demonstrate needed skills required for a Structural Plate certification test following proper procedures and meeting the requirements of the welding codes
- Write and/or alter robotic welding programs for use in a manufacturing environment
- Demonstrate proper technique in the application of GMAW (MIG)
- Demonstrate needed skills required for a SMAW Pipe certification test following proper procedures and meeting the requirements of the welding codes

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**14**
WLD 129	Metal Working Tools	3
WLD 111	Arc Welding I	4
WLD 115	Arc Welding III	4
	Social Science Requirement	3
SECOND SEMESTER		**14**
WLD 113	Arc Welding II	4
WLD 225	Arc Welding Pipe I	4
	General Education Requirement	3
	General Elective	3
THIRD SEMESTER		**6**
WLD 109	Gas Metal Arc Welding II	3
WLD 204	Metallurgy	3
FOURTH SEMESTER		**14**
ENG 165	Professional Communication	3
MAT 170	Algebra, Geometry and Trigonometry I	3
WLD 132	Inert Gas Welding Ferrous	4
WLD 154	Pipefitting and Welding	4
FIFTH SEMESTER		**12**
EGT 103	Print Reading	2
EGT 114	Welding Print Basics	2
WLD 235	Robotic Welding I	2
	General Elective	3
	Humanities Requirement	3
SIXTH SEMESTER		**6**
WLD 160	Fabrication Welding	3
WLD 208	Advanced Pipe Welding	3
GRADUATION CREDITS REQUIRED:		**66**

- Demonstrate needed skills required for a GTAW Pipe, Steel certification test following proper procedures and meeting the requirements of the welding codes
- Demonstrate needed skills required for a Stainless Steel weld certification test following proper procedures and meeting the requirements of the welding codes

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**8**
WLD 111	Arc Welding I	4
WLD 115	Arc Welding III	4
SECOND SEMESTER		**8**
WLD 113	Arc Welding II	4
WLD 225	Arc Welding Pipe I	4
THIRD SEMESTER		**6**
WLD 109	Gas Metal Arc Welding II	3
WLD 204	Metallurgy	3
FOURTH SEMESTER		**8**
WLD 132	Inert Gas Welding Ferrous	4
WLD 154	Pipefitting and Welding	4
FIFTH SEMESTER		**4**
EGT 103	Print Reading	2
EGT 114	Welding Print Basics	2
SIXTH SEMESTER		**6**
WLD 160	Fabrication Welding	3
WLD 208	Advanced Pipe Welding	3
GRADUATION CREDITS REQUIRED:		**40**

INDUSTRIAL WELDING CERTIFICATE

Description

The Industrial Welding certificate program prepares students for a variety of employment opportunities, primarily in construction and metalworking. Courses offer hands-on, practical training in basic and advanced welding techniques. Students learn to weld steel, stainless steel, and aluminum in structural and pipe applications, and to perform other welding skills needed in the workplace.

Program Outcomes

Upon completion, students will be able to:

- Interpret blueprints and associated weld symbols
- Demonstrate ability to complete tasks in a metal fabrication environment including identifying/choosing proper materials, cutting materials to proper dimensions, fitting the materials together, and tack welding the materials in the proper location
- Demonstrate needed skills required for a Structural Plate certification test following proper procedures and meeting the requirements of the welding codes
- Demonstrate proper technique in the application of GMAW (MIG)
- Demonstrate needed skills required for a SMAW Pipe certification test following proper procedures and meeting the requirements of the welding codes
- Demonstrate needed skills required for a GTAW Pipe, Steel certification test following proper procedures and meeting the requirements of the welding codes
- Demonstrate needed skills required for a Stainless Steel weld certification test following proper procedures and meeting the requirements of the welding codes

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**8**
WLD 111	Arc Welding I	4
WLD 115	Arc Welding III	4
SECOND SEMESTER		**8**
WLD 113	Arc Welding II	4
WLD 225	Arc Welding Pipe I	4
THIRD SEMESTER		**6**
WLD 109	Gas Metal Arc Welding II	3
WLD 204	Metallurgy	3
FOURTH SEMESTER		**8**
WLD 132	Inert Gas Welding Ferrous	4
WLD 154	Pipefitting and Welding	4
GRADUATION CREDITS REQUIRED:		**30**

MULTI-PROCESS WELDING CERTIFICATE

Description

This program focuses on SMAW, GMAW, and GTAW welding for application in the industry. Training includes fillet welds and groove welds on plate, groove welds on pipe in all positions, and MIG welding and TIG welding. Students will undergo multiple welding qualification tests and have the opportunity to gain an AWS certification to AWS D1.1, the structural steel welding code, as well as two ASME Section IX Boiler and Pressure Vessel: one on SMAW welded pipe and the other on GTAW welded pipe.

Program Outcomes

Upon completion, students will be able to:

- Demonstrate needed skills required for a Structural Plate certification test following proper procedures and meeting the requirements of the welding codes
- Demonstrate proper technique in the application of GMAW (MIG)

- Demonstrate needed skills required for a SMAW Pipe certification test following proper procedures and meeting the requirements of the welding codes
- Demonstrate needed skills required for a GTAW Pipe Steel certification test following proper procedures and meeting the requirements of the welding codes

SHIELDED METAL ARC WELDING (SMAW) - PIPE CERTIFICATE

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**8**
WLD 111	Arc Welding I	4
WLD 115	Arc Welding III	4
SECOND SEMESTER		**8**
WLD 113	Arc Welding II	4
WLD 225	Arc Welding Pipe I	4
GRADUATION CREDITS REQUIRED:		**16**

Description

This program focuses on SMAW welding of steel for application in the structural steel and pipeline industry. Training includes fillet and groove welds on plate, and groove welds on pipe in all positions. Students will undergo a welding qualification test at the completion and have the opportunity to gain an AWS certification to AWS D1.1 structural steel welding code and ASME Section IX Boiler and Pressure Vessel on SMAW welded pipe.

Program Outcomes

Upon completion, students will be able to:

- Demonstrate needed skills required for a Structural Plate certification test following proper procedures and meeting the requirements of the welding codes
- Demonstrate needed skills required for a SMAW Pipe certification test following proper procedures and meeting the requirements of the welding codes

SHIELDED METAL ARC WELDING (SMAW) - STRUCTURAL CERTIFICATE

Course Number	Course Title	Credit Hours
FIRST SEMESTER		**8**
WLD 111	Arc Welding I	4
WLD 115	Arc Welding III	4
GRADUATION CREDITS REQUIRED:		**8**

Description

This program focuses on SMAW welding of steel for application in the structural steel industry. Training includes fillet and groove welds in all positions. Students will undergo a welding qualification test at the completion and have the opportunity to gain an AWS certification to AWS D1.1 the structural steel welding code.

Program Outcomes

Upon completion, students will be able to:

- Demonstrate needed skills required for a Structural Plate certification test by following proper procedures and meeting the requirements of the welding codes

NOTES: