



# STEM & INDUSTRIAL TECHNOLOGY DIVISION

Contact the STEM & INDUSTRIAL TECHNOLOGY Division

[Stem@northweststate.edu](mailto:Stem@northweststate.edu)

# Science, Technology, Engineering Tech and Math (STEM) & Industrial Technologies Division

## STEM

**Mission:** To serve by providing an excellent educational experience, with genuine interest in our students' success and personal growth for their entire college career and beyond.

**Vision:** To be an integral part of NSCC as a recognized leader in the STEM fields, not only in the community but the region and the state.

Northwest State Community College offers a variety of degree and certificate programs in the field of engineering technologies as well as mathematics, natural science, and computer science classes. Students enrolled in a STEM class will benefit from the small classroom sizes as they learn to analyze problems and, more importantly how to solve them.

STEM Division students will be prepared to enter the workforce immediately after graduation from the engineering and technology program. Students concentrating in mathematics and natural sciences along with engineering and technology will also have the option of transferring into a four-year program at a partnering college or university.

Degree and certificate programs offered through the Engineering Technologies Division include:

### Associate of Applied Science Degree

- Computer Programming
- Computer Science Engineering Technology
- Cybersecurity & Network Administration
- Electro-Mechanical Engineering Technology
- Electrical Engineering Technology
- Mechanical Engineering Technology
- Project Management Technology

### Associate of Applied Science in Mechanical Engineering Degree

- CAD/CAM
- Plastics

### Certificate Programs

- Computer Aided Design
- Computer Technician
- Plastics Manufacturing
- Quality Control

### Short-Term Technical Certificate Programs

- Cybersecurity
- Manufacturing Foundations
- IT Specialist

### Course Sequence

The suggested sequence of courses is for full-time students. If you are a part-time student or have transferred courses in from another school, you should generally complete the courses listed under semester 1 before moving on to semester 2, 3, and then 4. Elective courses may be taken at any time. Please meet with your advisor if you need assistance to register. Your advisor can help you make any necessary changes to this recommended sequence.

### General Education

For Northwest State Core Requirements for all graduates, see page 40. Unless specified on the program page, Humanities and Social Behavioral Science electives should be selected from the Core Requirements list while Communication and Natural Science electives should be selected from the following elective lists.

#### Natural Science

CHM101	Principles of Chemistry
CHM201	General Chemistry I
PHY101	Principles of Physical Science
PHY251	Physics: Mechanics & Heat
PHY252	Physics: Electricity & Magnetism

#### Technical Electives

Any AET, CAD, CET, EET, IND, INT, MET, PET, PLC or QCT course

### Prerequisites

All students are required to demonstrate proficiencies in reading, writing, and mathematics based on scores on the assessment test or take the recommended classes. If you have not taken these tests, stop by the Admissions Office in C106 or call (419) 267-1320 for information or referral to testing.

Some courses listed in this program have specific prerequisites. See prerequisites required for each course in the Course Description section of this publication.

# Science, Technology, Engineering Tech and Math (STEM) & Industrial Technologies Division

## Industrial Technology Division

Northwest State Community College offers a variety of degree and certificate programs in the field of Industrial Technologies. Students enrolled in an Industrial Technologies program will benefit from the small classroom sizes as they learn to analyze problems and, more importantly, how to fix them.

Students will be prepared to enter the workforce immediately after graduation. They will also have the option of transferring into a four-year degree program at a partnering college or university.

Industrial Technologies Degree and certificate programs include:

### Associate of Applied Science Degree

- Industrial Technology
- Maintenance Technician Mechatronics

### Certificate Programs

- HVACR (Climate Control)
- Industrial Electrical
- Industrial Maintenance
- Machining
- Millwright
- Programmable Controller (PLC)

### Short-Term Technical Certificate Programs

- CNC Operations
- Industrial Automation Maintenance
- Industrial Welding

### Course Sequence

The suggested sequence of courses is for full-time students. If you are a part-time student or have transferred courses in from another school, you should generally complete the courses listed under semester 1 before moving on to semester 2, 3, and then 4. Elective courses may be taken at any time. Please meet with your advisor if you need assistance to register. Your advisor can help you make any necessary changes to this recommended sequence.

### General Education

For Northwest State Core Requirements for all graduates, See page 39. Unless specified on the program page, Humanities and Social Behavioral Science electives should be selected from the Core Requirements list while Communication and Natural Science electives should be selected from the following elective lists.

#### Communications:

- |        |                                 |
|--------|---------------------------------|
| ENG111 | Composition I (General Studies) |
| ENG113 | Speech                          |
| ENG210 | Technical Communications        |
| ENG214 | Discussion & Conference Methods |

#### Natural Science:

See Page 50 for Natural Science Electives

#### Technical Electives:

Any AET, CAD, EET, IND, INT, MET, PET, PLC or QCT course

# Associate of Applied Science in Mechanical Engineering Technology CAD/CAM

## STEM & Industrial Technology Division

The CAD/CAM graduate will earn an Associate of Applied Science degree in the Mechanical Engineering Technology. Students completing the associate degree are qualified to play a support role to the engineering professionals in industry preparing blueprints, layouts, bills of materials, manufacturing and product support documentations. The CAD/CAM major will also prepare the student to interpret designs and to design components and tooling used in manufacturing and to operate production machines and program CNC machines, using G Codes and state-of-the-art CAM software.

### Career Outlook

Job seekers who have a two-year degree should have the best prospects for employment. With the shortage of skilled metalworkers in the United States today, the job opportunities are favorable for the CAD/CAM Technician.

### Program Learning Outcomes

Students earning an Associate degree from this program will:

1. Interpolate and complete engineered drawings using orthographic projection, isometric views, and proper dimensioning practices, then employ the use of Computer-Aided-Design (CAD) software.
2. Describe the different manufacturing processes and demonstrate proper use of precision measuring devices and instruments.
3. Demonstrate machining projects with an emphasis on safety, fixturing, feeds and speeds, tooling, precision, and accuracy.
4. Employ the use of Computer-Aided-Manufacturing (CAM) software.

<b>First Semester</b>		<b>Credits</b>
	CAD112 CAD II.....	4
	ENG111 Composition I.....	3
+	IND140 Principles of Machining.....	3
	MET100 Intro to Engineering Technology .....	2
+	MET107 Engineering Graphics.....	<u>3</u>
		15

<b>Second Semester</b>		<b>Credits</b>
+	CAD213 CAD III .....	4
	ENG112 Composition II.....	3
+	IND241 Tooling & Fixtures .....	3
+	MET222 Programming CNC .....	3
	MTH109 College Algebra.....	<u>3</u>
		16

<b>Third Semester</b>		<b>Credits</b>
+	MET223 CAM I .....	4
	MTH112 Trigonometry .....	3
+	QCT100 Quality Concepts .....	3
	ENG210 Technical Communications.....	3
	ELECTIVE* Social/Behavioral Science Elective	<u>3</u>
		16

<b>Fourth Semester</b>		<b>Credits</b>
+	MET260 CAM II.....	3
+	MET262 CAD/CAM Project .....	4
	PHY251 Physics: Mechanics & Heat.....	4
+	CET115 Project Management or	
	MET121 Manufacturing Processes or	
	MET134 Engineering Materials .....	3
	ELECTIVE* Humanities Elective .....	<u>3</u>
		17

**Total Program Hours                    64**

\* See page 45 for a list of Humanities and Social/Behavioral Science Electives.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# CNC Operations Certificate (Short-Term Technical Certificate)

The Computer Numerical Control (CNC) Operations program focuses on the operation and setup of production CNC equipment. Students in this program will develop their skills in machining processes, including operation of the drill press, lathe, vertical and horizontal milling machine, surface grinder, CNC vertical machining center and turning center. Students learn the basics of transforming raw material into finished parts in a production environment.

### Career Outlook

Contact with several regional machine shops has indicated a strong desire to bring jobs back which had been outsourced. Additionally, area industries have both expressed need for and provided input on training content making up the CNC Operations certificate program.

### Program Learning Outcomes

1. Demonstrate the safe use of electric and manual hand tools.
2. Analyze technical data.
3. Set-up and operate manual machine tools including the mill, lathe, drill press, band saw, surface grinder and hand tools.
4. Set-up and operate CNC vertical milling machine.
5. Set-up and operate CNC metal machining lathe.
6. Interpret the 2D and 3D mechanical prints used in Machining.
7. Create a CNC program from a machine sequence pattern.
8. Weld various metals used in molds and fixtures.
9. Write part programs for CNC machine tools.
10. Demonstrate the ability to interpret and apply technical information from mechanical blueprints.
11. Measure machined parts with manual and automated measuring devices.

### First Semester

		<u>Credits</u>
+	IND 103 Applied Geometry & Trig .....	3
+	IND 132 Benchwork .....	2
+	IND 107 Print Reading and Sketching.....	3
+	IND 140 Principles of Machining.....	3
+	IND 240 Machining Processes II.....	<u>3</u>
		14

### Second Semester

		<u>Credits</u>
+	IND 241 Tooling & Fixtures.....	3
+	IND 100 Precision Management .....	3
+	MET222 Programming of Computer Numerical Control.....	3
+	WLD 110 Introduction to Applied Welding Tech.....	<u>3</u>
		12

**Total Program Hours** **26**

+ Refers to technical course work. Students must maintain a minimum grade of "C" in these courses to progress in the program and graduate.

# Computer Aided Design Certificate

## STEM & Industrial Technology Division

A Computer Aided Design Certificate prepares the individual to create engineering drawings using CAD software. Typically these individuals will work closely with mechanical engineers, sometimes receiving objectives and technical advice from supervisors and/or engineers (both Electrical and Mechanical), displaying both their knowledge of the software and current knowledge of drafting and design standards. It is expected by employers that individuals demonstrate excellent verbal, written and interpersonal communication skills.

Coursework (100 level or higher) completed in this certificate directly applies toward the associate degree in mechanical engineering technology with a CAD/CAM major.

### Career Outlook

Graduates of this program may find employment as an entry-level CAD operator/technician or as a detailer working under the direction of a design engineer. Some of the typical duties of a CAD operator/technician will include: compiling and computing a variety of engineering data; developing and preparing schematics from designs made by you and/or others; making preliminary designs from rough specifications and/or verbal directions; generating and revising current engineering prints and three-dimensional patterns for parts and products; designing and modifying equipment used for manufacturing; building a bill of material for new or revised designs, revising drawings and checking prints for accuracy.

Job opportunities for CAD technicians will remain stable through the next several years, with most of the positions occurring from replacing workers who leave the profession or retire.

### Program Learning Outcomes

Students earning a certificate from this program should demonstrate:

1. Demonstrate file handling and management
2. Demonstrate familiarity with computer software, CAD, computer hardware, and component terminologies
3. Interpret and apply the Cartesian coordinate system
4. Demonstrate setup, display, drawing, inquiry, and modify commands
5. Develop, modify, and manipulate symbols, crosshatching, and various types of dimensioning
6. Demonstrate inquiry commands and develop industrial-type detail and assembly drawings as well as produce finished projects

<b>First Semester</b>		<b>Credits</b>
+	CAD112 CAD II.....	4
	IND103 Applied Geometry & Trigonometry ..	3
+	IND140 Principles of Machining.....	3
	MET100 Into to Engineering Tech.....	2
+	MET107 Engineering Graphics & Sketching....	<u>3</u>
		15

<b>Second Semester</b>		<b>Credits</b>
+	CAD213 CAD III .....	4
	ENG111 Composition I.....	3
+	IND241 Tooling & Fixtures .....	3
+	MET121 Manufacturing Processes or	
+	MET222 Programming CNC .....	3
+	QCT141 Precision Measurement.....	<u>3</u>
		16

**Total Program Hours                    31**

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Computer Programming Associate of Applied Science

## STEM & Industrial Technology Division

Computers play a part in nearly all phases of our life today. Businesses and governmental agencies, large and small, require trained computer specialists. The computer programming degree prepares computer programmers and computer operators to work with a wide variety of computers and languages used by area employers. Emphasis is placed upon business-oriented computer languages. Programming and practical applications of business data are stressed. In the laboratory, hands-on experience is provided using the Internet and PC compatible computers.

Graduates may find employment in entry-level positions with typical titles such as Computer Operator, Application Programmer, Maintenance Programmer, Software Developer or in Technical Support. A career path may include Lead or Senior Programmer and Data Processing Manager.

### Career Outlook

Employment of computer programmers is expected to be quite good. Opportunities should be especially favorable for those programmers who know several programming languages.

### Program Learning Outcomes

Student will be able to:

1. Demonstrate the ability to apply structured programming concepts.
2. Install and troubleshoot current Personal Computer hardware and current Operating System software.
3. Demonstrate software skills.
4. Write and debug programs.

<b>First Semester</b>		<b>Credits</b>
EET107	Python Programming.....	3
MET100	Intro to Engineering Technology .....	2
+ CIT191	Computer Operations .....	3
ENG111	Composition I.....	3
+ CIT165	Java Programming .....	<u>4</u>
		15

<b>Second Semester</b>		<b>Credits</b>
CIS114	Microsoft Applications.....	3
+ CIT194	IT Security Fundamentals .....	3
+ CIT265	Java Programming II .....	3
ELECTIVE*	Math Elective.....	3
PHI210	Ethics .....	<u>3</u>
		15

<b>Third Semester</b>		<b>Credits</b>
ACC111	Financial Accounting.....	3
+ CIT150	Programming C+.....	4
+ CYB210	CyberSecurity Programming.....	3
ENG210	Technical Communications.....	3
ELECTIVE*	Social Behavioral Science Elective.....	<u>3</u>
		16

<b>Fourth Semester</b>		<b>Credits</b>
+ CIT108	Internet Scripting.....	4
+ CIT161	C#.....	4
+ CIT109	Database Programming .....	4
ELECTIVE*	Natural Science Elective	<u>3</u>
		15

**Total Program Credit Hours      61**

### Mathematics Electives:

MTH105	Quantitative Reasoning
MTH109	College Algebra
STA120	Introduction to Statistics

\* **See page 39 for Natural Science and Social Behavioral Science Electives**

+ Students must attain a 2.00 grade point average in these technical courses to graduate.

# Computer Science Engineering Technology

## Associate of Applied Science

### STEM & Industrial Technology Division

The Computer Science Engineering Technology program prepares graduates for the field of computer science with a comprehensive understanding of computer hardware and software at the machine and system level. The program combines curriculum in electronics and computer programming addressing both hardware and software aspects of computer design and applications. The design aspect places emphasis on computer structures, computer architectures, microcomputer systems, digital design, and computational applications. The applications part of the program includes a general knowledge of computer operating systems, utilization of software in engineering technologies, low- and hi-level programming techniques, and the use of mathematical algorithms.

### Career Outlook

With an increasing utilization of computer systems and programming, demand for technicians with a computer science background is ever increasing. Graduates of this program will have the foundational coursework leading into four year computer science and electrical engineering programs at various universities, as well as being qualified for entry level engineering technicians in product design, engineering support, and other technical support positions. Typical job titles with this degree would include Application Specialist, Computer Systems Specialist, Computer Maintenance Technician, Field Service Representative, Field Engineer, Installation Technician, and Systems Integrator.

### Program Learning Outcomes

Students earning an Associate degree from this program will be able to:

1. Apply fundamental electrical and magnetic theory and reduce to practice direct current (DC) circuits.
2. Discuss the foundations of digital logic.
3. Implement logic circuits using electronic and microprocessor hardware.
4. Write and debug software using high- and low-level structured programming techniques.
5. Utilize foundational algorithms and mathematical constructs.
6. Design and manage data network systems, including routers, switches, and data cable installations.

<b>First Semester</b>		<b>Credits</b>
+ CIT191	Computer Operations .....	3
+ EET121	DC Circuits .....	3
ENG111	Composition I.....	3
MET100	Intro to Engineering Technology .....	2
MTH109	College Algebra.....	3
ELECTIVE*	Humanities Elective .....	<u>3</u>
		17

<b>Second Semester</b>		<b>Credits</b>
+ EET122	AC Circuits .....	3
+ MTH132	Discrete Structures .....	3
+ EET107	Python Programming.....	3
ENG210	Technical Communications.....	3
MTH112	Trigonometry .....	<u>3</u>
		15

<b>Third Semester</b>		<b>Credits</b>
+ CIT165	Java Programming .....	4
+ EET231	Microprocessors .....	4
+ CIT195	Networking Essentials.....	3
PHY251	Physics: Mechanics & Heat.....	<u>4</u>
		15

<b>Fourth Semester</b>		<b>Credits</b>
+ EET221	Digital Circuits.....	4
PHY252	Physics: Electricity & Magnetism.....	4
ENG113	Speech .....	3
+ EET282	Networking II.....	3
ELECTIVE*	Social/Behavioral Science Elective ...	<u>3</u>
		17

**Total Program Hours                    64**

\* **See page 44-45 for Humanities and Social Behavioral Science Electives.**

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.



# Computer Technician Certificate

## STEM & Industrial Technology Division

The computer technician must have experience working on personal computers, experience working on networks and some programming experience. Technicians are acquainted with software packages such as word processors and spreadsheets. The computer technician must be knowledgeable in computer operations and computer systems.

### Career Outlook

Students can earn the associate degree by completing one year of full-time study beyond the Computer Technician Certificate. Graduates may find employment in entry-level positions such as computer technician, peripheral equipment operator, help desk technician or technical support.

### Program Learning Outcomes

Students earning a certificate from this program will be able to:

1. Demonstrate the ability to apply structured programming concepts.
2. Install and troubleshoot current Personal Computer hardware and current Operating System software.
3. Demonstrate software skills.
4. Write and debug programs.
5. Implement procedures designed to counteract current computer and network security risks.

<b>First Semester</b>		<b>Credits</b>
	EET107 Python Programming.....	3
+	CIT191 Computer Operations .....	3
	MET100 Intro to Engineering Technology .....	2
	ENG111 Composition I.....	3
+	ELECTIVE Technical Elective.....	<u>4</u>
		15

<b>Second Semester</b>		<b>Credits</b>
	CIS114 Microsoft Applications.....	3
+	CIT109 Database Programming .....	4
+	CIT194 IT Security Fundamentals .....	3
	ELECTIVE Mathematics Elective .....	3
+	ELECTIVE Technical Elective.....	<u>4</u>
		17

**Total Program Credit Hours      32**

### Mathematics Electives:

MTH105	Quantitative Reasoning
MTH109	College Algebra
STA120	Introduction to Statistics

### Technical Electives:

CIT155	Linux Networking I
CIT165	Java Programming
CIT193	Microsoft Server Technology
CIT195	Networking Essentials
CIT265	Java Programming II
CIT284	Microsoft Infrastructure Technology

- + Students must attain a 2.00 grade point average in these technical courses to graduate.

# CyberSecurity

## Short-Term Technical Certificate

### STEM & Industrial Technology Division

Cybersecurity is the next logical evolution for IT professionals. Specifically, the Ohio Attorney General launched the CyberOhio Initiative in 2016; two of the goals of CyberOhio are to provide cybersecurity training opportunities for Ohio businesses and to create collaborative opportunities for colleges to partner with businesses for internships.

<u>Course</u>	<u>Credits</u>
+ CIT191 Computer Operations .....	3
+ EET107 Python to Programming .....	3
+ CIT194 IT Security .....	3
+ CIT195 Networking Essentials.....	3
+ CYB210 Cyber Security Programming.....	3
+ CYB220 Security Auditing .....	3
+ CYB230 Network Security .....	3
	<b>21</b>

### Career Outlook

The career outlook for cyber security is very good. There is currently 0% unemployment in the field. According to current reports and statistics, there will be 6 million cyber security jobs by 2019. There will be a shortage of trained workforce and 1.5 million of those jobs will go unfilled. (Source: "One Million Cybersecurity Job Openings in 2016," Forbes.com)

**Total Program Hours                    21**

+ Refers to technical course work. Students must maintain a minimum grade of "C" in these courses to progress in the program and graduate.

Possible career titles are security operations center analyst, information security analyst, cyber security analyst, penetration tester, information assurance analyst, and cyber operations analyst.

### Program Learning Outcomes

1. Demonstrate the ability to work with various operating systems.
2. Analyze an organization's assets and develop an appropriate risk management framework.
3. Conduct security audits and provide appropriate reporting to stakeholders.
4. Demonstrate the ability to create and deploy software that improves an organization's security posture.
5. Select the appropriate cybersecurity controls for an organization to be compliant with governance and regulations.
6. Demonstrate the ability to design and secure small to medium sized networks.
7. Create appropriate security policies and procedures based upon business processes.

# CyberSecurity and Network Administration

## Associate of Applied Science

### STEM & Industrial Technology Division

The CyberSecurity and Network Administration major provides the skills and training necessary to install and maintain networks using Microsoft and Linux Operating Systems. Students will also receive training in security penetration testing as well as securing networks using intrusion prevention systems and firewalls. The program provides the student with training in a current programming language. Material in the major aligns with and helps to prepare students for industry standard certifications from organizations such as CompTIA and Microsoft.

### Career Outlook

Career opportunities are numerous for individuals in this field. All organizations, large and small, use computers as an integral part of how they do business. Graduates may find employment in entry-level positions such as Technical Support, Help Desk Technician, IT Consultant, Network Administrator or Security Specialist.

### Program Learning Outcomes

Students earning an Associate degree from this program will be able to:

1. Demonstrate the ability to apply structured programming concepts.
2. Install and troubleshoot current personal computer hardware and current operating system software.
3. Demonstrate software skills.
4. Install and troubleshoot network operating systems and protocols.
5. Implement procedures designed to counteract current computer and network security risks.

<b>First Semester</b>		<b>Credits</b>
EET107	Python Programming.....	3
+ CIT191	Computer Operations .....	3
+ CIT195	Networking Essentials.....	3
ENG111	Composition I.....	3
MET100	Intro to Engineering Technology .....	<u>2</u>
		14

<b>Second Semester</b>		<b>Credits</b>
CIS114	Microsoft Applications.....	3
+ CIT155	Linux Networking I.....	4
+ CIT194	IT Security Fundamentals .....	3
PHI210	Ethics.....	3
ELECTIVE	Mathematics Elective .....	<u>3</u>
		16

<b>Third Semester</b>		<b>Credits</b>
ACC111	Financial Accounting.....	3
+ CIT193	Microsoft Server Technology.....	3
+ CYB210	CyberSecurity Programming.....	3
+ CYB230	Network Security .....	3
ENG210	Technical Communications.....	<u>3</u>
		15

<b>Fourth Semester</b>		<b>Credits</b>
+ CIT109	Database Programming .....	4
+ CIT284	Microsoft Infrastructure Technology..	3
+ CYB220	Security Auditing .....	3
ELECTIVE*	Natural Science Elective .....	3
ELECTIVE*	Social Science Elective .....	<u>3</u>
		16

**Total Program Credit Hours      61**

### Mathematics Electives:

MTH105	Quantitative Reasoning
MTH109	College Algebra
STA120	Introduction to Statistics

\* See page 39 for a list of Social/Behavioral Science Electives.

+ Students must attain a 2.00 grade point average in these technical courses to graduate.

# Electro-Mechanical Engineering Technology

## Associate of Applied Science

### STEM & Industrial Technology Division

Graduates of this program will have the foundational coursework leading into four year mechanical and/or and electrical engineering technology programs at various universities, including a direct transfer into the Miami University degree completion program, as well as being qualified for entry level engineering technicians in product design, engineering support, and other technical support positions. This program, as well, is aligned to provide an option for college credit plus students who may be interested in an engineering technology field.

### Career Outlook

The demand for technicians and engineering technologists remains high, with two of the main areas of interest in mechanical and electrical. While positions have historically been described as either mechanical or electrical, today many companies are looking for mechanical engineering technologists with some electrical background or electrical with some mechanical aptitude. Companies are looking for individuals with both mechanical and electrical skills. This has also been recognized by universities, who now offer Bachelor of Science degrees in electro-mechanical engineering technology. Graduates from this program will have the foundational coursework leading into four year mechanical and/or electrical engineering technology programs at various universities, including a direct transfer into the Miami University degree completion program. Graduates will also be qualified for entry level engineering technicians in product design, engineering support, and other technical support positions.

### Program Learning Outcomes

Students earning an Associate degree from this program will be able to:

1. Understand fundamental electrical and magnetic theory and reduce to practice direct current (DC) and alternating current (AC) circuits.
2. Interpret electrical diagrams and schematics to predict behavior and to assess functionality using handheld and bench-top measurement instruments.
3. Implement computer-based instrumentation, and control of digital and analog electronics.
4. Interpolate and complete engineered drawings using orthographic projection, isometric views, and proper dimensioning practices, then employ the use of Computer-Aided-Design (CAD) software.
5. Describe the different manufacturing processes and demonstrate proper use of precision measuring devices and instruments.
6. Analyze and calculate the resolution of forces on rigid bodies; determine the stress, strain, and deflection.

<b>First Semester</b>		<b>Credits</b>
ENG111	Composition I .....	3
MTH109	College Algebra .....	3
MET100	Intro to Engineering Technology.....	2
+ MET107	Engineering Graphics .....	3
+ EET121	DC Circuits .....	<u>3</u>
		14

<b>Second Semester</b>		<b>Credits</b>
ENG210	Technical Communications .....	3
MTH112	Trigonometry.....	3
PHY251	Physics-Mechanics and Heat.....	4
+ MET121	Manufacturing Processes .....	3
+ EET122	AC Circuits.....	<u>3</u>
		16

<b>Third Semester</b>		<b>Credit</b>
+ MET235	Statics .....	3
+ MET234	Strengths of Materials .....	3
+ EET231	Microprocessors.....	4
ENG113	Speech.....	3
ELECTIVE*	Social/Behavioral Science Elective....	<u>3</u>
		16

<b>Fourth Semester</b>		<b>Credits</b>
+ EET221	Digital Electronics .....	4
+ CAD213	CAD III .....	4
+ CET115	Project Management .....	3
+ (or) QCT100	Quality Concepts	
ELECTIVE*	Natural Science Elective.....	3
ELECTIVE*	Humanities Elective.....	<u>3</u>
		17

**Total Program Hours** **63**

\* **See page 39 for a list of Humanities and Social/Behavioral Science and Natural Science Electives.**

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Electrical Engineering Technology

## Associate of Applied Science

### STEM & Industrial Technology Division

Electrical Engineering Technology (EET) is a comprehensive electrical technologies program that prepares graduates for employment as skilled technicians, or for pursuit of a Bachelor of Science degree in Engineering Technology. The EET program provides a foundation of electrical and electronics theory and practice applicable to a variety of subject areas including, but not limited to, Alternative energy systems, automation and control and electric drive technology. A focus on laboratory experience gives students the technical hand skill and problem solving insight to employ solutions in the field. The curriculum includes algebra-based courses with emphasis on applied science and engineering.

Students in the EET program have opportunity to participate in applied research and testing activities to supplement coursework.

### Career Outlook

Demand is growing for technicians in the electrical-related fields in northwest Ohio and across the country who possess diverse technical skills and problem solving acumen. The career outlook for graduates of the EET program is promising, with special opportunities in Alternative Energy and Electric Vehicle manufacturing and product improvement.

### Program Learning Outcomes

Students earning an Associate degree from this program will be able to:

1. Understand fundamental electrical and magnetic theory and reduce to practice direct current (DC) and alternating current (AC) circuits.
2. Interpret electrical diagrams and schematics to predict behavior and to assess functionality using handheld and benchtop measurement instruments.
3. Analyze electrical circuits using Ohm's Law and theorems for specifying conductors and components, and for calculating power and energy.
4. Fabricate electrical circuits, modules, and systems using industry-accepted practices.

<b>First Semester</b>		<b>Credits</b>
	CAD112	CAD II..... 4
+	EET121	DC Circuits ..... 3
	ENG111	Composition I..... 3
	MET100	Intro to Engineering Technology ..... 2
	MTH109	College Algebra..... 3
		15

<b>Second Semester</b>		<b>Credits</b>
+	EET122	AC Circuits ..... 3
+	EET221	Digital Electronics..... 4
+	EET107	Python Programming..... 3
	MTH112	Trigonometry ..... 3
	ENG113	Speech ..... 3
		16

<b>Third Semester</b>		<b>Credits</b>
+	EET231	Microprocessors ..... 4
+	CIT195	Networking Essentials..... 3
+	EET277	Electronics ..... 3
	PHY251	Physics: Mechanics & Heat..... 4
	ELECTIVE*	Social/Behavioral Science Elective 3
		17

<b>Fourth Semester</b>		<b>Credits</b>
	ENG210	Technical Communications..... 3
+	PHY252	Physics: Electricity & Magnetism ..... 4
+	PLC200	Programmable Controller I..... 3
+	EET282	Networking II
	(or) PLC230	Servo/Robotics Systems
	(or) CET115	Project Management I..... 3
	ELECTIVE*	Social/Behavioral Science Elective ... 3
		16

**Total Program Hours 64**

\* See page 39 for a list of Humanities and Social/Behavioral Science Elective

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# HVAC-R (Climate Control) Certificate

## STEM & Industrial Technology Division

Heating, Ventilating, Air Conditioning, and Refrigeration, as a technical discipline, has made its transition to the “high-tech” field. Modern environmental control equipment use advanced controls involving pneumatic, electro-mechanical and direct digital control technologies. Today, common HVAC-R applications include the use of computers and computer network interfaces to facilitate building/space climate control and monitoring. Presently, manpower shortages exist for qualified personnel (see <http://www.mepatwork.com> for additional information). Men and women wanting to enter this field must understand these advanced technologies, their controls and communications networks if they are to be successful in this changing field.

### Career Outlook

A wide variety of employment possibilities exist for those individuals who have training in the Climate Control field. HVAC-R Installers and Service Technicians are always needed to support companies involved in product sales and service. These skilled tradespersons work in residential, commercial and industrial settings keeping related equipment operational throughout the climate seasons. refrigeration journeymen work in commercial and industrial settings providing support for the food industry. Air balance specialists work with environmental engineers to test and adjust newly installed and existing HVAC-R systems. Systems integrators unify various sub-systems involving the HVAC-R and fire control-life safety technologies under one common control.

### Program Learning Outcomes

Students earning a certificate from this program should demonstrate:

1. Comprehend relevant electrical symbols and abbreviations within projects.
2. Apply basic knowledge of operating systems, networking, and computer hardware in projects.
3. Illustrate proficiency in design concepts, orthographic projection, dimensioning practices, and blueprint reading through hands on projects and assignments.
4. Apply physics of fluids, components, troubleshooting and design applications for hydraulic and pneumatic systems.

<b>First Semester / 1st 8 weeks</b>		<b>Credits</b>
+	IND120 Industrial Electricity I.....	3
	IND105 Industrial Safety.....	2
+	AET110 Energy Audit.....	<u>3</u>
		8

<b>First Semester / 2nd 8 weeks</b>		<b>Credits</b>
+	INT120 HVACR I.....	3
+	INT220 Electrical Prints and Troubleshooting ..	3
+	IND131 Industrial Pipefitting.....	<u>3</u>
		9

<b>Second Semester / 1st 8 weeks</b>		<b>Credits</b>
+	IND223 Motors & Motor Controls .....	3
+	IND121 Industrial Electricity II.....	3
	ELECTIVE* Communications Elective.....	<u>3</u>
		9

<b>Second Semester / 2nd 8 weeks</b>		<b>Credits</b>
+	INT220 HVACR II.....	3
+	INT221 HVACR III.....	<u>3</u>
		6

**Total Program Hours                    32**

\* **See page 51 for a list of Communications Electives.**

Must be proficient in MTH080.

+ Refers to technical coursework. Students must attain a minimum grade of “C” in these technical courses to progress in the program and to graduate.

# Industrial Automation Maintenance (Short-Term Technical Certificate)

## STEM & Industrial Technology Division

The Industrial Automation Maintenance program focuses on the maintenance of electrical, mechanical and fluid power equipment. Students of this program will develop their skills in maintenance and troubleshooting of electrical, pneumatic, mechanical, programmable logic controllers, variable frequency drives and more.

### Career Outlook

Many manufacturing companies across the country no longer employ segregated trades (electrician, millwright, machinist, etc.) Instead, they are moving to a multi-craft classification that will perform electrical, mechanics, machining, welding, etc. Therefore, positions for general maintenance and industrial maintenance are currently in great demand.

### Program Learning Outcomes

1. Install, maintain and troubleshoot industrial electrical systems.
2. Analyze technical data.
3. Install, maintain and troubleshoot electric motors and transformers.
4. Fabricate and weld structural components.
5. Install, maintain and troubleshoot a fluid power system.
6. Install and maintain industrial plumbing and piping components & systems.
7. Install, maintain and troubleshoot Programmable Logic Controller systems.
8. Troubleshoot servo and robotic systems.
9. Troubleshoot mechanical system components.

<b>First Semester</b>		<b>Credits</b>
+ IND 120	Industrial Electricity I.....	3
+ IND 121	Industrial Electricity II.....	3
+ WLD 110	Introduction to Applied Welding Tech.....	3
+ IND 132	Benchwork.....	2
+ IND 131	Industrial Pipefitting.....	<u>3</u>
		14

<b>Second Semester</b>		<b>Credits</b>
+ IND 223	Motors & Controls.....	3
+ IND 134	Industrial Fluid Power.....	3
+ PLC 200	Programmable Controller I.....	3
+ PLC 230	Servo and Robots.....	3
+ IND 232	Machine Repair.....	<u>3</u>
		15

**Total Program Hours** **29**

+ Refers to technical course work. Students must maintain a minimum grade of "C" in these courses to progress in the program and graduate.

# Industrial Electrical Certificate

## STEM & Industrial Technologies Division

This program will focus on learning experiences that will prepare students with the technical skills to work in the industrial electrical field in positions such as Industrial Electrician, Electrical Technician, Industrial Controls Technician or Maintenance Technician. All of these courses apply toward the comparable associate degree. Students in the program will be trained not only in traditional Electrician skills, but also how to operate and troubleshoot state-of-the-art programmable controller systems, solid state motor drives, instrument systems and industrial computer systems used by maintenance personnel in manufacturing and process plants.

Students will receive hands-on training on AC/DC motors, transformers, test equipment, basic hydraulic systems, and industrial wiring practices according to the National Electrical Code. Most of the technical classes will have 50 percent of the learning experience in the classroom, and the other 50 percent in the laboratory with hands-on training. This program focuses on basic fundamentals so that graduates can also adapt to the continuous changes in technology.

### Career Outlook

As manufacturers invest in new technology-driven equipment, the need for skilled technicians will remain in high demand.

### Program Learning Outcomes

Students earning a certificate from this program should demonstrate:

1. Illustrate knowledge of electrical symbols and abbreviations by applying toward assignments.
2. Illustrate proficiency in basic electrical theory, motor starters, solenoid valves, various control devices, motor circuits, and variable frequency drivers by applying knowledge and skills in individual and group projects.
3. Proficiency in the systematic elimination of the various parts of a system to locate a malfunctioning part safely but properly.
4. Comprehend PLC control systems, analog instrumentation, and Servo Robotics systems through knowledge and hands on based assessments.
5. Apply the physics of fluids, components, troubleshooting and design applications for hydraulic and pneumatic systems using instrumentation and controls systems through individual and group assignments.

<b>First Semester</b>		<b>Credits</b>
+	IND120 Industrial Electricity I.....	3
	IND110* Industrial Computing I.....	3
	IND105 Industrial Safety.....	<u>2</u>
		8

<b>Second Semester</b>		<b>Credits</b>
+	IND121 Industrial Electricity II.....	3
+	IND134 Industrial Fluid Power .....	3
+	IND122 Industrial Wiring (NEC) .....	<u>3</u>
		9

<b>Third Semester</b>		<b>Credits</b>
+	IND220 Electrical Prints & Troubleshooting ...	3
+	IND223 Motors and Motor Controls.....	3
+	PLC200 Programmable Controller I.....	<u>3</u>
		9

<b>Fourth Semester</b>		<b>Credits</b>
+	IND221 Instrumentation & Controls I.....	3
+	PLC230 Servo/Robotics Systems.....	3
	ELECTIVE* Communications Elective.....	<u>3</u>
		9

**Total Program Hours** **35**

\* **See page 51 for a list of Communications Electives.**

\* Prior to taking IND110, students should have basic computer literacy in Windows and at least one Windows application.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.



# Industrial Maintenance Certificate

## STEM & Industrial Technologies Division

The Industrial Maintenance Technician not only troubleshoots and repairs advanced industrial equipment, but is responsible for the layout and installation. This individual will be versed in electrical, hydraulics, pneumatics, pipefitting, welding, machine repair and installation as well as motor control systems and PLC control systems.

Coursework (100 level or higher) completed in this certificate directly applies toward the associate degree in maintenance technician/mechatronics.

### Career Outlook

Many manufacturing companies across the country no longer employ segregated trades (electrician, millwright, machinist, etc.) Instead, they are moving to a multi-craft classification that will perform electrical, mechanics, machining, welding, etc. Therefore, positions for general maintenance and industrial maintenance are currently in great demand.

### Program Learning Outcomes

Students earning a certificate from this program should demonstrate:

1. Distinguish electrical symbols and abbreviations and apply uses in assignments.
2. Illustrate proficiency in basic electrical theory, motor starters, solenoid valves, various control devices, motor circuits, and variable frequency drivers through practical lab exercises.
3. Illustrate proficiency in the systematic elimination of the various parts of a system to locate a malfunctioning part safely but promptly, through lab exercises.
4. Apply basic knowledge of PLC control systems through lectures, readings, exercises.
5. Apply mechanical knowledge of hydraulic and pneumatic systems through individual or group projects and assignments.

<b>First Semester</b>		<b>Credits</b>
+ IND120	Industrial Electricity I .....	3
	IND105 Industrial Safety.....	2
+ IND121	Industrial Electricity II.....	3
IND132	Benchwork .....	<u>2</u>
		10

<b>Second Semester</b>		<b>Credits</b>
	IND103 Applied Geometry & Trigonometry ..	3
+ IND232	Machine Repair.....	3
+ PLC200	Programmable Controller I.....	3
+ IND134	Fluid Power I .....	3
		12

<b>Third Semester</b>		<b>Credits</b>
+ WLD110	Introduction to Applied .....	<u>3</u>
	Welding Techniques	
+ IND130	Rigging & Erecting.....	<u>2</u>
+ IND131	Industrial Pipefitting.....	<u>3</u>
+ IND234	Fluid Power II .....	3
		11

<b>Fourth Semester</b>		<b>Credits</b>
+ IND223	Motors & Motor Controls .....	3
		3

**Total Program Hours 36**

\* **See page 51 for a list of Communications Electives.**

\* Prior to taking IND110, students should have basic computer literacy in Windows and at least one Windows application.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Industrial Technologies

## Associate of Applied Science in Industrial Technology

### STEM & Industrial Technologies Division

This degree will focus on learning experiences that will prepare students with the technical skills to work within diverse technological fields within manufacturing and industrial environments.

Students will be able to obtain a generalist degree as well as have the opportunity to specialize in areas such as Industrial Electrical, Machining/CNC Programming, and Maintenance/Mechatronics. Courses consist of theory and practical, hands on applications. Students work collaboratively with each other and with the instructor to achieve competencies of each discipline, observing and practicing safety at all times. The technical classes will have 50 percent of the learning experiences in the classroom, and the remaining 50 percent in the laboratory environment applying hands-on learning. The courses comprising the generalist and specialist degree areas incorporate fundamentals critical in allowing students to adapt to the continuous changes in technology.

### Career Outlook

As manufacturers invest in new, technology-driven equipment, the demand for skilled graduates in diverse technical areas will remain in high demand.

### Program Learning Outcomes

Students earning an Associate degree from this program should:

1. Identify common industrial symbols and abbreviations and demonstrate their use (Industrial Electrical, PLC, HVACR)
2. Interpret and develop basic prints including dimensioning, calculations, and sketching, orthographic, isometric, sectional and auxiliary views (Machining, PLC)
3. Apply principles of electrical controls and fluid power applications to industrial situations (Maintenance Tech/ Mechatronics)
4. Basic knowledge of PLC control systems (Industrial Maintenance)
5. Knowledge of basic machining principles using lathes, mills, drills, band saw, and various hand tools (Millwright)
6. Basic knowledge of operating systems, networking, and computer hardware (PLC)
7. Knowledge of physics of fluids, components, troubleshooting and design applications for hydraulic and pneumatic systems (HVACR, Millwright, Industrial Maintenance, Machining CNC, Industrial Electrical)

<b>First Semester</b>		<b>Credits</b>
ENG111	Composition I.....	3
IND105	Industrial Safety.....	2
IND110 <sup>^</sup>	Industrial Computing I.....	3
	Or	
CIS114	Microsoft Applications.....	3
MTH109	College Algebra.....	3
+ELECTIVE	Technical Elective**.....	<u>3</u>
		14

<b>Second Semester</b>		<b>Credits</b>
ENG112	Composition II.....	3
IND103	Applied Geometry & Trig.....	3
+ELECTIVE	Technical Electives**.....	<u>9</u>
		15

<b>Third Semester</b>		<b>Credits</b>
ELECTIVE*	Humanities Elective.....	3
ELECTIVE*	Natural Science Elective.....	3
+ELECTIVE	Technical Electives**.....	<u>9</u>
		15

<b>Fourth Semester</b>		<b>Credits</b>
ELECTIVE*	Natural Science Elective (Including a Lab).....	4
ELECTIVE*	Social/Behavioral Science Elective....	3
+ELECTIVE	Technical Electives**.....	<u>10</u>
		17

**Total Program Hours** **61**

\* See page 45 for a list of Humanities and Social/Behavioral Science Electives.

\*\* See pages 50-51 for a list of Communications and Natural Science.

<sup>^</sup> Prior to taking IND110, students should have basic computer literacy in Windows and at least one Windows application.

\*\* See next page for listing of Technical Electives.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Industrial Technologies

## Associate of Applied Science in Industrial Technology

### STEM & Industrial Technologies Division

#### Technical Electives

CourseID	Title	Credit Hours
AET110	Energy Audit.....	3
IND100	Precision Measurement.....	3
IND120	Industrial Electricity I.....	3
IND121	Industrial Electricity II.....	3
IND122	Industrial Wiring (NEC) .....	3
IND130	Rigging and Erecting.....	3
IND131	Industrial Pipefitting.....	3
IND132	Bench Work.....	2
IND134	Industrial Fluid Power I.....	3
IND140	Principles of Machining.....	3
IND141	Metallurgy & Heat Treatment.....	2
IND220	Electrical Prints & Troubleshooting.....	3
IND221	Instrumentation & Controls I.....	3
IND223	Motors & Motor Controls .....	3
IND232	Machine Repair .....	3
IND234	Industrial Fluid Power II.....	3
IND240	Machining Processes II.....	3
IND241	Tooling & Fixtures Lubricants & Coolants .	3
INT120	HVACR I.....	3
INT220	HVACR II .....	3
INT221	HVAC III Heating Systems .....	3
MET107	Engineering Graphics & Sketching.....	3
MET222	Program Computer Numerical Control .....	3
MET223	CAM I.....	4
PLC200	Programmable Controller I.....	3
PLC210	Programmable Controller II (AB).....	3
PLC220	PLC III.....	3
PLC230	Servo/Robotic Systems.....	3
QCT100	Quality Concepts .....	3
WLD100	Blue Print & Weld Symbols .....	2
WLD110	Intro to Applied Welding Techniques.....	3
WLD120	Gas Metal Arc Welding.....	3
WLD130	Flat and Horizontal Shield Metal Arc.....	3
WLD140	Gas Tungsten Arc Welding .....	3
WLD150	Advanced Gas Metal Arc Welding .....	3
WLD210	Vertical & Overhead SMAW.....	3
WLD220	Advanced Gas Tungsten Arc Welding .....	3
WLD250	Pipe Welding .....	3
WLD260	Pre-Pipe Certification .....	3

# IT Specialist (Short-Term Technical Certificate)

## STEM & Industrial Technologies Division

The IT Specialist short-term certificate program develops skills in database management and reporting as well as foundations of computer programming. Students will work with industry-recognized databases (such as Oracle) and related tools for pulling data (SQL). Students will also develop skills with object-oriented programming languages that will enable them to create both windows- and web-based solutions for end-users.

### Career Outlook

Increased financial regulations, privacy rules and security guidelines are causing more companies to handle data analysis and processing within national markets. But with the high cost of information technology service in larger urban areas, provider companies are being drawn to less populated locales, prompting the demand for highly-trained employees living in these areas. The market is eager for a local option in the IT outsourcing sector for data report writing, electronic forms development and applications development.

### Program Learning Outcomes

1. Use the applications found in the Microsoft Office suite and apply them in a business setting.
2. Develop data analysis and project management skills and be able to apply them in a business setting.
3. Utilize structured programming concepts to develop applications using programming languages such as VBA, VB, and C#, to meet end user requirements.
4. Identify basic networking infrastructure components and list items that comprise a secure network.
5. Set up a basic webpage with HTML/CSS technology.
6. Utilize a Relational Database Management System and be able to query data from various databases (Access, Oracle, SQL).
7. Present database data in a user friendly format using reporting and dashboarding tools.
8. Develop communication skills for both technician-to-technician as well as technician-to-end user interactions.

### Admission Requirements for the Program:

- Basic computer application literacy. Be able to pass 4-part diagnostic exam on Concepts of Information and Communication Technology, Using the Computer and Managing Files, Databases/Access and Spreadsheets/Excel.
- ACCUPLACER testing. Complete any developmental courses needed.
- Course placement Algebra score at the MTH080 level or successful completion of MTH080.
- GPA 2.0 or higher.

<b>First Semester</b>		<b>Credits</b>
+ DBP110	ICDL Computer Technologies.....	1
+ DBP150	Database Basics.....	3
+ DBP205	Discrete Structures Applications.....	3
+ DBP210	Computer Programming I.....	3
	.....	10

<b>Second Semester</b>		<b>Credits</b>
+ CIT195	Networking Essentials.....	3
+ DBP130	IT Customer Service and Communication .....	3
+ DBP220	Database Reporting.....	3
+ DBP225	Computer Programming II .....	3
		12

**Total Program Hours                    21**

+ Refers to technical course work. Students must maintain a minimum grade of "C" in these courses to progress in the program and graduate.

# Machining Certificate

## STEM & Industrial Technologies Division

This program is designed to prepare the student for a career path as a skilled tradesman. Designed to meet the needs of a diverse vocational audience, the machining certificate is for students interested in career fields such as computer numerical control programming (CNC), or tool and die maker pattern maker.

### Career Outlook

The U.S. Department of Labor projects employment of machinists and tool and die makers to grow by 6 percent in the next decade. Employees with computer software application skills and the ability to perform multiple tasks have a greater chance for advancement.

### Program Learning Outcomes

Students earning a certificate from this program should demonstrate:

1. Demonstrate knowledge of basic print reading skills including dimensioning practices and calculations, sketching, including orthographic, isometric, sectional, and auxiliary views through individual and group projects, and written assessments.
2. Apply basic machining principles using lathes, mills, drills, band saw, and various hand tools through lectures, study, and assessments.
3. Illustrate proficiency in machining and fabricating projects with an emphasis on safety, fixturing, feeds and speeds, tooling, precision, and accuracy through assignments and projects.
4. Illustrate proficiency in welding with an emphasis on shielded metal arc (stick), oxy-acetylene, gas metal (MIG) and gas tungsten (TIG), through assignments and projects.

<b>First Semester</b>		<b>Credits</b>
+	IND107	Print Reading & Sketching..... 3
	IND110 <sup>^</sup>	Industrial Computing..... 3
	IND105	Industrial Safety..... 2
+	IND132	Benchwork ..... <u>2</u>
		10

<b>Second Semester</b>		<b>Credits</b>
	IND103	Applied Geometry & Trigonometry ..... 3
+	WLD110	Intro to Applied Welding Techniques... 3
+	IND140	Principles of Machining ..... <u>3</u>
		9

<b>Third Semester</b>		<b>Credits</b>
+	IND100	Precision Measurement..... 3
+	IND240	Machining Processes II..... 3
	ELECTIVE*	Communications Elective..... <u>3</u>
		9

<b>Fourth Semester</b>		<b>Credits</b>
+	IND241	Tooling & Fixtures ..... 3
+	IND141	Metallurgy & Heat Treatment ..... 2
+	MET222	Programming Computer Numerical Control..... <u>3</u>
		8

**Total Program Hours 36**

\* See page 51 for a list of Communications Electives.

<sup>^</sup> Prior to taking IND110, students should have basic computer literacy in Windows and at least one Windows application.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Maintenance Technician/Mechatronics

## Associate of Applied Science in Industrial Technology

### STEM & Industrial Technologies Division

This program prepares students for positions responsible for layout and installation of advanced industrial equipment. Graduates will also be able to troubleshoot and repair equipment to ensure the manufacturing lines keep running. Skills learned include electrical, hydraulics, pneumatics, pipefitting, welding, machine repair and installation as well as motor control systems, PLC control systems and instrumentation control networking.

### Career Outlook

Employers trying to stay competitive with an international marketplace are hard pressed to find a multi-crafted maintenance employee who can accomplish a multitude of vocational qualities (electrician, plumber, pipefitter, hydraulics and pneumatics specialists, HVACR, machine set-up, machine installer, welder, systems troubleshooter and control systems programming). This program will provide those employers with such a skilled professional.

### Program Learning Outcomes

Students earning an Associate degree from this program should:

1. Demonstrate a knowledge of fluid power and electrical symbols per ISO and JIC standards.
2. Read and interpret fluid power schematics.
3. Analyze electrical and PLC controls within fluid power circuits and systems.
4. Specify components, hoses, pipes and tubing, in the design, construction, and sizing of fluid power systems.
5. Apply principles of electrical controls and fluid power applications to industrial situations.

<b>First Semester</b>		<b>Credits</b>
+ IND120	Industrial Electricity II.....	3
+ IND132	Benchwork.....	2
+ IND121	Industrial Electricity II.....	3
+ IND105	Industrial Safety.....	<u>2</u>
		10

<b>Second Semester</b>		<b>Credits</b>
+ WLD110	Intro to Applied Welding Techniques	3
+ IND107	Blue Print Reading and Sketching.....	3
+ IND134	Fluid Power I.....	3
+ IND131	Industrial Pipefitting.....	3
ELECTIVE*	Humanities Electives.....	<u>3</u>
		15

<b>Third Semester</b>		<b>Credits</b>
+ PLC200	Programmable Controller I.....	3
+ MTH109	College Algebra (16 weeks).....	3
	ENG111 Composition I.....	3
+ IND223	Motors & Motor Control.....	<u>3</u>
		12

<b>Fourth Semester</b>		<b>Credits</b>
ELECTIVE*	Natural Science Elective..... (Including a lab)	4
+ IND234	Industrial Fluid Power II.....	3
+ IND103	Applied Geometry and Trig.....	3
+ IND221	Instrumentation & Controls 1.....	<u>3</u>
		13

<b>Fifth Semester</b>		<b>Credits</b>
+ IND130	Rigging & Erecting.....	3
ELECTIVE*	Social/Behavioral Science Elective.....	3
+ IND232	Machine Repair.....	3
+ PLC230	Servo/Robotic Systems.....	3
		16

**Total Program Hours 62**

\* See page 45 for a list of Humanities and Social/Behavioral Science Electives.

\* See pages 50-51 for a list of Communications and Natural Science Electives.

\* Prior to taking IND110, students should have basic computer literacy in Windows and at least one Windows application.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Manufacturing Foundations Short-Term Technical Certificate

## STEM & Industrial Technology Division

There is a critical need for more students to go into manufacturing and Engineering professions. Because of that need OhioTechNet and Ohio Higher ED worked with the Ohio Engineering Technology Educators, and the Ohio Manufacturers Association to develop the Manufacturing Foundations Certificate.

This program was designed by the ODHE and OhioTechNet and endorsed by the Ohio Engineering Technology Educators Association and the Ohio Manufactures Association.

### Career Outlook

The Occupations that these students can go into are: Manufacturing, Engineering, Design, Drafting, Maintenance, Machining, Associate's Degrees in Engineering and Manufacturing, along with Bachelor's Degrees in Engineering and Manufacturing. The program was designed to be stackable. Students can get the certificate and go straight to work or they can continue on with an Associate's Degree and then get a Bachelor's Degree if they choose.

### Program Learning Outcomes

1. Use a commercially available CAD system to create meaningful engineering drawings including: dimensions and tolerances, multiple views and projections; assemblies and bill of materials; and 3D models.
2. Apply fundamental knowledge of engineering materials and why they are utilized in a particular application. Students will demonstrate an understanding of material composition; processes for manufacturing of steels and alloying; cold and hot working processes; and material hardness, modulus of elasticity, tensile strength, yield strength, and shear strength.
3. Apply their knowledge of materials to manufacturing processes and demonstrate an understanding of: processes such as material removing, forging, casting, forming, finishing; fabrication processes such as welding, adhesives, and fasteners; production efficiencies (e.g., speed and feeds); and safety procedures and methods.
4. Work as a member of a team to communicate effectively, solve problems, and improve productivity.

<b>First Semester</b>		<b>Credits</b>
	ENG111	Composition I..... 3
	MTH109	College Algebra..... 3
+	MET121	Manufacturing Processes..... <u>3</u>
		9

<b>Second Semester</b>		<b>Credits</b>
+	MET134	Engineering Materials ..... 3
+	CAD213	CAD III ..... 4
+	MET290	Engineering Technology Co-op/Internship or..... 3
		Work Experience ..... <u>1-3</u>
		8-10

**Total Program Hours**                      **17-19**

+ Refers to technical course work. Students must maintain a minimum grade of "C" in these courses to progress in the program and graduate.

# Mechanical Engineering Technology

## Associate of Applied Science

### STEM & Industrial Technology Division

The machinery of modern industry consists of mechanical devices, levers that move, wheels that spin and cogs that must mesh. The mechanical engineering technology degree is designed to educate students in technology based, entry-level occupations related to the mechanical and manufacturing engineering fields. Graduates will be able to assist engineers and other professional staff engaged in plant and facilities maintenance and other plant engineering and management functions.

All aspects of industry are dependent on the production and reading of drawings to convey information.

The mechanical engineering technology degree provides students the opportunity to study engineering topics associated with the design and installation of mechanical equipment and systems with the option of transferring to another institution to pursue a four-year bachelor degree in Mechanical Engineering Technology.

The student who follows this course of study will be trained to function as a Mechanical Technician in a number of industrial situations which require knowledge of mechanical systems, engineering materials and equipment. The student may find himself/herself working closely with engineers engaged in designing, testing, servicing or assembly and installation of machinery and industrial equipment.

### Career Outlook

Many diverse occupations find their origins in the mechanical field. These occupations include a variety of titles in the areas of drafting, production, testing, design and analysis, to name a few. Employment in the mechanical field should be quite good with job opportunities growing as fast as average nationally and in the state of Ohio.

The largest need for mechanical engineering technicians will be in manufacturing, with companies continually wanting new or improved machinery.

### Program Learning Outcomes

Students earning an Associate degree from this program will:

1. Interpolate and complete engineered drawings using orthographic projection, isometric views, and proper dimensioning practices, then employ the use of Computer-Aided-Design (CAD) software.
2. Describe the different manufacturing processes and demonstrate proper use of precision measuring devices and instruments.
3. Examine the physical and chemical properties of engineering materials, analyze and calculate the properties of fluids.
4. Analyze and calculate the resolution of forces on rigid bodies; determine the stress, strain, and deflection, then design machines and mechanisms.

<b>First Semester</b>		<b>Credits</b>
	ENG111	Composition I..... 3
	MET100	Intro to Engineering Technologies 2
+	MET107	Engineering Graphics..... 3
+	MET121	Manufacturing Processes..... 3
	MTH109	College Algebra..... <u>3</u>
		14

<b>Second Semester</b>		<b>Credits</b>
+	CAD213	CAD III ..... 4
	ENG210	Technical Communications..... 3
+	MET134	Engineering Materials ..... 3
	MTH112	Trigonometry ..... 3
	PHY251	Physics: Mechanics and Heat..... <u>4</u>
		17

<b>Third Semester</b>		<b>Credits</b>
+	QCT100	Quality Concepts ..... 3
+	MET234	Strength of Materials ..... 3
+	MET235	Statics..... 3
	ENG113	Speech ..... 3
	ELECTIVE*	Natural Science Elective ..... <u>4</u>
		16

<b>Fourth Semester</b>		<b>Credits</b>
+	MET255	Fluid Mechanics..... 3
+	MET265	Machine Design..... 3
+	CAD112	CAD II or
+	EET121	DC Circuits or
+	CET115	Project Management..... 3
	ELECTIVE*	Social/Behavioral Science Elective .... 3
	ELECTIVE*	Humanities Elective ..... <u>3</u>
		15

**Total Program Hours 62**

\* See page 45 for a list of Humanities and Social/Behavioral Science Electives.

\* See page 50 for a list of Natural Science Electives.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.



# Millwright Certificate

## STEM & Industrial Technologies Division

The millwright is trained to install, dismantle or move machinery and heavy equipment according to engineered plans, blueprints or other drawings. The skill level of the millwright ranges from rigger, welder and machine repairman to fabricator, pipefitter and machine reconitioner.

### Career Outlook

Openings for millwrights will be found in areas where manufacturing is high. Related vocations are also a possibility with pipefitters and riggers, machine repairmen, structural iron and steel workers being in high demand.

### Program Learning Outcomes

Students earning a certificate from this program should demonstrate:

1. Illustrate knowledge of basic print reading skills including dimensioning practices and calculations, sketching including orthographic, isometric, sectional and auxiliary views through drawing projects and other practical and knowledge based assessment methods.
2. Demonstrate knowledge of basic machining principles using lathes, mills, drills, band saw, and various hand tools through practical exercises and knowledge assessment methods.
3. Demonstrate proficiency in machining and fabricating projects with an emphasis on safety, fixturing, feeds and speeds, tooling, precision, and accuracy through individual and group hands on projects.
4. Demonstrate proficiency in welding with an emphasis on shielded metal arc (stick), oxy-acetylene, gas metal (MIG) and gas tungsten (TIG) through hands on projects and assignments.
5. Illustrate knowledge of the physics of fluids, components, troubleshooting and design by applying principles in hands on projects and assignments.
6. Identify appropriate rigging tools necessary for various needs.
7. Employ mobile crane safety, inspection, hand signals and proper crane usage methods.

<u>First Semester / 1st 8 weeks</u>		<u>Credits</u>
+	IND132 Benchwork .....	2
+	IND107 Print reading & Sketching .....	<u>3</u>
		5

<u>First Semester / 2nd 8 weeks</u>		<u>Credits</u>
	ENG111 Composition I .....	3
+	IND140 Principles of Machining .....	<u>3</u>
		6

<u>Second Semester / 1st 8 weeks</u>		<u>Credits</u>
+	WLD110 Intro to Applied Welding Techniques...	3
+	IND100 Precision Measurement .....	<u>3</u>
		6

<u>Second Semester / 2nd 8 weeks</u>		<u>Credits</u>
+	IND232 Machine Repair .....	3
+	IND134 Industrial Fluid Power I .....	<u>3</u>
		6

<u>Third Semester / 1st 8 weeks</u>		<u>Credits</u>
	IND105 Industrial Safety .....	2
+	IND130 Rigging & Erecting .....	<u>3</u>
		5

<u>Third Semester / 2nd 8 weeks</u>		<u>Credits</u>
+	IND234 Industrial Fluid Power II .....	3
+	IND131 Industrial Pipefitting .....	<u>3</u>
		6

**Total Program Hours** **34**

\* **See page 51 for a list of Communications Electives.**

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Associate of Applied Science in Mechanical Engineering Technology Plastics

## STEM & Industrial Technology Division

Plastics is one of the fastest growing manufacturing industries today. The plastics program at Northwest State Community College was created in response to the industry demand in northwest Ohio for employee training and student education in plastics manufacturing. Students will receive specialized training in thermoplastic materials, injection molding and plastics testing. Graduates will also be skilled in various processes such as blow molding, extrusion and thermoforming.

### Career Outlook

While consumer demand for convenient, plastic products increases, so will the need for highly-skilled plastics technicians. Job titles in this field can include Molding Technician, Production Supervisor, design and development and quality control technician to name a few. Employment of plastic processing workers is expected to grow as fast as the average both nationally and in the state of Ohio. An increase in workers trained in the field will stem from manufacturers substituting plastic parts for those that had been manufactured from metal in the past.

### Program Learning Outcomes

Students earning an Associate degree from this program will:

1. Discuss and explain polymers including history, current industry, recycling, types of polymers and properties, as well as analyze various polymeric structures and applications based on those structures.
2. Explain, compare, and contrast common manufacturing processes used in the plastics industry and select the appropriate process depending on the product, as well as the ability to outline major plastics process and establish a production intent process and troubleshoot various defects.
3. Demonstrate and explain the various properties and test associated with plastics materials, as well as the ability to make decisions on part requirements based on various properties and tests.
4. Explain secondary operations used in the plastics industry primarily for assembly and decoration and select appropriate secondary operations based on production requirements.
5. Evaluate and design a mold and die for dimensional stability, process ability, flow characteristics for production intent.

<b>First Semester</b>		<b>Credits</b>
ENG111	Composition I.....	3
MET100	Intro to Engineering Technology .....	2
MTH109	College Algebra.....	3
+ MET107	Engineering Graphics.....	3
+ MET121	Manufacturing Processes.....	<u>3</u>
		14

<b>Second Semester</b>		<b>Credits</b>
ENG210	Technical Communications.....	3
MTH112	Trigonometry .....	3
PHY251	Physics: Mechanics and Heat.....	4
+ CAD213	CAD111.....	4
+ PET115	Plastics Processes.....	<u>4</u>
		18

<b>Third Semester</b>		<b>Credits</b>
+ QCT100	Quality Concepts .....	3
+ MET234	Strength of Materials .....	3
+ MET235	Statics.....	3
CHM101	Chemistry .....	4
+ PET215	Plastics Processes II .....	<u>4</u>
		17

<b>Fourth Semester</b>		<b>Credits</b>
+ CET115	Program Management OR	
+ MET255	Fluid Mechanics.....	3
+ MET134	Engineering Materials .....	3
ENG113	Speech .....	3
ELECTIVE*	Social/Behavioral Science Elective ....	3
ELECTIVE*	Humanities Elective .....	<u>3</u>
		15

**Total Program Hours                      64**

\* **See page 45 for a list of Humanities and Social/Behavioral Science Electives.**

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Plastics Manufacturing Certificate

## STEM & Industrial Technology Division

A Plastics Manufacturing Certificate prepares the individual to setup and maintain injection molding processes; plastics testing processes and ensure quality control. Individuals may also be skilled in various processes such as blow molding, extrusion, and thermoforming. Typically these individuals report to manufacturing supervisors, receiving daily objectives from them.

Technicians work on assignments and tasks with minimum supervision and guidance, often requiring the technician to interface and pass down information to personnel on incoming and outgoing shifts. It is expected by employers that technicians demonstrate excellent verbal, written and interpersonal communication skills.

Coursework (100 level or higher) completed in this certificate directly applies toward the associate degree in plastics engineering technology.

### Career Outlook

Graduates of this program may find employment as entry-level mold technicians, mold setters, job setters and material handlers working under the direction of the manufacturing department. Some of the typical duties of these technicians will include performing: mold insert changes; material color changes; press start-ups and shut downs; mold changes and planned maintenance (PMs) on the molds; performing product inspections to verify conformance to specifications, ensuring quality control; and directing and performing adjustments of molding equipment, working closely with the production and the quality control departments.

### Program Learning Outcomes

Students earning a certificate from this program should demonstrate:

1. Discuss and explain polymers including history, current industry, recycling, types of polymers and properties.
2. Explain, compare, and contrast common manufacturing processes used in the plastics industry. Select the appropriate process depending on the product, as well as the ability to outline major plastics process and establish a production intent process and troubleshoot various defects.
3. Produce design concepts and orthographic projection. Interpolate dimensioning practices and read blueprints, as well as explain the various properties associated with plastics and the ability to perform functional tests used to determine properties.
4. Explain the theory of common secondary operations used in the plastics industry primarily for assembly and decorating.

<b>First Semester</b>		<b>Credits</b>
IND105	Industrial Safety.....	2
MET100	Intro to Engineering Tech .....	2
+ MET107	Engineering Graphics & Sketching....	3
+ PET110	Principles of Plastics.....	4
+ PET115	Plastics Processes I.....	<u>4</u>
		15

<b>Second Semester</b>		<b>Credits</b>
ENG111	Composition I.....	3
IND103	Applied Geometry and Trigonometry	3
+ PET215	Plastics Processes II .....	4
+ PET250	Plastics Secondary Operations .....	4
+ QCT100	Quality Concepts .....	<u>3</u>
		17

**Total Program Hours** **32**

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Programmable Controller (PLC) Certificate

## STEM & Industrial Technologies Division

A Programmable Logic Controller (PLC) Certificate prepares the individual to install, maintain and troubleshoot industrial grade PLC systems. Technicians will work closely with maintenance supervisors and electrical engineers. Extensive self study (reading, research and practice) may be required on the job to improve and maintain technical proficiency of new and improved electrical control devices.

Typically, technicians work on assignments and tasks with minimum supervision and guidance, often requiring the technician to interface and pass down information between cross function personnel of incoming and outgoing shifts. It is expected by employers that technicians demonstrate excellent verbal, written and interpersonal communication skills.

### Career Outlook

Graduates of this program may find employment as entry-level control technicians, electrical technicians or as service technicians working under the direction of the maintenance or engineering department. Some of the typical duties of these technicians will include: troubleshooting and programming of PLC control systems; variable frequency drives; 480 volt 3 phase motor wiring; reading blueprints and electrical schematics; installing conduit and wiring; testing wiring connections; working closely with electrical engineers and / or general contractors.

### Program Learning Outcomes

Students earning a certificate from this program should demonstrate:

1. Illustrate knowledge of electrical symbols and abbreviations through knowledge and hands on assignments.
2. Demonstrate basic knowledge of operating systems, networking, and computer hardware through various assessment instruments.
3. Demonstrate proficiency in design concepts, orthographic projection, dimensioning practices, and blueprint reading through knowledge and hands on based assessments.
4. Illustrate basic ladder logic programming, addressing, editing, and troubleshooting by applying concepts to PLC design and demonstration projects.

<b>First Semester / 1st 8 weeks</b>			<b>Credits</b>
+	IND120	Industrial Electricity I.....	3
	IND110*	Industrial Computing I.....	3
	IND105	Industrial Safety.....	<u>2</u>
			8

<b>First Semester / 2nd 8 weeks</b>			<b>Credits</b>
+	IND121	Industrial Electricity II.....	3
+	PLC200	Programmable Controller I.....	3
	ELECTIVE*	Communications Elective.....	<u>3</u>
			9

<b>Second Semester / 1st 8 weeks</b>			<b>Credits</b>
+	IND223	Motors & Motor Controls.....	3
+	IND221	Instrumentation & Controls.....	<u>3</u>
			6

<b>Second Semester / 2nd 8 weeks</b>			<b>Credits</b>
+	PLC210	Programmable Controller II.....	3
+	PLC220	Programmable Controller III.....	3
+	PLC230	Servo/Robotics Systems.....	<u>3</u>
			9

**Total Program Hours** **32**

**\* See page 51 for a list of Communications Electives.**

\* Prior to taking IND110, students should have basic computer literacy in Windows and at least one Windows application.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Project Management Technology

## Associate of Applied Science

### STEM & Industrial Technology Division

This program is designed to prepare graduates for careers as technicians, management trainees or supervisors in manufacturing. Courses include a mixture of business management topics with an emphasis on engineering technologies.

### Career Outlook

The demand for educated Project Managers continues to grow nationally and in the State of Ohio. Time management, hands on engineering, and refined communication skills are required by several industries in order to meet tight profit margins. Construction, Engineering, Logistics, and Manufacturing will be the strongest areas of employment for Project Management Technology.

### Program Learning Outcomes

Students earning an Associate degree from this program should demonstrate:

1. Interpolate and complete and complete engineered drawings using orthographic projection, isometric views, and proper dimensioning practices, as well as employ the use of Computer-Aided-Design (CAD) software.
2. Demonstrate proper use of precision measuring devices and instruments and the ability to apply SPC practices to various processes within the industry.
3. Efficiently and effectively manage projects, including scheduling, monitoring, and analyzing with respect to cost, time, and resources..
4. Basic knowledge of Engineering Technology based on the selected track

### Engineering Technology Tracks (Choose a track):

**Alternative Energy:** AET 100 Intro. to Alternative Energy and AET 200 Sustainable Building Design

**Construction:** CET 100 Construction Methods and Materials and CET 120 Construction Materials Testing

**Electrical:** EET 121 DC Circuits and EET 122 AC Circuits

**Mechanical:** MET 121 Manufacturing Processes and MET 134 Engineering Materials

**Plastics:** PET115 Plastics Processes I and PET215 Plastics Processes II

<b>First Semester</b>		<b>Credits</b>
	ENG111	Composition I..... 3
+	MET100	Intro to Engineering Technology ..... 2
+	MET107	Engineering Graphics..... 3
+	CIS114	Microsoft Applications..... 3
	MTH109	College Algebra..... <u>3</u>
		14

<b>Second Semester</b>		<b>Credits</b>
	ENG210	Technical Communications..... 3
	MTH112	Trigonometry ..... 3
+	CAD213	CAD III ..... 4
+	CET115	Project Management..... 3
+		Track 1 ..... <u>3</u>
		16

<b>Third Semester</b>		<b>Credits</b>
	PHY251	Physics: Mechanics & Heat..... 4
+	CET215	Project Management II ..... 3
	ECO212	Microeconomics..... 3
	ENG113	Speech ..... 3
+		Track 2 ..... <u>3</u>
		16

<b>Fourth Semester</b>		<b>Credits</b>
+	QCT100	Quality Concepts ..... 3
	ACC111	Financial Accounting..... 3
+	AET290	Capstone OR
+	MET290	Engineering Tech Co-op Internship.. 3
	ELECTIVE*	Humanities Elective ..... 3
	ELECTIVE*	Natural Science Elective ..... <u>4</u>
		16

**Total Program Hours 62**

\* See pages 44-45 for a list of Humanities and Natural Science Electives.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Quality Control Certificate

## STEM & Industrial Technology Division

A Manufacturing Quality Certificate prepares the student for a career as a quality specialist (supplier quality engineer, green belt, mechanical inspector, quality technician, auditor and similar roles).

Twenty-first century manufacturing operations link productivity to quality. Lean manufacturing quality concepts are essential to modern competitiveness. Accordingly, persons seeking greater responsibility should consider the quality curriculum.

This program of study prepares the student to sit for American Society for Quality Technician exam. ASQ certifications are widely recognized and favorably impact hiring and compensation decisions.

### Career Outlook

The greatest demand for engineering technicians will be in manufacturing. Companies need improved machinery, up-to-date processes, and lean manufacturing methods to compete on a global basis. Quality skills apply during all phases of the product cycle – from concept to production to distribution and service.

ISO/TS/OHSA certifications are becoming a common prerequisite for doing business, worldwide. This course of study imparts the skills needed to comply with many certification system requirements. Skills learned in this course form a solid foundation on which to build if your goal is to become a Quality Assurance Manager, Quality Engineer, or Quality Auditor.

### Program Learning Outcomes

Students earning a certificate from this program should demonstrate:

1. Basic knowledge leading to quality from management, practitioner and customer perspectives.
2. Concentration on quality problem solving and process control tools.
3. Basic understanding of probability and philosophies espoused by Deming, Crosby, and Juran.
4. Basic knowledge of quality, measurement system analysis and control charting principles.
5. Proper selection and use of measuring tools for the feature based upon the print specification.
6. Proficiency for dealing with tolerance stacks, another layer of G D & T.
7. Basic understanding of more complex quality improvement methods by studying at least three of the following topics: Advanced SPC, Six Sigma Start-Up, DOE: Screening Experiments, Measurement Systems Analysis or Problem Solving.

<b>First Semester</b>		<b>Credits</b>
+ MET107	Engineering Graphics & Sketching....	3
	MTH109 College Algebra.....	3
+ QCT100	Quality Concepts .....	<u>3</u>
		9

<b>Second Semester</b>		<b>Credits</b>
<i>(choose CAD112 or CAD213)</i>		
+ CAD112	CAD II.....	4
+ CAD213	CAD III .....	4
+ QCT131	Quality for Lean Manufacturing .....	<u>3</u>
		7

<b>Third Semester</b>		<b>Credits</b>
+ QCT141	Precision Measurement.....	3
+ QCT243	Advanced Quality Improvement.....	3
ELECTIVE*	Communications Elective.....	<u>3</u>
		9

<b>Fourth Semester</b>		<b>Credits</b>
+ MET121	Manufacturing Processes.....	3
+ QCT142	Advanced Concepts of GD&T .....	3
+ QCT250	Certified Quality Technician/ Certified Mechanical Inspector Review	<u>3</u>
		9

**Total Program Hours** **34**

\* See page 51 for a list of Communications Electives.

\* Prior to taking IND110, students should have basic computer literacy in Windows and at least one Windows application.

+ Students must attain a minimum grade of "C" in all courses with a '+' to progress in the program and to graduate.

# Industrial Welding

## (Short-Term Technical Certificate)

### STEM & Industrial Technologies Division

This welding program provides the students with the technical skills and knowledge to work in the industrial welding field. Such positions as Welder/Fabricator, Production Welder, Millwright, Welding Technician and Welder/Pipe Fitter all utilize multiple welding and fabricating skills. Students are trained in many welding processes which include Shield Metal Arc Welding, Gas Metal Arc Welding, Gas Tungsten Arc Welding, Flux Core Arc Welding, Oxy Fuel Gas Welding /Cutting and Plasma Arc Cutting. Various kinds of metals and thicknesses will be used including mild steel, aluminum and stainless steel. Graduates are eligible to take the American Welding Society certification tests.

### Career Outlook

Welding is a career choice that is in high demand. It offers you the flexibility to switch industries without changing careers. With the increase of manufacturing, the building and repairing of major infrastructure, nuclear power plants, windmills, or drilling of oil, welding has endless opportunities that keep fueling the demand for this skilled technology.

### Program Learning Outcomes

1. Demonstrate safe workplace practices by identifying potential hazards.
2. Accurately follow shop drawings and demonstrate describing, recognizing, and interpreting weld symbols to complete weld jobs.
3. Fabricate and assemble a given project according to prints and within specified tolerances.
4. Identify and demonstrate basic welding terminology and safety in the workplace.
5. Demonstrate accurate working knowledge of GMAW, GTAW, and SMAW welding principles and practices.
6. Demonstrate proper and safe operation of related cutting/beveling equipment
7. Correct and safe setup and shut down of all welding machines and torch equipment
8. Demonstrate proper selection of appropriate electrode, polarity, amperage setting, and electrode manipulation for each specific application.

<b>First Semester</b>			<b>Credits</b>
+	WLD 100	Blue Print Reading and Welding Symbols	2
+	WLD 110	Introduction of Applied Welding Techniques	3
+	WLD 120	Gas Metal Arc Welding	<u>3</u>
			8
<b>Second Semester</b>			<b>Credits</b>
+	WLD 130	Flat & Horizontal Shield Metal Arc Welding	3
+	WLD 140	Gas Tungsten Arc Welding	3
+	WLD 150	Advance Gas Metal Arc Welding	<u>3</u>
			9
<b>Total Program Hours</b>			<b>17</b>

+ Refers to technical course work. Students must maintain a minimum grade of "C" in these courses to progress in the program and graduate.