The ability to recognize opportunities and move in new – and sometimes unexpected – directions will benefit you no matter your interests or aspirations.

- Drew Gilpin Faust
INDUSTRIAL TECHNOLOGIES

Contact:
stem@northweststate.edu
Industrial Technologies 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:

**Applied Science**
- Industrial Technology
- Mechatronics

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

**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.

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

**Natural Science:**
- See Page 40 for Natural Science Electives

**Technical Electives:**
- Any AET, CAD, EET, IND, INT, MET, PET, PLC or QCT course
HVAC-R (Climate Control)
Certificate

Industrial Technologies 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.

See page 69 for a list of Communications Electives.

Gainful employment information for NSCC's certificate programs can be found online at: https://northweststate.edu/gedt/hvac/
Gainful employment information includes: estimated cost of the program, average student loan debt and types of jobs available.

Must be proficient in MTH080.

+ Students must attain a minimum grade of “C” in all courses with a ‘+’ to progress in the program and to graduate.
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.

**Gainful employment information for NSCC’s certificate programs can be found online at:**
https://northweststate.edu/gedt/indust-elec/
Gainful employment information includes: estimated cost of the program, average student loan debt and types of jobs available.

* 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.

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<thead>
<tr>
<th>First Semester</th>
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<tr>
<td>+ IND120 Industrial Electricity I</td>
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<td>IND105 Industrial Safety</td>
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<td>+ IND134 Industrial Fluid Power</td>
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<tr>
<td>+ IND122 Industrial Wiring (NEC)</td>
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<tr>
<td>+ IND220 Electrical Prints &amp; Troubleshooting</td>
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<tr>
<td>+ IND223 Motors and Motor Controls</td>
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<tr>
<td>+ PLC200 Programmable Controller I</td>
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<td>+ PLC230 Servo/Robotics Systems</td>
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**Total Program Hours** **35**

See page 69 for a list of Communications Electives.
Industrial Maintenance Certificate

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.

See page 69 for a list of Communications Electives.

First Semester
+ IND120 Industrial Electricity I.......................... 3
+ IND110* Industrial Computing.......................... 3
+ IND105 Industrial Safety................................. 2
 8

Second Semester
IND103 Applied Geometry & Trigonometry .................. 3
+ IND232 Machine Repair.................................. 3
+ IND132 Benchwork....................................... 2
+ PLC200 Programmable Controller I..................... 3
 11

Third Semester
+ IND121 Industrial Electricity II........................... 3
+ IND134 Industrial Fluid Power........................... 3
  Communication Elective................................. 3
  9

Fourth Semester
+ IND131 Industrial Pipefitting.............................. 3
+ WLD110 Intro to Applied Welding Techniques............ 3
+ IND223 Motors & Motor Controls.......................... 3
  9

Total Program Hours 37

Gainful employment information for NSCC's certificate programs can be found online at:
https://northweststate.edu/gedt/indust-maintenance/
Gainful employment information includes: estimated cost of the program, average student loan debt and types of jobs available.

* 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

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)

See page 40 for a list of Humanities and Social/Behavioral Science Electives.

See page 69 for a list of Communications, Natural Science and Technical Electives.

* 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 elective concentration areas.

+ Students must attain a minimum grade of “C” in all courses with a ‘+’ to progress in the program and to graduate.

** See next page for listing of technical elective concentration areas.
Technical Electives

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

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), exy-acetylene, gas metal (MIG) and gas tungsten (TIG), through assignments and projects.

First Semester

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<td>COMM114 or another</td>
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Fourth Semester

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<td>MET222</td>
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Total Program Hours 36

See page 69 for a list of Communications Electives.

Gainful employment information for NSCC’s certificate programs can be found online at: https://northweststate.edu/gedt/machining/
Gainful employment information includes: estimated cost of the program, average student loan debt and types of jobs available.

* 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.
Programs and Degrees

Maintenance Technician/Mechatronics
Associate of Applied Science in Industrial Technology

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.

See page 40 for a list of Humanities and Social/Behavioral Science Electives.

See page 69 for a list of Communications, Natural Science and Technical Electives.

First Semester

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<td>Industrial Computing I</td>
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<td>+ IND120</td>
<td>Industrial Electricity I</td>
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<td>+ IND132</td>
<td>Benchwork</td>
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Second Semester

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<td>IND103</td>
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Third Semester

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<td>+ IND223</td>
<td>Motors &amp; Motor Controls</td>
<td>3</td>
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<tr>
<td>+ IND232</td>
<td>Machine Repair</td>
<td>3</td>
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<tr>
<td>+ PLC200</td>
<td>Programmable Controller I</td>
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Fourth Semester

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<td>+ IND234</td>
<td>Industrial Fluid Power II</td>
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<td>+ PLC230</td>
<td>Servo/Robotic Systems</td>
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<td>Natural Science Elective (Including a lab)</td>
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<tr>
<td>Social/Behavioral Science Elective</td>
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Total Program Hours 62

* 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.
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 reconditioner.

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.

See page 69 for a list of Communications Electives.

Gainful employment information for NSCC’s certificate programs can be found online at: https://northweststate.edu/gedt/millwright/
Gainful employment information includes: estimated cost of the program, average student loan debt and types of jobs available.

+ 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

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.

See page 69 for a list of Communications Electives.

First Semester / 1st 8 weeks

<table>
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<tr>
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<tbody>
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First Semester / 2nd 8 weeks

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Communications Elective

Second Semester / 1st 8 weeks

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Second Semester / 2nd 8 weeks

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<tbody>
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<td>PLC230 SERvo/Robotics Systems</td>
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Total Program Hours 32

Gainful employment information for NSCC’s certificate programs can be found online at:
https://northweststate.edu/gedt/plc/

Gainful employment information includes: estimated cost of the program, average student loan debt and types of jobs available.

* 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.