

# INDUSTRIAL TECHNOLOGY

Keith Byman, Division Head  
(515) 422-4202

## Automotive

Automotive Service  
Automotive Service Technology

## Building Trades

Building Trades - Day  
Building Trades - Evening

## Climate Control

Climate Control Mechanics  
Climate Control Technology

## Electronics

Electronics Technology

## Manufacturing

General Machinist  
Tool and Die Technology

## Mechanical Design Technology

## Welding - Evening

Industrial Technology careers have become highly sophisticated and specialized. Electronic controls are standard in nearly all branches of industrial technology. Continuous retraining throughout one's entire career is commonly required in many occupations. For all of these reasons, a strong background in math, science, technology, and communications as shown below is recommended for entrance into NIACC's Industrial Technology Programs.

### Minimum Recommended High School Courses:

MATH .....3 years  
Applied Math OR  
Algebra, Geometry, Trigonometry

SCIENCE .....3 years  
Applied Biology/Chemistry OR  
Biology and Chemistry  
Principles of Technology OR  
Physics

ENGLISH/COMMUNICATIONS .....4 years  
Applied Communications  
Workplace Readiness  
Traditional English courses

TECHNOLOGY  
Drafting/CAD .....1 or 2 years  
Electricity/Electronics .....1 year  
Metals Processing .....1 year  
Other Electives .....1 or 2 years

NIACC has support services through the Independent Study Lab (ISL) for students needing to strengthen their skills in one or more of these areas.

### Quotable Quote:

When everything seems to be going against you, remember that the airplane takes off against the wind, not with it.

-Henry Ford

## Automotive Service Technology

Automotive Service Technology is a 4½ semester associate of applied science (AAS) degree program. The program is ASE/NATEF Master Certified. All eight instructional areas meet industry and educational standards as identified by Automotive Service Excellence and evaluated by the National Automotive Technicians Education Foundation:

Engine Repair  
Automatic Transmission/Transaxle  
Manual Drive Train and Axles  
Suspension and Steering  
Brakes  
Electrical/Electronic Systems  
Heating and Air Conditioning  
Engine Performance



Technicians are employed at automotive dealerships and independent service/repair facilities as general (line) technicians or as specialty technicians.

### AAS DEGREE REQUIREMENTS:

Completion of required curriculum, with an average grade point of 2.00 (C).

### AUTOMOTIVE PROGRAM GOAL

Prepare individuals for employment in the automotive service industry by:

- Maintaining an environment that is conducive to learning.
- Offering curriculum that reflects current industry requirements.
- Delivering classroom instruction that encourages analytical thinking.
- Providing laboratory experience that utilizes technical and problem-solving skills.
- Promoting workmanship that meets or exceeds industry standards,

### QUOTABLE QUOTE:

Both the educational and automotive communities should be proud of your commitment to quality automobile training programs.

- ASE President Ronald H. Weiner to NIACC regarding Automotive Program ASE/NATEF Certification

## Automotive Service

Automotive Service serves as a foundation for the Automotive Service Technology AAS program. Students have the option to complete the 2½ semester program and earn a diploma, however, they are encouraged to seek an AAS degree to maximize their potential for success in the automotive service industry. Occupational areas of instruction of the diploma program are ASE/NATEF certified.

### DIPLOMA OPTION REQUIREMENTS:

This recognition is granted to a person who has completed at least thirty (30) semester hours of credit.

### ENTRANCE ADVISING:

Due to the highly technical nature of the Automotive programs and NIACC's commitment to giving students the best possible opportunity for success, students will be scheduled for advisement sessions with counselors and program personnel. In these sessions, the student's career plans, previous background, transcripts, test scores, life experiences, and motivation will aid in designing a positive educational experience.

**Automotive Service Technology**

ASSOCIATE OF APPLIED SCIENCE DEGREE

## SCHEDULE

## First Term

96:132 Electrical Concepts.....	3 s.h.
91:101 Career Math I .....	4 s.h.
95:130 Communications I.....	3 s.h.
98:144 Intro to Automotive Technology.....	3 s.h.
98:145 Brake Systems .....	3 s.h.
98:146 Suspension and Steering .....	3 s.h.
	<b>19 s.h.</b>

## Second Term

91:102 Career Math II .....	4 s.h.
96:150 Career Physics .....	4 s.h.
98:147 Electrical Systems I.....	3 s.h.
98:148 Engine Repair.....	3 s.h.
98:149 Manual Drive Train & Axles.....	3 s.h.
98:161 Metal Processing & Metallurgy.....	2 s.h.
	<b>19 s.h.</b>

## Summer Term

98:133 Heating and Air-Conditioning. ....	3 s.h.
98:180 Computerized Controls.....	2 s.h.
	<b>5 s.h.</b>

## Third Term

15:241 Human Relations.....	3 s.h.
98:179 Automatic Transmissions & Transaxles .5 s.h.	
98:208 Fuel Delivery Systems.....	3 s.h.
98:209 Electrical Systems II .....	5 s.h.
	<b>16 s.h.</b>

## Fourth Term

89:150 Job-Seeking Skills .....	1 s.h.
95:131 Communications II.....	3 s.h.
98:211 Engine Performance Testing.....	5 s.h.
98:212 Adv. Engine Performance .....	7 s.h.
	<b>16 s.h.</b>

**Total 75 s.h.****DIPLOMA OPTION SCHEDULE**

Completion of First Term, Second Term, and Summer Term (2 ½ Semesters). Job-Seeking Skills (89:150) will be offered to students who select this option.

**Course Descriptions - Automotive Service and Automotive Service Technology**

**15:241 Human Relations (3 s.h.)** Problems of defining the wants of the worker and of management and bringing these elements together in formal and informal organizations; implementing programs to help them achieve their common purpose to work together productively and cooperatively and with economic, psychological, and social satisfaction. (45-0)

**89:150 Job-Seeking Skills (1 s.h.)** Develop skills necessary to find, obtain, and keep a job. Students learn to understand and appreciate the world of work as they examine personal job readiness and skills to make job-entry successful. (15-0)

**91:101 Career Math I (4 s.h.)** This course is intended to provide the student with mathematics topics and applications having specific emphasis to Automotive, Building Trades, Climate Control Technology, General Machinist, and Tool & Die Technology. Topics include basic mathematical operations, formulas, and multi-dimensional measurement and calculation. (60-0)

**91:102 Career Math II (4 s.h.)** This course is a continuation of Career Math I. Additional topics include geometry, trigonometry and descriptive statistics with an emphasis on application. (60-0)

**91:299A-D Special Problems in Career Programs (1-4 s.h.)** Course arranged with special permission of instructor and Division Chair. Credit is based on standard contact hours and assigned by Division Chair and approved by Vice President for Academic Affairs.

**95:130 Communications I (3 s.h.)** Study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**95:131 Communications II (3 s.h.)** Further study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**96:132 Electrical Concepts (3 s.h.)** The purpose of this course is to acquaint the student with electrical fundamentals. It will provide basic electrical and electronic background for a variety of technical fields which require such knowledge. Areas of instruction include safety, direct and alternating current, semiconductor and digital electronics, motors and controls, shop and lab practices. (30-45)

**96:150 Career Physics (4 s.h.)** Prerequisite/Corequisite: one semester of Career Math. An introduction to basic operating principles of gears, levers, pulleys, simple machines, and the effects of heat on solids, liquids, and gases. (45-30)

**98:133 Heating & Air-Conditioning (3 s.h.)** Prerequisite/Corequisite: 96:132, Electrical Concepts, or instructor's permission. Instruction in heat transfer principles applied in testing, repairing, and/or replacing heating and air-conditioning system components. Laboratory procedures for servicing and maintaining air-conditioning systems utilizing refrigerant recovery and recycling equipment. (30-45)

**98:144 Introduction to Automotive Technology (3 s.h.)** Prerequisite/Corequisite: strong mechanical aptitude. Instruction in fundamental shop safety, service procedures, precision measurement and engine operation, use of service manuals and service equipment. Laboratory procedures in performing new vehicle predelivery inspections, vehicle lubrication and fluid changes, and general maintenance and service of engine exhaust and cooling systems. (30-60)

**98:145 Brake Systems (3 s.h.)** Prerequisite/Corequisite: 98:144, Introduction to Automotive Technology. Instruction in the theory and operating principles of hydraulic and antilock (ABS) systems. Laboratory procedures for inspecting, testing diagnosing, repairing and/or replacing conventional, power, and ABS system components. (15-90)

**98:146 Suspension and Steering (3 s.h.)** Prerequisite/Corequisite: 98:144, Introduction to Automotive Technology. Instruction/laboratory service procedures for inspection, adjustments, alignment, repair and/or replacement of suspension and steering components. (15-90)

**98:147 Electrical Systems I (3 s.h.)** Prerequisite/Corequisite: 98:144, Introduction to Automotive Technology and 96:132, Electrical Concepts. Instruction in the electrical and electronic principles and testing procedures as applied to automotive circuits and microprocessors. Laboratory procedures to include the utilization of wiring schematics and test equipment for diagnosing and repairing instrumentation, electrical accessory, and lighting systems. (30-60)

**98:148 Engine Repair (3 s.h.)** Prerequisite/Corequisite: 98:144, Introduction to Automotive Technology. Instruction/laboratory procedures for engine repair diagnosis, removal, disassembly, inspection, overhaul and reassembly of automotive and/or light truck engines according to manufacturer's specifications. (15-90)

**98:149 Manual Drive Train & Axles (3 s.h.)** Prerequisite/Corequisite: 98:144, Introduction to Automotive Technology. Instruction/laboratory procedures for servicing, diagnosing, and repairing/replacing standard transmissions and clutches, transaxles, and differentials. (15-90)

**98:161 Metal Processing and Metallurgy (2 s.h.)** Practical applications of basic metal working tools and processes used in the field of automotive service. Covers basic SMAW, GMAW, GTAW, and oxyacetylene welding and cutting. (15-30)

**98:179 Automatic Transmissions & Transaxles (5 s.h.)** Prerequisite/Corequisite: 96:132, Electrical Concepts, or instructor's permission. Instruction in diagnosis, maintenance, and overhaul of major automatic transmissions and transaxles in various makes of automobiles. (45-90)

**98:180 Computerized Controls (2 s.h.)** Prerequisite/Corequisite: 96:132, Electrical Concepts, or instructor's permission. Instruction in theory, application, and diagnostics of automotive computers, sensors, and control devices. (15-45)

**98:208 Fuel Delivery Systems (3 s.h.)** Prerequisite/Corequisite: 96:132, Electrical Concepts, or instructor's permission; and strong mechanical aptitude. Instruction in the fundamentals of operation and service of complete fuel systems, including storage, delivery, and metering. (30-60)

**98:209 Electrical Systems II (5 s.h.)** Prerequisite/Corequisite: 98:147, Electrical Systems I, or instructor's permission. Strong mechanical aptitude. Instruction in operation, service, and troubleshooting of automotive electronic/electrical circuits and systems; to include starting, charging, and ignition systems. (45-90)

**98:211 Engine Performance Testing (5 s.h.)** Prerequisite/Corequisite: 98:180, Computerized Controls, or instructor's permission. Strong mechanical aptitude. Instruction in the theory, operation, and analysis of computer control distributorless ignition and emission systems, with emphasis placed on diagnosis/repair of problems using manufacturer flow charts, oscilloscopes, DVOMs, and scan tools. (45-90)

**98:212 Advanced Engine Performance (7 s.h.)** Prerequisite/Corequisite: 98:180, Computerized Controls, or instructor's permission. Strong mechanical aptitude. Instruction in the theory, operation, and testing of computerized engine control systems and other advanced electronic systems on the automobile, with emphasis placed on diagnosis/repair of problems using manufacturer flow charts, oscilloscopes, DVOMs, and scan tools. (75-105)

## Building Trades - Day

Building Trades is a diploma program designed for individuals interested in a career in residential, commercial, or industrial building construction. Residential construction involves the building or remodeling of houses, condominiums, or apartment complexes. These structures are primarily wood frame construction. Commercial construction involves the building of single story office buildings, stores, or restaurants. These structures often use light gauge metal framing in addition to wood construction. Industrial construction includes the building of factories, hospitals, schools, or multistory office buildings. These structures may be constructed of concrete, masonry, structural steel, or a combination of materials.

The Building Trades Program develops students' skills through a combination of classroom-structured units, manipulative lab projects, and mentored job experiences. Classroom units provide students with necessary information on safety, blueprint reading, and craft work processes. Manipulative projects provide students the opportunity to learn craft skills at their own pace in a mock job site setting. The Building Trades Lab is equipped with state-of-the-art power tools and places students in a competency-based setting where each individual learns skills by constructing manipulative projects. Mentored job experiences provide students the opportunity to apply learned skills as well as develop new skills while working under the guiding supervision of skilled contractors on job sites around North Iowa.

Graduating students are eligible to compete for a \$500 scholarship awarded each semester by the Contractors' Advisory Association and the North Iowa Area Builders Exchange. The Contractors' Advisory Association has also created a financial assistance agreement to enable a contractor to repay a portion of a student's educational costs after the student has completed the program requirements. In exchange for a commitment to work for a Contractors' Advisory Association member contractor after graduation, a student may receive full or partial tuition assistance from the contractor. A diploma will be awarded upon successful completion of the prescribed curriculum with a grade point average of 2.00 (C) or better.

### SCHEDULE

#### First Term (Summer)

91:101 Career Math I .....	4 s.h.
91:151 Fundamentals of Carpentry I.....	3 s.h.
91:152 Fundamentals of Carpentry II.....	3 s.h.
89:100 Cooperative Work Experience.....	1 s.h.
	<b>11 s.h.</b>

#### Second Term (Fall)

91:153 Carpentry I.....	4 s.h.
91:154 Carpentry I Lab.....	4 s.h.
91:102 Career Math II .....	4 s.h.
91:159 Intro to the PC .....	1 s.h.
95:130 Communications I.....	3 s.h.
89:101 Cooperative Work Experience.....	1 s.h.
89:150 Job-Seeking Skills.....	1 s.h.
	<b>18 s.h.</b>

#### Third Term (Spring)

91:156 Carpentry II.....	4 s.h.
91:157 Carpentry II Lab.....	4 s.h.
96:150 Career Physics .....	4 s.h.
89:102 Cooperative Work Experience.....	1 s.h.
91:198 Blueprint Reading and Estimating.....	3 s.h.
15:214 Human Relations.....	3 s.h.
	<b>19 s.h.</b>

**Total 48 s.h.**

## Building Trades - Evening

The evening Building Trades Program is designed for individuals interested in completing the first term diploma carpentry course requirements of the daytime program, or for those individuals interested in gaining some basic carpentry skills. Students choosing to complete the first term carpentry diploma course requirements need to complete Fundamentals of Carpentry I and Fundamentals of Carpentry II. Students seeking to gain carpentry experience may elect to enroll in a semester length class, or they may take individual skill modules. Enrollment in individual carpentry skill modules is available through the NIACC Continuing Education office on an open entry/open exit basis to accommodate flexible scheduling.

You may work during the day and attend classes in the evening. Evening carpentry classes are designed to be hands-on, self-paced, and individualized. Classes are three hours in length and are offered two evenings per week during the semester. Students completing the evening program may begin the daytime Building Trades diploma program in the second term (fall semester) having already completed the summer term courses.

You may also enroll in Cooperative Work Experience and receive college credit for related work experience.

### SCHEDULE

#### First Term (Fall)

91:151 Fundamentals of Carpentry I .....	3 s.h.
89:100 Cooperative Work Experience .....	1 s.h.
	<b>4 s.h.</b>

#### Second Term (Spring)

91:152 Fundamentals of Carpentry II .....	3 s.h.
89:101 Cooperative Work Experience .....	1 s.h.
	<b>4 s.h.</b>

**Total 8 s.h.**

**Course Descriptions - Building Trades**

**15:241 Human Relations (3 s.h.)** Problems of defining the wants of the worker and of management and bringing these elements together in formal and informal organizations; implementing programs to help them achieve their common purpose to work together productively and cooperatively and with economic, psychological, and social satisfaction. (45-0)

**89:100-102 Cooperative Work Experience (1 s.h.)** Practical training on the job under the cooperative supervision of the college and work supervisor. (15-435)

**89:150 Job-Seeking Skills (1 s.h.)** Develop skills necessary to find, obtain, and keep a job. Students learn to understand and appreciate the world of work as they examine personal job readiness and skills to make job entry successful. (15-0)

**91:101 Career Math I (4 s.h.)** This course is intended to provide the student with mathematics topics and applications having specific emphasis to Automotive, Building Trades, Climate Control Technology, General Machinist, and Tool & Die Technology. Topics include basic mathematical operations, formulas, and multi-dimensional measurement and calculation. (60-0)

**91:102 Career Math II (4 s.h.)** This course is a continuation of Career Math I. Additional topics include geometry, trigonometry and descriptive statistics with an emphasis on application. (60-0)

**91:151 Fundamentals of Carpentry I (3 s.h.)** (15-60)

**91:152 Fundamentals of Carpentry II (3 s.h.)** (15-60)  
General skills instruction covers safety; basic hand tools; basic power tools; job site safety; printreading; construction materials and systems; construction fasteners and processes; residential construction practices; and commercial construction practices.

**91:153 Carpentry I (4 s.h.)** (60-0)

**91:154 Carpentry I Lab (4 s.h.)** (0-210)  
General skills instruction covers safety; hand tools; power tools; printreading; builders level, transit, and laser; scaffolding; rigging; arc welding, cutting, and burning. Residential skills instruction covers site work; building layout; form work; floor and sill framing; wall and ceiling framing; roof framing; stair construction; exterior walls, soffits, and cornice construction; roof coverings; window and door installation; cabinet fabrication; and running trims and hardware installations.

**91:156 Carpentry II (4 s.h.)** (60-0)

**91:157 Carpentry II Lab (4 s.h.)** (0-210)  
General skills instruction covers safety; hand tools; power tools; printreading; builders level, transit, and laser; scaffolding; rigging; arc welding, cutting, and burning. Commercial skills instruction covers site work; building layout; footing, wall, stair, column, beam, and deck form constructions; wood and steel stud framing; exterior walls and canopy constructions; cabinet fabrication; wood and steel jamb, window, door, millwork, and hardware installations; office partition, and acoustical ceiling installations.

**91:198 Blueprint Reading and Estimating (3 s.h.)** Residential and commercial blueprint reading and materials estimating covers understanding drawings, the language of construction. Students learn how to gather and use information from prints and drawings to estimate quantities of materials and perform construction work processes. (45-0)

**95:130 Communications I (3 s.h.)** Study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**96:150 Career Physics (4 s.h.)** Prerequisite/Corequisite: one semester of Career Math. An introduction to basic operating principles of gears, levers, pulleys, simple machines, and the effects of heat on solids, liquids, and gases. (45-30)

## Climate Control

### (Residential/Commercial Heating and Air-Conditioning)

Today's climate control technician installs, maintains, analyzes, and modifies heating and air-conditioning systems.

The Climate Control curriculum provides opportunities to develop the skills necessary for entry into the HVAC (heating, ventilation, air-conditioning) industry.

The Climate Control curriculum allows students to choose between completing a program in Climate Control Mechanics, which leads to a diploma with an emphasis in residential heating and air-conditioning or a program in Climate Control Technology, which leads to an associate in applied science degree with an emphasis in commercial heating and air-conditioning. Both programs are designed around a common group of courses. A diploma will be awarded upon successful completion of the prescribed curriculum with a grade point average of 2.00 (C) or better. This recognition is granted to a person who has completed at least thirty (30) semester hours of credit.

#### ENTRANCE ADVISING

Due to the highly technical nature of this program and NIACC's commitment to giving students the best possible opportunity for success, students will be scheduled for advisement sessions with counselors and program personnel. In these sessions, the student's career plans, previous background, transcripts, test scores, life experiences, and motivation will aid in designing a positive educational experience.

### Climate Control Mechanics

The Climate Control Mechanics diploma program is designed to provide graduates with the basic knowledge and skills necessary for installing and servicing residential heating and air-conditioning systems. Theory of operation, as well as installation and service techniques, for several types of residential heating and air-conditioning systems is covered.

Completion of this program prepares graduates to enter the Climate Control Technology degree program or to enter the following occupations:

- \* Residential heating/air-conditioning service mechanic
- \* Heating/air-conditioning installer
- \* Heating/air-conditioning parts salesperson

#### SUGGESTED SCHEDULE

##### First Term

91:101 Career Math I .....	4 s.h.
95:130 Communications I.....	3 s.h.
96:132 Electrical Concepts.....	3 s.h.
96:128 Residential Heating Systems .....	4 s.h.
96:129 Troubleshooting Heating Systems .....	3 s.h.
	<b>17 s.h.</b>

##### Second Term

89:150 Job-Seeking Skills .....	1 s.h.
91:102 Career Math II .....	4 s.h.
96:134 Air-Conditioning Principles .....	2 s.h.
96:150 Career Physics .....	4 s.h.
96:138 Residential Air-Conditioning Systems .....	4 s.h.
96:139 Troubleshooting Air-Cond. Systems.....	3 s.h.
	<b>18 s.h.</b>

**Total 35 s.h.**

### Climate Control Technology

The Climate Control Technology Program prepares students for entry into the commercial and industrial heating, ventilation, and air-conditioning industry.

The program does this by training the student in the following areas: designing, testing, troubleshooting, and servicing residential, commercial, institutional, and industrial heating, ventilation, and air-conditioning systems.

Special emphasis is placed on energy conservation and energy management. Students in the Climate Control Technology Program supplement their first year mechanics curriculum with specialty courses in the third and fourth terms that prepare graduates to enter the following occupations:

- \* Commercial heating/air-conditioning service technician
- \* Heating/air-conditioning lab technician
- \* Heating/air-conditioning sales engineer
- \* Heating/air-conditioning parts manager
- \* Manufacturer's field service representative

#### SUGGESTED SCHEDULE

##### First Term

91:101 Career Math I .....	4 s.h.
95:130 Communications I.....	3 s.h.
96:132 Electrical Concepts.....	3 s.h.
96:128 Residential Heating Systems .....	4 s.h.
96:129 Troubleshooting Heating Systems .....	3 s.h.
	<b>17 s.h.</b>

##### Second Term

91:102 Career Math II .....	4 s.h.
96:134 Air-Conditioning Principles .....	2 s.h.
96:150 Career Physics .....	4 s.h.
96:138 Residential Air-Conditioning Systems .....	4 s.h.
96:139 Troubleshooting Air-Cond. Systems.....	3 s.h.
	<b>17 s.h.</b>

##### Third Term

15:134 Computer Applications OR	
15:140 Intro to Computers and	
Information Systems.....	3 s.h.
91:124 Technical Graphics.....	2 s.h.
96:140 Metal Fabrication.....	2 s.h.
96:230 Commercial Heating Systems .....	5 s.h.
96:231 Advanced Control Systems .....	4 s.h.
	<b>16 s.h.</b>

## Fourth Term

15:241 Human Relations.....	3 s.h.
89:150 Job-Seeking Skills.....	1 s.h.
95:131 Communications II.....	3 s.h.
96:232 Air Distribution.....	3 s.h.
96:234 Commercial Air-Conditioning Systems .....	5 s.h.
96:235 Energy Management.....	3 s.h.
	<b>18 s.h.</b>
	<b>Total 68 s.h.</b>

## Course Descriptions - Climate Control Mechanics and Climate Control Technology

**15:134 Computer Applications (3 s.h.)** Emphasis on business applications of computer software. Students do business problems using electronic spreadsheets, word processing software, and data base management software. (30-30)

**15:140 Introduction to Computers and Information Systems (3 s.h.)** Emphasis on computer literacy and business applications of computer software. Students do business problems using electronic spreadsheets, word processing software, data base management software, and presentation software. Students also are exposed to some programming and web page development. (45-0)

**15:241 Human Relations (3 s.h.)** Problems of defining the wants of the worker and of management and bringing these elements together in formal and informal organizations; implementing programs to help them achieve their common purpose to work together productively and cooperatively and with economic, psychological, and social satisfaction. (45-0)

**89:150 Job-Seeking Skills (1 s.h.)** Develop skills necessary to find, obtain, and keep a job. Students learn to understand and appreciate the world of work as they examine personal job readiness and skills to make job-entry successful. (15-0)

**91:101 Career Math I (4 s.h.)** This course is intended to provide the student with mathematics topics and applications having specific emphasis to Automotive, Building Trades, Climate Control Technology, General Machinist, and Tool & Die Technology. Topics include basic mathematical operations, formulas, and multi-dimensional measurement and calculation. (60-0)

**91:102 Career Math II (4 s.h.)** This course is a continuation of Career Math I. Additional topics include geometry, trigonometry and descriptive statistics with an emphasis on application. (60-0)

**91:124 Technical Graphics (2 s.h.)** development of the skills of interpreting machine/system drawings, including mechanical, hydraulic, pneumatic layouts. Electronic circuit drawing, terms, symbols, and standards. Use of templates with printed circuits, schematic diagrams, and sketching. (30-0)

**91:299A-D Special Problems in Career Programs (1-4 s.h.)** Course arranged with special permission of instructor and Division Chair. Credit is based on standard contact hours and assigned by Division Chair and approved by Vice President for Academic Affairs.

**95:130 Communications I (3 s.h.)** Study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**95:131 Communications II (3 s.h.)** Further study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**96:128 Residential Heating Systems (4 s.h.)** Prerequisite: 96:132, Electrical Concepts, or instructor's permission. The purpose of this course is to introduce the student to the various types of residential heating systems. Areas and concepts covered include combustion theory, basic air distribution, furnace construction, filters, humidifiers, installation techniques, and maintenance procedures. (30-105)

**96:129 Troubleshooting Heating Systems (3 s.h.)** Prerequisite: 96:132, Electrical Concepts, or instructor's permission. The purpose of this course is to introduce the student to the fundamentals of troubleshooting by utilizing a practical and systematic approach to locate and repair heating system malfunctions. The student will also have the opportunity to study, in detail, the motors and controls used in today's heating systems. Topics to be covered include basic electric circuits, electrical test meters, motors and controls, diagnosis of electrical and mechanical malfunctions, and special emphasis on writing diagrams. (15-90)

**96:132 Electrical Concepts (3 s.h.)** The purpose of this course is to acquaint the student with electrical fundamentals. It will provide basic electrical and electronic background for a variety of technical fields which require such knowledge. Areas of instruction include safety, direct and alternating current, semiconductor and digital electronics, motors and controls, shop and lab practices. (30-45)

**96:134 Air-Conditioning Principles (2 s.h.)** Study of the theory of air-conditioning. Includes psychometrics, heat gain/loss problems, and equipment sizing. (15-45)

**96:138 Residential Air-Conditioning Systems (4 s.h.)** Prerequisite: 96:132, Electrical Concepts, or instructor's permission. The purpose of this course is to introduce the student to the various types of residential air-conditioning and heat pump systems. Areas and concepts covered include refrigeration, air-conditioning, heat pump theory, heat pump construction, installation techniques, and maintenance procedures. (30-105)

**96:139 Troubleshooting Air-Conditioning Systems (3 s.h.)** Prerequisite: 96:132, Electrical Concepts, or instructor's permission. The purpose of this course is to introduce the student to the fundamentals of troubleshooting by utilizing a practical and systematic approach to locate and repair air-conditioning and heat pump system malfunctions. The student will also have the opportunity to study, in detail, the motors and controls used in today's air-conditioning and heat pump systems. Topics to be covered include basic electric circuits, electrical test meters, motors and controls, diagnosis of electrical and mechanical malfunctions, and special emphasis on wiring diagrams. (15-90)

**96:140 Metal Fabrication (2 s.h.)** Use of selected sheet metal tools, layout, cutting, forming, and assembly of sheet metal as well as soldering and brazing processes. (15-45)

**96:150 Career Physics (4 s.h.)** Prerequisite/Corequisite: one semester of Career Math. An introduction to basic operating principles of gears, levers, pulleys, simple machines, and the effects of heat on solids, liquids, and gases. (45-30)

**96:230 Commercial Heating Systems (5 s.h.)** Prerequisite: 96:128, Residential Heating Systems, or instructor's permission. This course covers large heating systems used in commercial, institutional, and industrial applications. Types of equipment include hot water and low-pressure steam boilers and rooftop heating units. (30-135)

**96:231 Advanced Control Systems (4 s.h.)** Prerequisite: 96:129, Troubleshooting Heating Systems; and 96:139, Troubleshooting Air-Conditioning Systems, or instructor's permission. Major emphasis is on four basic types of control systems: pneumatic, electronic, electromechanical, and digital as applied to large heating and air-conditioning applications. (30-120)

**96:232 Air Distribution (3 s.h.)** Prerequisite: 96:134, Air-Conditioning Principles, or instructor's permission. A study of the construction and design of duct work and related duct fittings. Includes correct layout and sizing of ducts, return and supply grills, and use of airflow measuring instruments. (30-60)

**96:234 Commercial Air-Conditioning Systems (5 s.h.)** Prerequisite: 96:138, Residential Air-Conditioning Systems, or instructor's permission. This course covers large cooling systems used in commercial, institutional, and industrial applications. Types of equipment include water chillers, multistage reciprocating units, and an introduction to absorption systems. (30-135)

**96:235 Energy Management (3 s.h.)** Prerequisite/Corequisite: 96:231, Advanced Control Systems, or instructor's permission. A course designed to examine the consumption of energy in commercial and industrial buildings and how energy usage may be reduced. Topics include building design, load management, improving equipment efficiency, improved lighting systems, utility rate structures, and energy management control systems. (30-60)

#### **Quotable Quote:**

Nobody can go back and start a new beginning, but anyone can start today and make a new ending.

-Maria Robinson

## Electronics Technology

Electronics Technology is an associate of applied science degree program designed to prepare the graduate for immediate employment as electronic maintenance personnel in manufacturing settings and with manufacturers of electronic equipment.

### ACCREDITATION

The Electronics Technology Program is fully accredited by the National Association of Industrial Technology (NAIT). This is your guarantee that these programs have attained the highest standards and remain committed to providing you with the best education possible.

### CERTIFICATIONS

Graduates of the Electronics Technology Program are automatically eligible for recognition as a Certified Industrial Technologist (CIT) by the National Association of Industrial Technology (NAIT). Applicable fees are paid by the graduate if certification is desired. Students may also earn recognition as a Certified Electronic Technician Associate Level (CETa) by the Electronics Technicians Association (ETA). To earn such recognition, the student must pass the National Certified Electronics Technician Exam which is required of all program completers. These certifications are additional evidence to you and potential employers of NIACC's commitment to your success.

### ENTRANCE ADVISING

Due to the highly technical nature of these programs and NIACC's commitment to giving students the best possible opportunity for success, students will be scheduled for advisement sessions with counselors and program personnel. In these sessions, the student's career plans, previous educational background, transcripts, test scores, life experiences, and motivation will aid in designing a positive educational experience.

### COLLEGE TRANSFER OPTION

Through articulation agreements with Iowa State University and the University of Northern Iowa, graduates may continue their education by transferring to baccalaureate programs in such industrial technology fields as manufacturing, electromechanical systems, engineering technology, or supervision and management. Help of a NIACC counselor or program instructor is required.

### ENTRANCE REQUIREMENTS

1. Two years of high school algebra or applied math with a grade of C or better, OR
2. College intermediate algebra or equivalent with a grade of C or better, OR
3. COMPASS algebra test of 76 or higher.

Classes may be scheduled to accommodate the part-time student with the help of a counselor or program instructor.

Graduates of the Electronics Technology Program may find work in the following occupations:

- \*Electronics technician
- \*Industrial process technician
- \*Industrial maintenance technician
- \*Instrumentation technician
- \*Electromechanical technician
- \*Control systems technician
- \*Computer automated process control technician

## Special Program Requirements

As part of the requirements for graduation, students are required to take the Certified Electronics Technology (CET) Exam during their fourth semester. The cost (\$50) for the exam is the student's responsibility. Students are required to complete 12 semester hours of their technical core course work for the Electronics Technology Program at North Iowa Area Community College.

### SUGGESTED SCHEDULE

#### First Term

96:132 Electrical Concepts.....	3 s.h.
91:104 Intro to Tech Computing & CAD.....	3 s.h.
91:175 DC/AC Theory.....	5 s.h.
91:107 Technical Mathematics I OR .....	4 s.h.
40:151 College Alg & Trig I (4 s.h.)	
95:130 Communications I OR .....	3 s.h.
30:101 Comm Skills I (3 s.h. or 4 s.h.)	

**18 s.h.**

#### Second Term

91:179 Electronic Devices & Circuits .....	3 s.h.
91:214 Digital Electronics.....	3 s.h.
91:108 Technical Mathematics II OR .....	4 s.h.
40:152 College Alg & Trig II (4 s.h.)	
91:105 Motors, Controls & Industrial Wiring.....	4 s.h.
92:202 C/C++ Programming .....	3 s.h.
95:131 Communications II OR .....	3 s.h.
30:102 Comm Skills II (3 s.h. or 4 s.h.)	

**20 s.h.**

#### Summer Term

91:110 Electronics Tech Internship.....	<b>2 s.h.</b>
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#### Third Term

91:281 Microprocessors.....	3 s.h.
91:204 Advanced Control Systems.....	5 s.h.
91:109 Technical Mathematics III OR .....	3 s.h.
40:240 Calculus For Business (3 s.h.)	
91:210 Technical Physics I OR .....	4 s.h.
70:280 General Physics I (4 s.h.) OR	
70:122 Prin of Physics (4 s.h.) OR	
70:140 Introductory Chemistry (4 s.h.)	
92:118 Fluid Power .....	3 s.h.

**18 s.h.**

## Fourth Term

91:206 Computer Automated Manufacturing .....	3 s.h.
91:207 Instrumentation Technology .....	3 s.h.
92:227 Automated Manufacturing Processes ....	3 s.h.
89:150 Job-Seeking Skills .....	1 s.h.
15:241 Human Relations OR .....	3 s.h.
80:101 General Psychology (3 s.h.)	
91:211 Technical Physics II OR .....	4 s.h.
70:281 Gen Physics II (4 s.h.) OR	
70:122 Prin of Physics (4 s.h.) OR	
70:140 Introductory Chemistry (4 s.h.)	
91:289 Certified Electronics Tech Exam	
Elective (2 s.h.)	

17 s.h.

**Total 75 s.h.****Course Descriptions -  
Electronics Technology**

**15:241 Human Relations (3 s.h.)** Problems of defining the wants of the worker and of management and bringing these elements together in formal and informal organizations; implementing programs to help them achieve their common purpose to work together productively and cooperatively and with economic, psychological, and social satisfaction. (45-0)

**30:101C Communication Skills I (3 s.h.)** Improvement of skills in reading and writing with an emphasis on expository methods of development and personal experience as supporting material. Students must meet minimum competency requirements in writing and speaking to receive a grade of C or higher. Students may use the computer editing system, Writer's Workbench. (45-0)

**30:101 Communication Skills I (4 s.h.)** Improvement of skills in reading, writing, speaking, and listening, with emphasis on expository methods of development and personal experience as supporting material. Students must meet minimum competency requirements in writing and speaking to receive a grade of C or higher. Students may use word processors and the computer-aided editing system, Writer's Workbench. (60-0)

**30:102C Communication Skills II (3 s.h.)** Continuation of 30:101 with emphasis on argumentative and persuasive writing, research methods, and language. Students must meet minimum competency requirements in writing to receive a grade of C or higher. Students may use the computer editing system, Writer's Workbench. (45-0)

**30:102 Communications Skills II (4 s.h.)** Continuation of 30:101 with emphasis on argumentative and persuasive writing and speaking, research methods, and language. Students must meet minimum competency requirements in writing and speaking to receive a grade C or higher. Students may use the computer editing system, Writer's Workbench. (60-0)

**40:151 College Algebra & Trigonometry I (4 s.h.)** Prerequisite: three semesters of high school algebra or 40:120, Intermediate Algebra, or equivalent. This course is intended for students majoring in business, social science, biological sciences, liberal arts, and those mathematics students with insufficient background to begin the study of calculus and feel they cannot keep up the pace of Precalculus. Topics include review of algebraic operations, field properties, introduction to plane analytic geometry, including points and lines, functions of various types such as polynomials and their graphs, operations with complex numbers, and circular functions. (60-0)

**40:152 College Algebra & Trigonometry II (4 s.h.)** Prerequisite: 40:151, College Algebra & Trigonometry I. This course is a continuation of 40:151. Topics include further study of functions, inverse functions, study of vectors, complex numbers, DeMoivre's theorem, solution of systems of equations, matrices, solid analytical geometry, probability, sequences and series, logarithmic and exponential functions. (60-0)

**40:240 Calculus for Business (3 s.h.)** Prerequisite: 40:161, Precalculus, or equivalent. This course uses calculus techniques with an emphasis on applications. Topics include derivatives and their uses, exponential and logarithmic functions, integration and its applications, and calculus of several variables. (45-0)

**70:122 Principles of Physics (4 s.h.)** Prerequisite: 40:120, Intermediate Algebra or equivalent. An introductory level, one-term course. Major topics are measurement, matter in motion, heat, wave motion, electricity and magnetism, and modern physics. (45-30)

**70:140 Introductory Chemistry (4 s.h.)** Prerequisite: 40:060, Beginning Algebra, or equivalent. A first year college chemistry course which covers the concepts of chemistry. Among the topics included are systems of measurement, matter and energy, atomic theory, energy levels and atomic structure, the periodic table, ionic and covalent bonding, chemical equations, stoichiometry, acids and bases, states of matter, solutions, and redox. Lab experiments are performed and complement the classroom theory. Not accepted as a prerequisite for other advanced chemistry courses except 70:273, Organic Chemistry. (45-30)

**70:280 General Physics I (4 s.h.)** Prerequisite: 40:151, College Algebra & Trigonometry, or equivalent. Mechanics, simple harmonic motion, waves, and fluids. Designed for students in pharmacy, medicine, dentistry, and professional fields other than engineering. Liberal arts students with an interest in science may elect this course. (45-30)

**70:281 General Physics II (4 s.h.)** Prerequisite: Math, 40:151, College Algebra & Trigonometry, or equivalent, and 70:280, General Physics I, or equivalent algebra-based first semester physics course as approved by the instructor. A continuation of 70:280, thermodynamics, electricity and magnetism, DC and AC circuits, optics, and atomic physics. (45-30)

**80:101 General Psychology (3 s.h.)** Prerequisite: New students with entering ACT or COMPASS reading scores below college level will be required to enroll in College Reading Skills (30:120). Introduction to the scientific study of behavior: a brief history of psychology as a science; influences of heredity and environment; motivation, frustration and conflict; the learning process, intelligence, perception, and mental health. (45-0)

**89:150 Job-Seeking Skills (1 s.h.)** Develop skills necessary to find, obtain, and keep a job. Students learn to understand and appreciate the world of work as they examine personal job readiness and skills to make job entry successful. (15-0)

**91:104 Introduction to Technical Computing and Computer-Aided Drafting (3 s.h.)** Prerequisite/Corequisite: Ability to key-enter the equivalent of 25 words/minute at a computer keyboard. Introduction to Technical Computing and Computer-Aided Drafting is designed to familiarize the student with microcomputer basics relating to occupations in the industrial/technical area. Topics include elementary computer management and organization using Microsoft WINDOWS, disk organization and access, file handling, basic word processing, and two-dimensional computer-aided drafting (CAD). (30-30)

**91:105 Motors, Controls, and Industrial Wiring (4 s.h.)** Prerequisite: 96:132, Electrical Concepts; and 91:178, DC/AC Theory. Introduction to industrial electrical motor and control circuitry. Emphasis placed on AC single and three-phase circuit and transformer theory and industrial applications. Applications include various types of control elements. Study of the National Electrical Code as it pertains to manufacturing/industrial environment. Fundamental skills in electrical wiring and raceway techniques are learned through lab and/or project exercises. (30-60)

**91:107 Technical Mathematics I (4 s.h.)** Prerequisite: One year of high school algebra or consent of instructor. This course provides an integrated approach to mathematics designed to provide principles of measured data, engineering procedures, basic algebra, geometry, right and oblique triangle trigonometry, logarithms, and elementary vectors. Practical mathematics is emphasized. (60-0)

**91:108 Technical Mathematics II (4 s.h.)** Prerequisite: 91:107, Technical Mathematics I; or 40:151, College Algebra and Trigonometry I. This course is a continuation of Technical Mathematics I. Topics include advanced algebra, complex numbers, binary and hexadecimal numbers, trigonometric identities, and analytic geometry. Practical mathematics is emphasized. (60-0)

**91:109 Technical Mathematics III (3 s.h.)** Prerequisite: 91:108, Technical Mathematics II; or equivalent. Basic Calculus: provides manipulative skills of calculus and basic theory. Includes functions, limits, definitions, fundamental theorem, derivatives, transcendental functions, integral techniques, definite integrals, and basic applications. (45-0)

**91:110 Electronics Tech Internship (2 s.h.)** Prerequisite: sophomore status in the Electronics Technology Program and permission of internship coordinator. Supervised work experience in a business or industry. Work must be related to the major field of study; i.e., electricity/electronics, industrial maintenance, installation or service of control systems, etc. (0-160)

**91:113 Electronic Devices and Circuits II (4 s.h.)** Prerequisite/Corequisite: 91:179, Electronic Devices and Circuits I; 91:108, Technical Mathematics II. Advanced topics in electronic devices including field effect transistors (FETs), operational amplifiers (op amps), active filters, instrumentation circuits using op amps, thyristors, and voltage regulation. Applications and troubleshooting techniques. (30-60)

**91:118 Computer Programming and Programmable Logic Controllers (3 s.h.)** Prerequisite/Corequisite: 91:104, Introduction to Technical Computing and CAD. Structured programming using Quick BASIC and QBASIC. General input and output, subroutines, arrays, data handling, external I/O, and file I/O are covered. Practical program projects are utilized to reinforce programming theory. Introduction to programmable logic controllers (PLCs) using the Allen Bradley SLC500 and advanced programming software. Elementary ladder logic, internal and external contact instructions, counters, timers, program development techniques, and troubleshooting. (30-30)

**91:175 DC/AC Theory (5 s.h.)** Prerequisite/Corequisite: 96:132 Electrical Concepts, 91:107, Technical Mathematics I. Study of the nature of electricity involving direct and alternating current. DC circuit analysis utilizing more advanced techniques such as: superposition, Thevenin's and Norton's theorems. AC circuit analysis involving RL, RC, and RLC circuits, inductive and capacitive reactances, resonance, and transformer fundamentals. Computer circuit simulation of both DC and AC circuits is stressed along with a continued application of electronic test equipment; oscilloscopes, meters, and power supplies found in laboratory environments. (45-105)

**91:179 Electronic Devices and Circuits I (3 s.h.)** Prerequisite/Corequisite: 91:178, DC/AC Theory; 91:107, Technical Mathematics I. Study of diodes and bipolar transistors as they are used in both AC and DC electronic circuits. Applications such as power supplies, switching circuits, and amplifier circuits are covered. Special purpose semiconductors and their applications are also explored. Common base, common collector, and common emitter amplifier configurations and associated analysis techniques are covered. Both circuit analysis and measurement techniques using meters and oscilloscopes are stressed. Computer simulation of the devices under study, as they are utilized in AC and DC circuits, is covered. A term paper and oral presentation are required. (30-45)

**91:204 Advanced Control Systems (5 s.h.)** Prerequisite/Corequisite: 91:105, Motors, Controls, and Industrial Wiring. Introduction to programmable logic controllers (PLC's) using the Allen Bradley SLC500 and RS Logix 500 programming software, elementary ladder logic and external contact

instructions, counters, timers, program development techniques, and troubleshooting. Advanced topics in programmable logic controllers including program control instructions, math operations, analog I/O, sequencers, and data manipulation. Field wiring of PLCs to control devices using standardized practices. Motor control circuitry utilizing advanced control techniques, application of variable frequency drives for AC motors. Instrumentation programming with LabVIEW. Projects involving practical field devices and program development. (40-105)

**91:206 Computer Automated Manufacturing (3 s.h.)**

Prerequisite/Corequisite: 92:227, Automated Manufacturing Processes. Introduction to robotic fundamentals including the integration of robots and programmable logic controllers in the operation of a flexible manufacturing line (FML). Group dynamics, project structure, and troubleshooting techniques. (30-45)

**91:207 Instrumentation Technology (3 s.h.)** Prerequisite/Corequisite: 91:118, Computer Programming and PLCs; 91:113, Electronic Devices and Circuits II. Modern instrumentation techniques as they apply to the manufacturing environment. Instrumentation amplifiers and linear integrated circuits for industrial applications. Industrial sensors, transducers, and related components. Industrial process control theory, telemetry, and data communication. A final group instrumentation project is required. (30-45)

**91:210 Technical Physics I (4 s.h.)** Prerequisite/Corequisite: 91:107, Technical Mathematics I; 40:151, College Algebra and Trigonometry I. This course presents traditional fields of physics such as measurement, mechanics, properties of matter, simple harmonic motion, and waves. Emphasis is placed on industrial and technical applications of physics. (45-30)

**91:211 Technical Physics II (4 s.h.)** Prerequisite/Corequisite: 91:107, Technical Mathematics I; 40:151, College Algebra and Trigonometry I, or an equivalent course in algebra and trigonometry. This course presents traditional fields of physics such as thermodynamics, electricity and magnetism, DC and AC circuits, and light. Emphasis is placed on industrial and technical applications of physics. (45-30)

**91:214 Digital Electronics (3 s.h.)** Prerequisite/Corequisite: 91:178, DC/AC Theory. Study of number systems related to digital circuits, Boolean Algebra/Karnaugh Maps. Combinational logic including AND, OR, NAND, NOR, NOT, and XOR. Combinational circuits, decoders. Basic sequential elements including SR, D, JK, and Master-Slave flipflops. Sequential circuits including registers and counters. Memory circuits and applications. Analog to digital (A/D) and digital to analog (D/A) conversion, and elementary interfacing. Design, analysis, and computer simulation. (30-45)

**91:281 Microprocessors (3 s.h.)** Prerequisite/Corequisite: 91:215, Digital Electronics. Advanced topics in digital electronics including timers, analog to digital (A/D) and digital to analog (D/A) converters, and optocouplers. Microprocessor theory and architecture are covered. The architecture and instruction set of the

Motorola 68HC11 family are studied. Programming techniques utilizing elementary assembly language for the MC68HC11 are practiced. Applications and troubleshooting techniques. (30-30)

**91:289 Certified Electronics Technician Exam Review (2 s.h.)**

Prerequisite/Corequisite: 91:207, Instrumentation Technology. Review of fundamental electrical and electronic circuits are preparation for the Associate Level Certified Electronic Technician Examination. Application specific topics in radio frequency (RF) communications. (30-0)

**91:299A-D Special Problems in Career Programs (1-4 s.h.)**

Course arranged with special permission of instructor and Division Chair. Credit is based on standard contact hours as assigned by Division Chair and approved by the Vice President for Academic Affairs.

**92:118 Fluid Power (3 s.h.)**

Prerequisite/Corequisite: 91:107, Technical Mathematics I. Principles of fluid power pertaining to pressure, volume, and flow. Overview of hydraulic and pneumatic power generation, control transmission, and actuation devices. Computer design and simulation of fluid power circuits. Hands-on labs using practical fluid power equipment. (30-30)

**92:202 C/C++ Programming (3 s.h.)**

Prerequisite: 91:104 Intro to Technical Computing and CAD. Structured computer programming utilizing C/C++. Use of existing library functions. Development of structured programming practices and internal documentation. Branching, loops, pointers, strings, arrays and file I/O. Introduction to object-oriented programming. Data structure, language, and hardware interfacing concepts are introduced. Program debugging and implementation. (45-0)

**92:227 Automated Manufacturing Processes (3 s.h.)**

Prerequisite/Corequisite: 91:118, Computer Programming and Programmable Logic Controllers. Fundamentals of computer numerical control (CNC). Programming of CNC machines using G and M codes. Projects on CNC mill and/or CNC lathe. Fundamental skills in forming, separating, and fastening. (30-45)

**95:130 Communications I (3 s.h.)**

Study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**95:131 Communications II (3 s.h.)**

Further study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**96:132 Electrical Concepts (3 s.h.)**

The purpose of this course is to acquaint the student with electrical fundamentals. It will provide basic electrical and electronic background for a variety of technical fields which require such knowledge. Areas of instruction include safety, direct and alternating current, semiconductor and digital electronics, motors and controls, shop and lab practices. (30-45)

## General Machinist

General Machinist is a two-semester diploma program designed to provide in-depth study and considerable hands-on skills in the machine processing of a variety of metals. This one-year program provides the foundation for the associate of applied science program, Tool and Die Technology.

Students become proficient in the operation of manual mills, lathes, grinders, drills, and saws as they complete increasingly complex projects while holding tight tolerances. Various pieces of precision measuring equipment (optical comparator, coordinate measuring machine, etc.) are used to check quality. Additional work in blueprint reading, heat-treating, and computer numerical controlled (CNC) machining is required to complete the General Machinist Program.

Upon satisfactory completion of this program, students are awarded a NIACC diploma. Program graduates have the option to continue into the A.A.S. Tool and Die Technology Program or immediately begin employment in an area machine shop or manufacturing facility producing a wide variety of machined parts.

### ENTRANCE ADVISING

Due to the highly technical nature of this program and NIACC's commitment to giving students the best possible opportunity for success, students are scheduled for advisement sessions with counselors and program personnel. In these sessions, the student's career plans, previous background, transcripts, test scores, life experiences, and motivation aid in designing a positive educational experience.

### SUGGESTED SCHEDULE

#### First Term

91:101 Career Math I .....	4 s.h.
95:130 Communications I.....	3 s.h.
96:162 Computer Orientation.....	1 s.h.
96:163 Blueprint Reading I.....	1 s.h.
96:165 Machine Tool Practices I.....	9 s.h.
	<b>18 s.h.</b>

#### Second Term

91:102 Career Math II .....	4 s.h.
96:150 Career Physics.....	4 s.h.
96:164 Blueprint Reading II.....	1 s.h.
96:166 Machine Tool Practices II.....	7 s.h.
96:167 Fundamentals of CNC.....	3 s.h.
	<b>19 s.h.</b>

**Total** **37 s.h.**

## Tool and Die Technology

Tool and Die Technology is a five-semester degree program which is a continuation of the General Machinist diploma program. The Tool and Die Technology Program builds upon the previous studies with an in-depth study of high-precision industrial dies and die components, progressive dies, and plastics industry molds. A portion of the program is devoted to producing computer-aided drawings (CAD) of molds and dies, and then using computer-aided manufacturing (CAM) software to generate CNC machine language. Students operate computer-numeric controlled (CNC) machine tools to produce many of their second year projects.

Upon satisfactory completion of this program, students are awarded an associate in applied science degree. Program graduates are prepared to work in the "tool room" of area manufacturers or to work for a specialty tool and die shop producing dies and molds for a large variety of production machines in our area.

### SUGGESTED SCHEDULE

#### First Term

91:101 Career Math I .....	4 s.h.
95:130 Communications I.....	3 s.h.
96:162 Computer Orientation.....	1 s.h.
96:163 Blueprint Reading I.....	1 s.h.
96:165 Machine Tool Practices I.....	9 s.h.
	<b>18 s.h.</b>

#### Second Term

91:102 Career Math II .....	4 s.h.
96:150 Career Physics.....	4 s.h.
96:164 Blueprint Reading II.....	1 s.h.
96:166 Machine Tool Practices II.....	7 s.h.
96:167 Fundamentals of CNC.....	3 s.h.
	<b>19 s.h.</b>

#### Third Term (Summer)

96:168 Fundamentals of Drafting.....	1 s.h.
96:169 Welding .....	2 s.h.
96:170 Statistical Process Control (SPC).....	1 s.h.
96:171 Tool and Die Making I .....	5 s.h.
96:172 Fundamentals of EDM.....	2 s.h.
	<b>11 s.h.</b>

#### Fourth Term

15:241 Human Relations.....	3 s.h.
89:150 Job-Seeking Skills.....	1 s.h.
96:270 Computer-Aided Drafting (CAD).....	2 s.h.
96:271 Tool and Die Making II .....	8 s.h.
96:272 Computer-Aided Manufacturing (CAM) ..	3 s.h.
	<b>17 s.h.</b>

#### Fifth Term

95:131 Communications II.....	3 s.h.
96:273 Plastics Materials and Methods.....	1 s.h.
96:274 Mold Making I.....	9 s.h.
96:275 Advanced CNC & EDM .....	2 s.h.
	<b>15 s.h.</b>

**Total** **80 s.h.**

## Course Descriptions - General Machinist and Tool and Die

**89:150 Job-Seeking Skills (1 s.h.)** Develop skills necessary to find, obtain, and keep a job. Students learn to understand and appreciate the world of work as they examine personal job readiness and skills to make job entry successful. (15-0)

**91:101 Career Math I (4 s.h.)** This course is intended to provide the student with mathematics topics and applications having specific emphasis to Automotive, Building Trades, Climate Control Technology, General Machinist, and Tool & Die Technology. Topics include basic mathematical operations, formulas, and multi-dimensional measurement and calculation. (60-0)

**91:102 Career Math II (4 s.h.)** This course is a continuation of Career Math I. Additional topics include geometry, trigonometry and descriptive statistics with an emphasis on application. (60-0)

**95:130 Communications I (3 s.h.)** Study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**95:131 Communications II (3 s.h.)** Further study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**96:150 Career Physics (4 s.h.)** Prerequisite/Corequisite: one semester of Career Math. An introduction to basic operating principles of gears, levers, pulleys, simple machines, and the effects of heat on solids, liquids, and gases. (45-30)

**96:162 Computer Orientation (1 s.h.)** In this introductory course, students explore and compare DOS and Windows operating environments using the keyboard and mouse. The students create documents while exploring Microsoft Word. The students create spreadsheets and charts using Microsoft Excel, pull-down menus, tool bars, copying techniques, formatting techniques, and data management. (0-30)

**96:163 Blueprint Reading I (1 s.h.)** An introduction to the importance of prints in industry. Covers isometric drawings, orthographic projection, auxiliary views, detail and assembly drawing, dimensions and tolerances, and sectional views. Integrates the alphabet of lines and principles of sketching. Other information covered includes title blocks, drawing change systems, drawing notes, and material lists. (0-30)

**96:164 Blueprint Reading II (1 s.h.)** Prerequisite/Corequisite: 96:163, Blueprint Reading I. Continues Blueprint Reading I with emphasis on geometric dimensioning and tolerancing and the interpretation of more advanced prints used in the construction of tool and die and mold building. (0-30)

**96:165 Machine Tool Practices I (9 s.h.)** Prerequisite/Corequisite: 91:101, Career Math I; and 96:163, Blueprint Reading I. Covers theory and lab use of basic measuring and machining tools, layout inspection tools, as well as bench work. Safety is taught and enforced as it applies to each machine process. Proper terminology of the machinist trade is emphasized as well as following blueprints and holding tolerances through the use of a variety of machining processes to produce a product. (60-225)

**96:166 Machine Tool Practices II (7 s.h.)** Prerequisite/Corequisite: 96:165, Machine Tool Practices I and to be taken concurrently with 91:102, Career Math II; and 96:164, Blueprint Reading II. Continues Machine Tool Practices I. Covers more advanced principles in setup and operation of mills, lathes, and grinders, with an introduction to carbide tooling along with a continued emphasis on shop safety, communication, and cooperation. Stresses the interrelationship of manufactured mating parts. (45-195)

**96:167 Fundamentals of CNC (3 s.h.)** Prerequisite/Corequisite: 96:166, Machine Tool Practices II. Covers computer numerical control (CNC) as it relates to milling machines, turning lathes, microcomputers, and related software. Emphasis on input language, codes, machine setup and operation, inspection of parts, and communication of peripherals. (30-30)

**96:168 Fundamentals of Drafting (1 s.h.)** Theory, technical skills, industrial applications, and practices of technical sketching, engineering lettering, selection and use of equipment, geometric construction, multi-views, and auxiliary views. (0-30)

**96:169 Welding (2 s.h.)** This is a basic arc/oxy-fuel welding and cutting course. The students learn introductory skills in SMAW, GTAW, and GMAW welding, oxy-acetylene welding, and oxy-fuel cutting. The students learn and understand safety procedures relating to subjects and shop safety in general. (15-30)

**96:170 Statistical Process Control (SPC) (1 s.h.)** Covers the current transformation methods of industry and business toward a complete quality control system. Management theory on quality, productivity, and controlled charting techniques are included. (15-0)

**96:171 Tool and Die Making I (5 s.h.)** Prerequisite/Corequisite: 96:166, Machine Tool Practices II, 96:167, Fundamentals of CNC. This course is an introduction to the design of industrial dies and machining characteristics of die components. The student is introduced to additional machining skills that will be encountered in typical die shops in the building of dies, jigs, fixtures, and precision machine parts. (30-160)

**96:172 Fundamentals of EDM (2 s.h.)** Prerequisite/Corequisite: 96:171, Tool and Die Making I. The students are introduced to the electrical discharge machines, both wire and ram-type. Emphasis on how these tools are used in the manufacturing of punch and die components and injection mold cores and cavities. (15-45)

**96:192 Intro to Geometric Dimensioning and Tolerancing (2 s.h.)** Begins with an introduction to the international engineering language, Geometric Dimensioning and Tolerancing (GD&T). The students are taught to recognize the symbols and to understand the terms and rules used in GD&T, according to the American Society of Mechanical Engineers (ASME) Y 14.5M 1994 standards. The students then learn how to apply these symbols to the features of a part and provide a very concise and clear definition of design intent. (30-0)

**96:270 Computer-Aided Drafting (CAD) (2 s.h.)** Prerequisite/Corequisite: 96:168, Fundamentals of Drafting. Students are introduced to computer-aided drafting and design as an essential tool utilizing and enhancing the student's existing drafting skills. This is accomplished through the generation of two- and three-dimensional orthographic drawings as well as pictorial techniques in the CAD environment. Operating systems commands, cursor manipulation, direct display interaction, geometry creation and manipulation, file storage and retrieval, entity manipulation such as rotation and mirroring, and the use of output devices such as printers and plotters are just a few of the hardware and software capabilities to be covered. (15-30)

**96:271 Tool and Die Making II (8 s.h.)** Prerequisite/Corequisite: 96:171, Tool and Die Making I. This course is a continuation of Tool and Die Making I with instruction and practice in building a progressive die from a blueprint. Emphasis is placed on the die building procedures learned in Tool and Die Making I toward fabricating more complex dies. Instruction is given on the considerations involved in developing die components, such as calculation of clearances, cutting forces, press tonnage requirements, and practice in building a complete functional die from a blueprint. (45-225)

**96:272 Computer-Aided Manufacturing (CAM) (3 s.h.)** Prerequisite/Corequisite: 96:167, Fundamentals of CNC. This program provides an introduction to (Process Modeling) utilizing the CNC graphics programming system. Using engineering drawings, students program various parts for CNC mills and CNC lathes. Related topics include job planning, tool selection, construction of a process model, tool path verification, simulation, quality control, CAD, CAM data transfer, and CNC code generation. (15-60)

**96:273 Plastic Materials and Methods (1 s.h.)** This is a survey course designed to introduce the student to the field of plastics. This overview includes thermoplastics and thermoset materials along with the major processing methods being utilized by industry today. (15-0)

**96:274 Mold Making I (9 s.h.)** Prerequisite/Corequisite: 96:271, Tool and Die Making II; 96:273, Plastic Materials and Methods. Introduces the student to the field of mold making for the plastic injection industry. Focus is placed on mold theory, mold repair, identification of problems, and the correction as related to thermoplastic injection molds, standardization of mold components, mold blueprint reading, and machine shop skills necessary for mold making. In addition, this course gives students the necessary basic skills of stoning and polishing as well as hands-on experience necessary to manufac-

ture mold plates and ejection systems. This course gives the students an opportunity to make a prototype injection mold of their design. (45-285)

**96:275 Advanced CNC & EDM (2 s.h.)** Prerequisite/Corequisite: 96:274, Mold Making I. A continuation of CNC and EDM fundamentals as well as mold making with additional instruction and practice in the use of CAD, wire, and ram electrical discharge machines in the construction of die and mold components. (15-45)

## Mechanical Design Technology

The Mechanical Design Technology curriculum provides opportunities to be productive immediately as a CAD drafter with the technical competence to keep abreast of developments in the field and allow greater potential for future advancement into design.

The NIACC Drafting Program includes instruction on Computer-Aided Design (CAD) equipment. The curriculum is designed to prepare the student to apply technical knowledge, methods, and skills in support of engineering activities while becoming proficient in CAD. The graduate is ready for immediate employment with manufacturers of various products such as farm and industrial machinery, consumer products, computers and control equipment, governmental agencies, and engineering firms.

New employees are usually assigned as CAD technicians, mechanical design drafters, CAD drafters, mechanical drafting, drafters or designers. Upon completion of the prescribed curriculum with an average grade point of 2.00 (C), the student is awarded an associate in applied science degree. Some courses may be taken toward other associate degrees; check with a counselor.

### ENTRANCE ADVISING

Due to the highly technical nature of these programs and NIACC's commitment to giving students the best possible opportunity for success, students will be scheduled for advisement sessions with counselors and program personnel. In these sessions, the student's career plans, previous educational background, transcripts, test scores, life experiences, and motivation will aid in designing a positive educational experience.

### COLLEGE TRANSFER OPTION

Through articulation agreements with Iowa State University and the University of Northern Iowa, graduates may continue their education by transferring to baccalaureate programs in such fields as Industrial Technology, General Industry and Technology, or Manufacturing Technology. Help of a NIACC counselor or program instructor is required.

### ENTRANCE REQUIREMENTS

1. Two years of high school algebra with a grade of C or better, OR
2. College intermediate algebra or equivalent with a grade of C or better, OR
3. COMPASS algebra test of 76 or higher.

Classes may be scheduled to accommodate the part-time student with the help of a counselor or program instructor. Students are required to complete 50 percent of their course work for the Mechanical Design Technology Program at North Iowa Area Community College.

### SUGGESTED SCHEDULE

#### First Term

90:121 Intro to Drafting.....	3 s.h.
90:122 Drafting.....	3 s.h.
90:133 Computer Orientation .....	1 s.h.
91:107 Technical Mathematics I OR .....	4 s.h.
40:151 College Alg & Trig I (4 s.h.)	
91:120 Manufacturing Processes I.....	2 s.h.
15:241 Human Relations OR .....	3 s.h.
80:101 Gen Psychology (3 s.h.)	
95:130 Communications I OR .....	3 s.h.
30:101 Comm Skills I (3 s.h. or 4 s.h.)	

**19 s.h.**

#### Second Term

90:131 Drafting II.....	7 s.h.
91:108 Technical Mathematics II OR .....	4 s.h.
40:152 College Alg & Trig II (4 s.h.)	
91:121 Manufacturing Processes II.....	2 s.h.
91:150 Statics.....	2 s.h.
95:131 Communications II OR .....	3 s.h.
30:102 Comm Skills II (3 s.h. or 4 s.h.)	

**18 s.h.**

#### Third Term

91:109 Technical Mathematics III OR .....	3 s.h.
40:240 Calculus For Business (3 s.h.)	
91:226 Fundamentals of Unigraphics.....	4 s.h.
91:227 Fundamentals of Pro Engineering.....	4 s.h.
91:251 Strength of Materials .....	3 s.h.
91:210 Technical Physics I OR .....	4 s.h.
70:280 General Physics I (4 s.h.) OR	
70:122 Principles of Physics (4 s.h.) OR	
70:140 Introductory Chemistry (4 s.h.)	

**18 s.h.**

#### Fourth Term

90:231 Machine Element Design .....	9 s.h.
91:212 Design Research Laboratory.....	2 s.h.
91:240 Fluid Mechanics .....	3 s.h.
91:211 Technical Physics II OR .....	4 s.h.
70:281 General Physics II (4 s.h.) OR	
70:122 Principles of Physics (4 s.h.) OR	
70:140 Introductory Chemistry (4 s.h.)	
89:150 Job-Seeking Skills.....	1 s.h.

**19 s.h.**

**Total 74 s.h.**

## Course Descriptions - Mechanical Design Technology

**15:241 Human Relations (3 s.h.)** Problems of defining the wants of the worker and of management and bringing these elements together in formal and informal organizations; implementing programs to help them achieve their common purpose to work together productively and cooperatively and with economic, psychological, and social satisfaction. (45-0)

**30:101C Communication Skills I (3 s.h.)** Improvement of skills in reading and writing with an emphasis on expository methods of development and personal experience as supporting material. Students must meet minimum competency

requirements in writing and speaking to receive a grade of C or higher. Students may use the computer editing system, Writer's Workbench. (45-0)

**30:101 Communication Skills I (4 s.h.)** Improvement of skills in reading, writing, speaking, and listening, with emphasis on expository methods of development and personal experience as supporting material. Students must meet minimum competency requirements in writing and speaking to receive a grade of C or higher. Students may use word processors and a computer-aided editing system, Writer's Workbench. (60-0)

**30:102C Communication Skills II (3 s.h.)** continuation of 30:101 with emphasis on argumentative and persuasive writing, research methods, and language. Students must meet minimum competency requirements in writing to receive a grade of C or higher. Students may use the computer editing system, Writer's Workbench. (45-0)

**30:102 Communications Skills II (4 s.h.)** continuation of 30:101 with emphasis on argumentative and persuasive writing and speaking, research methods, and language. Students must meet minimum competency requirements in writing and speaking to receive a grade C or higher. Students may use the computer-aided editing system, Writer's Workbench. (60-0)

**40:151 College Algebra & Trigonometry I (4 s.h.)** prerequisite: three semesters of high school algebra or 40:120, Intermediate Algebra, or equivalent. This course is intended for students majoring in business, social science, biological sciences, liberal arts, and those mathematics students with insufficient background to begin the study of calculus and feel they cannot keep up the pace of Precalculus. Topics include review of algebraic operations, field properties, introduction to plane analytic geometry, including points and lines, functions of various types such as polynomials and their graphs, operations with complex numbers and circular functions. (60-0)

**40:152 College Algebra & Trigonometry II (4 s.h.)** prerequisite: 40:151, College Algebra & Trigonometry I. This course is a continuation of 40:151. Topics include further study of functions, inverse functions, study of vectors, complex numbers, DeMoivre's theorem, solution of systems of equations, matrices, solid analytical geometry, probability, sequences and series, logarithmic, and exponential functions. (60-0)

**40:240 Calculus for Business (3 s.h.)** prerequisite: 40:161, Precalculus, or equivalent. This course uses calculus techniques with an emphasis on applications. Topics include derivatives and their uses, exponential and logarithmic functions, integration and its applications, and calculus of several variables. (45-0)

**70:122 Principles of Physics (4 s.h.)** prerequisite: 40:120, Intermediate Algebra; or equivalent. An introductory level, one-term course. Major topics are measurement, matter in motion, heat, wave motion, electricity and magnetism. (45-30)

**70:140 Introductory Chemistry (4 s.h.)** Prerequisite: 40:060, Beginning Algebra, or equivalent. A first-year college chemistry course which covers the concepts of chemistry. Among the topics included are systems of

measurement, matter and energy, atomic theory, energy levels and atomic structure, the periodic table, ionic and covalent bonding, chemical equations, stoichiometry, acids and bases, states of matter, solutions, and redox. Lab experiments are performed and complement the classroom theory. Not accepted as a prerequisite for other advanced chemistry courses except 70:273, Organic Chemistry. (45-30)

**70:280 General Physics I (4 s.h.)** prerequisite: 40:151, College Algebra & Trigonometry, or equivalent. Mechanics, simple harmonic motion, waves, and fluids. Designed for students in pharmacy, medicine, dentistry, and professional fields other than engineering. Liberal arts students with an interest in science may elect this course. (45-30)

**70:281 General Physics II (4 s.h.)** prerequisite: Math; 40:151, College Algebra & Trigonometry, or equivalent, and 70:280, General Physics I, or equivalent algebra-based first semester physics course as approved by the instructor. A continuation of 70:280, thermodynamics, electricity and magnetism, DC and AC circuits, optics, and atomic physics. (45-30)

**80:101 General Psychology (3 s.h.)** prerequisite: New students with entering ACT or COMPASS reading scores below college level will be required to coenroll in College Reading Skills (30:120). Introduction to the scientific study of behavior: a brief history of psychology as a science; influences of heredity and environment; motivation, frustration and conflict; the learning process, intelligence, perception, and mental health. (45-0)

**89:150 Job-Seeking Skills (1 s.h.)** develop skills necessary to find, obtain, and keep a job. Students learn to understand and appreciate the world of work as they examine personal job readiness and skills to make job entry successful. (15-0)

**90:121 Introduction to Drafting (3 s.h.)** fundamentals of AutoCAD; layers, icons, pull-down menu, drawing and editing commands, object snaps, screen menu, filters, text, sketch, basic construction of 2D mechanical drawings. Use of board equipment and instruments, lettering, basic geometric construction, and sketching fundamentals. (30-90)

**90:122 Drafting (3 s.h.)** prerequisite: 90:121, Intro to Drafting. A continuation of AutoCAD and drafting fundamentals; multiview projections, rays, construction lines, auxiliaries, isometric drawings, theory of orthographic projection: points, lines, planes, and auxiliaries. (30-90)

**90:131 Drafting II (7 s.h.)** prerequisite: 90:121, Intro to Drafting; and 90:122, Drafting. AutoCAD 2D Fundamentals; array dimensioning (basic, intermediate, advanced), tolerancing, sections, threads and fasteners, editing using grips, display options, editing polylines and splines, blocks, viewports, attributes, bill of materials, and assemblies. (60-195)

**90:133 Computer Orientation (1 s.h.)** An introductory course which includes an overview of microprocessors and computer hardware; file, folder, and desktop navigation and manipulation within the Windows NT operating system; basic word processor and spreadsheet operations. (15-0)

**90:231 Machine Element Design (9 s.h.)** prerequisite: 91:150, Statics; 91:226, Fundamentals of Unigraphics;

and 91:227, Fundamentals of ProEngineer; Corequisite: 91:212, Design Research Laboratory. Combines basic graphical and mathematical analysis of linkages, gears, and cams; design optimization utilizing spreadsheets as mathematical models to simulate geometric and kinematic relationships; construction of 3D parametric models including assembly implementation to create a set of working drawings including details, parts lists, and specifications; usage of handbooks and suppliers' catalogs. (60-210)

**91:107 Technical Mathematics I (4 s.h.)** Prerequisite: One year of high school algebra or consent of instructor. This course provides an integrated approach to mathematics designed to provide principles of measured data, engineering procedures, basic algebra, geometry, right and oblique triangle trigonometry, logarithms, and elementary vectors. Practical mathematics is emphasized. (60-0)

**91:108 Technical Mathematics II (4 s.h.)** Prerequisite: 91:107, Technical Mathematics I; or 40:151, College Algebra and Trigonometry I. This course is a continuation of Technical Mathematics I. Topics include advanced algebra, complex numbers, binary and hexadecimal numbers, trigonometric identities, and analytic geometry. Practical mathematics is emphasized. (60-0)

**91:109 Technical Mathematics III (3 s.h.)** Prerequisite: 91:108, Technical Mathematics II; or equivalent. Basic Calculus: provides manipulative skills of calculus and basic theory. Includes functions, limits, definitions, fundamental theorem, derivatives, transcendental functions, integral techniques, definite integrals, and basic applications. (45-0)

**91:120 Manufacturing Processes I (2 s.h.)** Principles of basic metallurgy, technical report writing, and foundry technique. (15-30)

**91:121 Manufacturing Processes II (2 s.h.)** Knowledge and skills in the use of selected machine tools and precision measurement, oxyacetylene welding, TIG and MIG welding. (15-30)

**91:150 Statics (2 s.h.)** Prerequisite/Corequisite: 91:108, Technical Mathematics II. Provides the theory and practical background for analysis of the forces acting upon an object in equilibrium. The following are stressed: resultant and equilibrium of forces, moments, noncurrent-coplanar, and concurrent-coplanar forces. (30-0)

**91:210 Technical Physics I (4 s.h.)** Prerequisite/Corequisite: 91:107, Technical Mathematics I; or 40:151, College Algebra & Trigonometry I. This course presents traditional fields of physics such as measurement, mechanics, properties of matter, simple harmonic motion, and waves. Emphasis is placed on industrial and technical applications of physics. (45-30)

**91:211 Technical Physics II (4 s.h.)** Prerequisite/Corequisite: 91:107, Technical Mathematics I; or 40:151, College Algebra & Trigonometry I, or an equivalent course in algebra and trigonometry. This course presents traditional fields of physics such as thermodynamics, electricity and magnetism, DC and AC circuits, and light. Emphasis is placed on industrial and technical applications of physics. (45-30)

**91:212 Design Research Laboratory (2 s.h.)** Prerequisite: 91:251, Strength of Materials; and 91:210, Technical Physics I; Corequisite: 91:240, Fluid Mechanics; and 90:231, Machine Element Design. Course includes instruction and laboratory techniques in Statistical Process Control, including Deming's 14 points, project selection, data gathering, variable and attribute charts, interpretations and capabilities; rapid prototyping using stereolithography equipment; and geometric dimensioning and tolerancing including functional part relationships of features, manufacturing, inspection, and economics using ANSI Y14.5M-1994. (15-30)

**91:226 Fundamentals of Unigraphics (4 s.h.)** Prerequisite: 90:231 Drafting II. Solid modeling fundamentals using Unigraphics CAD software. Layers, creating lines, arcs and circles, fillets and chamfers, trimming, extruding, sweeping along a guide, sketch a datum plane, blends, hollow solid, tapers, holes, slot, groove, pocket, boss, threads, and instance array. (30-112)

**91:227 Fundamentals of ProEngineer (4 s.h.)** Prerequisite: 90:122, Drafting I; 90:131, Drafting II; 91:108, Technical Mathematics II. Solid modeling fundamentals using ProEngineer CAD software. Sketcher mode part creation and sketcher constraints; holes, cuts, shafts, rounds, chamfers, slots, revolved features, patterns, sweeps, blends, and shell. Fundamental knowledge of model trees, parent-child relations, datum planes and feature relations. Assembly fundamentals including components, constraints and sub-assemblies. Drawing creation with part and assembly associativity, view types, notes, and dimensioning. (30-112)

**91:240 Fluid Mechanics (3 s.h.)** Prerequisite/Corequisite: 91:108, Technical Mathematics II. A basic principles course using mathematical analysis dealing with confined noncompressible fluids and applications of fluid power systems. Primary emphasis is on the topics of fluid statics, flow of fluid in pipes, and flow measurement. (45-0)

**91:251 Strength of Materials (3 s.h.)** Prerequisite/Corequisite: 91:109, Technical Math III; and 91:150, Statics. Course includes simple stresses and properties, moment of inertia, torsional properties, columns, beams including shear, moment and deflection diagrams and formulas, flexure formula, and combined stresses. (45-0)

**95:130 Communications I (3 s.h.)** Study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

**95:131 Communications II (3 s.h.)** Further study designed to assist students in improving and/or refining skills in the areas of reading, writing, listening, and speaking to help meet communication needs in college and for success and advancement in a career. (45-0)

## Welding - Evening Program

The program is designed for industry and individuals seeking personal skill development. Students are first exposed to theory and demonstrations, along with laboratory experiences. This is followed with an open lab to allow students additional laboratory experience in order to achieve the program's outlined competencies. A certificate will be awarded at the end of each semester to those students acquiring the competencies outlined in the program. A student may take the program in either order.

Those currently involved in the following areas will benefit from the program:

- \* Maintenance
- \* Farm or Ag related
- \* Auto
- \* Construction
- \* General industrial
- \* Hobbies or backyard

### First Term

98:110 Welding Symbols & Blueprint Reading ...2 s.h.  
98:190 Oxyacetylene Welding & Cutting;  
Gas Tungsten Arc Welding. ....3 s.h.

### Second Term

98:135 Welding Symbols/Blueprint Reading II....2 s.h.  
98:191 Shielded Metal Arc & Gas Metal Arc.....3 s.h.

## Course Descriptions Welding - Evening Program

**98:110 Welding Symbols and Blueprint Reading (2 s.h.)** Prerequisite: None. This course provides instruction in the fundamentals of reading and interpreting blueprints. A student learns to interpret and apply welding symbols along with identifying proper assembly procedures. (30-0)

**98:135 Welding Symbols and Blueprint Reading II (2 s.h.)** Prerequisite: 98:110, Welding Symbols and Blueprint Reading. This course provides instruction in the reading and interpreting of blueprints. The course covers the applications of welding symbols, dimensions, and assembly procedures. (15-30)

**98:190 Oxyacetylene Welding and Cutting: Gas Tungsten Arc Welding (3 s.h.)** Fusion joining of mild steel and cutting processes. The basic principles of gas tungsten arc welding including AC and DC applications. Selection of proper torch tip sizes, filler rods, angles, and travel speeds for OAW processes. The setup and adjustment of gas tungsten arc welding equipment, along with practical experience using both ferrous and nonferrous metals. (15-90)

**98:191 Shielded Metal Arc and Gas Metal Arc (3 s.h.)** Flat and horizontal shielded arc, vertical, and overhead shielded arc welding. The operation of AC and DC transformer arc welders and motor-driven DC welders. The effects of amperage, polarity, and characteristics of various electrodes. Butt, fillet, corner, and lap welds are made in various positions. Application of techniques required for equipment repair. (15-90)

## Industrial Electives

If electives are required for your industrial program studies, counselors and industrial instructors will help you select courses from the following course listing which will help focus your specialty study:

### INDUSTRIAL ELECTIVES:

90:128 Introduction to CAD  
 90:129 CAD II  
 90:299 Special Problems in Career Programs  
 91:103 Industrial Math I  
 91:121 Manufacturing Processes II  
 91:128 Basic Electricity  
 91:129 Industrial Electricity I  
 91:164 Electrical Wiring I  
 91:171 Electrical Wiring II  
 92:202 C/C++ Programming  
 96:131 Refrigeration Systems  
 98:164 Properties of Metals  
 \*96:180 Survey of Machine Tool Practices I  
 \*96:181 Survey of Machine Tool Practices II  
 \*96:182 Survey of Machine Tool Practices III  
 98:191 Shielded Metal Arc and Gas Metal Arc  
 \*These courses taken in sequence are the equivalent of Machine Tool Practice I (96:165).

### Course Descriptions Industrial Electives

**90:128 Introduction to CAD (2 s.h.)** Prerequisite/Corequisite: none. A class in Auto CAD Release 13 commands. A thorough introduction of two-dimensional drafting commands and command options. The sessions are hands-on using a variety of application drawing exercises that are modified or created. (15-30)

**90:129 CAD II (2 s.h.)** Prerequisite/Corequisite: 90:128, Introduction to CAD, or equivalent experience. This course is designed to build on the skills acquired in introduction to CAD. This course will review multiview drawings, layers, linetypes, colors, basic and advanced dimensioning, blocks and attributes, sectional views, three-dimensional drawing techniques, plotting, and printing with AutoCAD 13. (15-30)

**90:299A Special Problems in Career Programs (1 s.h.)** Students may submit a proposal for a special project to the instructor. With the instructor's approval and the consent of the Division Chair and Vice President for Academic Affairs, credit may be given upon satisfactory completion of the project. (15-0)

**90:299B Special Problems in Career Programs (2 s.h.)** Students may submit a proposal for a special project to the instructor. With the instructor's approval and the consent of the Division Chair and Vice President for Academic Affairs, credit may be given upon satisfactory completion of the project. (30-0)

**90:299C Special Problems in Career Programs (3 s.h.)** Students may submit a proposal for a special project to the instructor. With the instructor's approval and the consent of the Division Chair and Vice President for Ac-

ademic Affairs, credit may be given upon satisfactory completion of the project. (45-0)

**91:103 Industrial Math I (3 s.h.)** Basic math required for manufacturing in the industrial setting. Practical problems are covered in class with the instructor. (45-0)

**91:121 Manufacturing Processes II (2 s.h.)** Knowledge and skills in the use of selected machine tools and precision measurement, oxyacetylene welding, TIG and MIG welding. (15-30)

**91:128 Basic Electricity (2 s.h.)** A basic fundamentals course required as a background in a variety of fields. Lab work covers practical applications. (15-30)

**91:129 Industrial Electricity I (2 s.h.)** Prerequisite/Corequisite: 91:128, Basic Electricity. This course provides an understanding of the theory, operation, installation, and maintenance of motor controllers. Labs stress development and troubleshooting of basic motor control circuits. (15-30)

**91:164 Electrical Wiring I (2 s.h.)** Prerequisite/Corequisite: 91:128, Basic Electricity. Provides an understanding of the types of control circuits, uses of electrical devices, wiring techniques, and application of the rules and regulations in the National Electrical Code concerning residential wiring. (15-30)

**91:171 Electrical Wiring II (2 s.h.)** Prerequisite/Corequisite: 91:128, Basic Electricity; 91:164, Electrical Wiring I. Provides an understanding of the types of control circuits, use of electrical devices, wiring techniques, and application of the rules and regulations in the National Electrical Code concerning commercial wiring. (15-30)

**92:202 C/C++ Programming (3 s.h.)** Prerequisite: 91:104 Intro to Technical Computing and CAD. Structured computer programming utilizing C/C++. Use of existing library functions. Development of structured programming practices and internal documentation. Branching, loops, pointers, strings, arrays and file I/O. Introduction to object-oriented programming. Data structure, language, and hardware interfacing concepts are introduced. Program debugging and implementation. (45-0)

**96:131 Refrigeration Systems (3 s.h.)** This course introduces the student to refrigeration concepts and systems. The theory of heat and pressure and the vapor compression cycle are covered along with hands-on experience in assembling, testing, and maintaining refrigeration systems. (15-90)

**96:180 Survey of Machine Tool Practices I (4 s.h.)** The student safely uses basic measuring tools, machine tools, and layout/inspection tools. Safety is taught and enforced as it applies to each machine process. Proper terminology of the machinist trade is emphasized. The student follows blueprints to produce products within tolerances specified. (30-90)

**96:181 Survey of Machine Tool Practices II (3 s.h.)** Continues Survey of Machine Tool Practices I. The student safely uses basic measuring tools, machine tools, and layout/inspection tools. Emphasis on basic milling machines. Safety is taught and enforced as it applies to each machine process. Proper terminology of the machinist trade is emphasized. The student follows blueprints to produce products within tolerances specified. (15-90)

**96:182 Survey of Machine Tool Practices III (2 s.h.)** With the emphasis on safety, the student practices advanced measurement techniques, surface grinding to close tolerances, cylindrical grinding, advanced turning on the lathe using 4-jaw chucks and steady rests. (15-90)

**98:164 Properties of Metals (2 s.h.)** lecture/lab course which covers the most commonly used metals and their important characteristics. The course covers the two main steel numbering systems, symbols for the Aluminum Association, and basic types of cast iron. A student becomes familiar with the spark test for identifying metals. (15-30)

**98:191 Shielded Metal Arc and Gas Metal Arc (3 s.h.)** Flat and horizontal shielded arc, vertical and overhead shielded arc welding. The operation of AC and DC transformer arc welders and motor-driven DC welders. The effects of amperage, polarity, and characteristics of various electrodes. Butt, fillet, corner, and lap welds are made in various positions. Application of techniques required for equipment repair. (15-90)

## **Are you considering transferring to a four-year college or university?**

Students who earn associate degrees in the Industrial Technology programs at NIACC may wish to apply their studies toward a bachelor's degree in technology-related fields at a four-year college or university. For further information on such options as industrial technology (manufacturing), construction management, electro-mechanical systems, engineering technology, general industry and technology, manufacturing technology, and technology education at Iowa State University, the University of Northern Iowa, Upper Iowa University, and Wartburg College, please see pages 117-138 in the catalog or speak with a NIACC advisor.