

# INDUSTRIAL TECHNOLOGY

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## Automotive

Automotive Service  
Automotive Service Technology

## Building Trades

Building Trades - Day  
Building Trades - Evening

## Climate Control

Climate Control Mechanics  
Climate Control Technology

## Electronics

Electromechanical Systems  
Technology

## Manufacturing

General Machinist  
Tool and Die Technology  
General Machinist Evening

## Mechanical Design Technology

## Welding - Evening

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

### TECHNOLOGY

Drafting/CAD  
Electricity/Electronics  
Metals Processing  
Other Electives

### MATH

Applied Math OR  
Algebra, Geometry, Trigonometry

### SCIENCE

Applied Biology/Chemistry OR  
Biology and Chemistry  
Principles of Technology OR  
Physics

### ENGLISH/COMMUNICATIONS

Applied Communications  
Workplace Readiness  
Traditional English courses

NIACC has support services through the Student Learning Center for students needing to strengthen their skills in one or more of these areas.

### Quotable Quote:

*No one is useless in this world who lightens the burden of it for any one else.*

-Charles Dickens

## Automotive Service Technology

Automotive Service Technology is a 4½ semester associate in 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:

A diploma is granted to a person who has completed at least thirty (30) semester hours of credit. A minimum cumulative grade point average of 2.00 (C) is required. Developmental courses are not used in calculating the cumulative grade point average for graduation.

### 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.

The NIACC Automotive program was the 2001 winner of the prestigious ASE Automotive Award of Excellence for the state of Iowa and was also the national runner-up.

## Automotive Service Technology

### ASSOCIATE IN APPLIED SCIENCE DEGREE

#### SCHEDULE

##### First Term

91:122 Occupational Math I .....	2 s.h.
91:123 Occupational Math II .....	2 s.h.
95:130 Communications I.....	3 s.h.
96:132 Electrical Concepts.....	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

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>15 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 Employment Strategies .....	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 Hours 71 s.h.**

## DIPLOMA OPTION SCHEDULE

Completion of First Term, Second Term, and Summer Term (2½ semesters). Employment Strategies (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.)** The study of how people satisfy both personal growth needs and organizational goals in their careers. Although also interested in the why of human behavior, human relations goes further and looks at what can be done to anticipate problems, resolve them, or prevent them from happening. This field emphasizes knowledge that can be applied in practical ways to problems of interpersonal relations at work or in our personal life. Significant developments in recent years in the workplace have increased the importance of interpersonal skills in almost every type of work setting; these trends provide support for the necessity of acquiring competence in human relations. (45-0)

**89:150 Employment Strategies (1 s.h.)** Develop skills necessary to enter the job market and experience long-term career growth. Students learn basic job seeking techniques, job keeping skills, and strategies for continued growth. (15-0)

**91:122 Occupational Math I (2 s.h.)** Prerequisite: Com pass Pre-Algebra Score greater than or equal to 49 or a score greater than or equal to 16 on the math portion of the ACT exam or completion of Basic Math with a C or better or completion of Career Math I with a C or better. This course covers essential topics in algebra, including ratio and proportion, and basic statistics. This course is offered during the first eight weeks of the fall semester and the first eight weeks of the spring semester. (30-0)

**91:123 Occupational Math II (2 s.h.)** Prerequisite: Completion of 91:122, Occupational Math I, with a C or better. This course covers essential topics in geometry and trigonometry. This course is offered during the second eight weeks of the fall semester and the second eight weeks of the spring semester. (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 as signed by Division Chair and approved by Vice President for Academic Affairs. Course may be repeated for credit.

**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.)** Electrical Concepts is an introductory survey of electricity and electronics suitable for students interested in pursuing a career in such technical fields as electronics, automotive, HVAC, and other fields that require knowledge of

basic electrical/electronic concepts. Topics include safety, shop and lab practices, motors and controls, direct and alternating current, and semiconductor and digital electronics. Course work consists of problem solving, computer-assisted instruction, computer simulation, and hands-on exercises with industrial grade equipment. (30-30)

**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. (30-60)

**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 pre-delivery 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 the 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 multi story office buildings. These structures may be constructed of concrete, masonry, structural steel, or a combination of materials.

Building Trades Program students learn and develop skills through a combination of classroom-structured units, manipulative lab projects, and mentored job experiences. Classroom units provide students with necessary information on safety, blue print 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 a state-of-the-art facility where students learn in an individualized, competency-based setting, mastering 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 guidance of supervision of skilled contractors on job sites around North Iowa.

Incoming students are eligible to compete for scholarships through the Tom and Linda Schaefer Endowment Fund, which provides twelve \$1000 scholarships each year for NIACC Building Trades students. 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.

Courses are structured so that students may enter the Building Trades Program at any semester--Summer, Fall, or Spring. For further information on the program, check out our website at: <http://staff.niacc.cc.ia.us/~awermes/btrades/index.html>

### SCHEDULE

#### First Term (Summer)

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>7 s.h.</b>

#### Second Term (Fall)

89:150	Employment Strategies .....	1 s.h.
91:122	Occupational Math I .....	2 s.h.
91:123	Occupational Math II .....	2 s.h.
91:153	Carpentry I.....	4 s.h.
91:154	Carpentry I Lab.....	4 s.h.
91:159	Intro to the PC.....	1 s.h.
95:130	Communications I.....	3 s.h.
89:100	Cooperative Work Experience.....	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.
91:198	Blueprint Reading and Estimating.....	3 s.h.
96:150	Career Physics .....	4 s.h.
89:100	Cooperative Work Experience.....	1 s.h.
		<b>16 s.h.</b>
<b>Total Hours</b>		<b>41 s.h.</b>

## 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.
89:100	Cooperative Work Experience .....	1 s.h.
		<b>4 s.h.</b>
<b>Total Hours</b>		<b>8 s.h.</b>

## Course Descriptions - Building Trades

**89:100A Cooperative Work Experience (1 s.h.)** Practical training on the job under the cooperative supervision of the college and work supervisor. (0-60)

**89:150 Employment Strategies (1 s.h.)** Develop skills necessary to enter the job market and experience long-term career growth. Students learn basic job seeking techniques, job keeping skills, and strategies for continued growth. (15-0)

**91:122 Occupational Math I (2 s.h.)** Prerequisite: Com pass Pre-Algebra Score greater than or equal to 49 or a score greater than or equal to 16 on the math portion of the ACT exam or completion of Basic Math with a C or better or completion of Career Math I with a C or better. This course covers essential topics in algebra, including ratio and proportion, and basic statistics. This course is offered during the first eight weeks of the fall semester and the first eight weeks of the spring semester. (30-0)

**91:123 Occupational Math II (2 s.h.)** Prerequisite: Completion of 91:122, Occupational Math I, with a C or better. This course covers essential topics in geometry and trigonometry. This course is offered during the second eight weeks of the fall semester and the second eight weeks of the spring semester. (30-0)

**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 power tools; basic power tools; job site safety; print reading; 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; print reading; 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 in installations. 91:153 and 91:154 must be taken concurrently.

**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; print reading; 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, mill work, and hardware in installations; office partition, and acoustical ceiling installations. 91:156 and 91:157 must be taken concurrently.

**91:159 Intro to the PC (1 s.h.)** Provides an introduction to the desktop PC, its parts and basic operation. Students learn how to operate the computer, work within the windows environment, and manipulate files. Course exercises include using a word processing program, sending E-mail, and exploring the Internet. (10-20)

**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: Completion of Career Math requirement and/or permission of the instructor. 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

91:122 Occupational Math I .....	2 s.h.
91:123 Occupational Math II .....	2 s.h.
95:130 Communications I.....	3 s.h.
96:128 Residential Heating Systems .....	4 s.h.
96:129 Troubleshooting Heating Systems .....	3 s.h.
96:132 Electrical Concepts.....	3 s.h.
	<b>17 s.h.</b>

##### Second Term

89:150 Employment Strategies .....	1 s.h.
96:134 Air-Conditioning Principles .....	2 s.h.
96:138 Residential Air-Conditioning Systems....	4 s.h.
96:139 Troubleshooting Air-Cond. Systems.....	3 s.h.
96:150 Career Physics .....	4 s.h.
	<b>14 s.h.</b>
<b>Total Hours</b>	<b>31 s.h.</b>

### 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

91:122 Occupational Math I .....	2 s.h.
91:123 Occupational Math II .....	2 s.h.
95:130 Communications I.....	3 s.h.
96:128 Residential Heating Systems .....	4 s.h.
96:129 Troubleshooting Heating Systems .....	3 s.h.
96:132 Electrical Concepts.....	3 s.h.
	<b>17 s.h.</b>

##### Second Term

96:134 Air-Conditioning Principles .....	2 s.h.
96:138 Residential Air-Conditioning Systems....	4 s.h.
96:139 Troubleshooting Air-Cond. Systems.....	3 s.h.
96:150 Career Physics .....	4 s.h.
	<b>13 s.h.</b>

##### Third Term

15:134 Computer Applications OR	
15:140 Introduction 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 Employment Strategies .....	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>Total Hours</b>	<b>18 s.h.</b>
	<b>64 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 word processing, electronic spreadsheet, and database management software. Students are also exposed to Windows operating systems, presentation software, and the Internet. (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, database 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.)** The study of how people satisfy both personal growth needs and organizational goals in their careers. Although also interested in the why of human behavior, human relations goes further and looks at what can be done to anticipate problems, resolve them, or prevent them from happening. This field emphasizes knowledge that can be applied in practical ways to problems of interpersonal relations at work or in our personal life. Significant developments in recent years in the work place have increased the importance of interpersonal skills in almost every type of work setting; these trends provide support for the necessity of acquiring competence in human relations. (45-0)

**89:150 Employment Strategies (1 s.h.)** Develop skills necessary to enter the job market and experience long-term career growth. Students learn basic job seeking techniques, job keeping skills, and strategies for continued growth. (15-0)

**91:122 Occupational Math I (2 s.h.)** Prerequisite: Com pass Pre-Algebra Score greater than or equal to 49 or a score greater than or equal to 16 on the math portion of the ACT exam or completion of Basic Math with a C or better or completion of Career Math I with a C or better. This course covers essential topics in algebra, including ratio and proportion, and basic statistics. This course is offered during the first eight weeks of the fall semester and the first eight weeks of the spring semester. (30-0)

**91:123 Occupational Math II (2 s.h.)** Prerequisite: Completion of 91:122, Occupational Math I, with a C or better. This course covers essential topics in geometry and trigonometry. This course is offered during the second eight weeks of the fall semester and the second eight weeks of the spring semester. (30-0)

**91:124 Technical Graphics (2 s.h.)** Corequisite: 96:140, Metal Fabrication, and 96:230, Commercial Heating Systems. A 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 as signed by Division Chair and approved by Vice President for Academic Affairs. Course may be repeated for credit.

**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.)** Corequisite: 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.)** Electrical Concepts is an introductory survey of electricity and electronics suitable for students interested in pursuing a career in such technical fields as electronics, automotive, HVAC, and other fields that require knowledge of basic electrical/electronic concepts. Topics include safety, shop and lab practices, motors and controls, direct and alternating current, and semiconductor and digital electronics. Course work consists of problem

solving, computer-assisted instruction, computer simulation, and hands-on exercises with industrial grade equipment. (30-30)

**96:134 Air-Conditioning Principles (2 s.h.)** A 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.)** Corequisite: 91:124, Tech Graphics, and 96:230, Commercial Heating Systems. Use of selected sheet metal tools, layout, cutting, forming, and assembly of sheet metal as well as soldering and brazing processes. (15-30)

**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, electro-mechanical, 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 air flow 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, multi-stage 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. This course is 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:

*If opportunity does n't knock, build a door.*  
-Milton Berle

## Electromechanical Systems Technology

Electromechanical Systems Technology is an associate in applied science degree program designed to prepare the graduate for immediate employment as electronic, electrical, and mechanical maintenance personnel in manufacturing settings.

### CERTIFICATIONS

Students may earn recognition as a Certified Electronic Technician Associate Level (CETa) by the Electronic Technicians Association (ETA). To earn such recognition, the student must pass the National Certified Electronic Technician exam which is required of all program completers.

### ENTRANCE ADVISING

Due to the highly technical nature of the Electromechanical Systems Technology program and NIACC's commitment to giving students the best possible opportunity for success, students will be scheduled for advisement with counselors and program personnel. During 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.

### ENTRANCE REQUIREMENTS

Students must either have completed Basic Math or higher OR score 16 or higher on ACT math OR have a COMPASS score at the Beginning Algebra level.

### MULTIPLE ENTRY/MULTIPLE EXIT COURSE ENROLLMENT RULES

Ten courses in the Electromechanical Systems Technology program are offered in an instructor-supervised/student-paced format. The courses are divided into five levels depending on their prerequisites. Students start with Level 1 courses and proceed to higher levels after completing their current level. Courses that span across more than one level may be taken in any of those levels. Although a suggested schedule appears on this page, the chart on the following page more clearly illustrates the sequencing of the courses.

### SPECIAL PROGRAM REQUIREMENTS

As part of the requirements for graduation, students are required to take the Certified Electronics Technician (CET) exam during their final semester. The cost of the exam (\$50) is the student's responsibility.

### COLLEGE TRANSFER OPTION

Through an articulation agreement with the University of Northern Iowa, graduates of the Electromechanical Systems Technology program 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 advised.

Graduates of the Electromechanical Systems Technology program may find work in the following occupations:

Electronics Technician  
Industrial Process Control Technician  
Industrial Maintenance Technician  
Instrumentation Technician  
Electromechanical Technician  
Control Systems Technician  
Computer Automated Process Control Technician

### SUGGESTED SCHEDULE

#### Term One

15:241 Human Relations OR	3 s.h.
80:101 General Psychology (3 s.h.)	
91:122 Occupational Math I	2 s.h.
91:123 Occupational Math II OR	2 s.h.
40:151 College Algebra & Trig I (4 s.h.)	
91:104 Intro to Tech Computing & CAD	3 s.h.
91:175 DC/AC Theory	3 s.h.
92:118 Fluid Power	3 s.h.
95:130 Communications I OR	3 s.h.
30:101 Comm. Skills I (3 s.h.)	
	<b>19 s.h.</b>

#### Term Two

91:105 Industrial Control Systems	3 s.h.
91:179 Analog Devices and Circuits	4 s.h.
91:214 Digital Electronics	3 s.h.
95:131 Communications II OR	3 s.h.
30:102 Comm. Skills II (3 s.h.)	
Math Elective	4 s.h.
	<b>17 s.h.</b>

#### Term Three

91:110 Electromechanical Internship	2 s.h.
	<b>2 s.h.</b>

#### Term Four

91:204 Advanced Industrial Control Systems	7 s.h.
91:210 Technical Physics I OR	4 s.h.
70:280 General Physics (4 s.h.) OR	
70:122 Principles of Physics (4 s.h.) OR	
70:140 Introductory Chemistry (4 s.h.)	
96:156 Maintenance Shop Operations	3 s.h.
96:157 Servos and Drives	2 s.h.
Open Elective	3 s.h.
	<b>19 s.h.</b>

#### Term Five

89:150 Employment Strategies	1 s.h.
91:206 Computer Automated Manufacturing	3 s.h.
91:207 Industrial Instrumentation	4 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.)	
96:155 Facilities Maintenance	5 s.h.
	<b>17 s.h.</b>

**Total Hours 74 s.h.**

Course Sequencing by Course Level						
Level	(91:122/91:123 and 91:104 may be taken concurrently with 91:175 and/or 92:118)					
1	91:122, 91:123 Occupational Math I & II*				91:104 Intro to Tech Computing/ CAD	96:156* Maintenance Shop Operations
2	91:175 DC/AC Theory			92:118 Fluid Power		
3	91:179 AD&C	91:214 Digital	91:105 ICS			
4		91:204 AICS	96:157 Servos	91:110* Internship	96:155 Facilities Maintenance	
5		91:207 Ind Instr	91:206* CAM			

\*These courses are not offered as Multiple Entry/Multiple Exit Courses.

The later in the semester that the student enrolls, the fewer technical core course credits he/she will be allowed to register in.

## Course Descriptions - Electromechanical Systems Technology

**15:241 Human Relations (3 s.h.)** The study of how people satisfy both personal growth needs and organizational goals in their careers. Although also interested in the why of human behavior, human relations goes further and looks at what can be done to anticipate problems, resolve them, or prevent them from happening. This field emphasizes knowledge that can be applied in practical ways to problems of interpersonal relations at work or in our personal life. Significant developments in recent years in the workplace have increased the importance of interpersonal skills in almost every type of work setting; these trends provide support for the necessity of acquiring competence in human relations. (45-0)

**30:101 Communication Skills I (4 s.h.)** Improvement of skills in reading, writing, speaking, and listening, with an emphasis on expository methods of development and personal experience as supporting material. Students may be requested to use word processors and the Writer's Workbench analyses programs, the Writer's Workbench STEPS programs, and the structuring sentences video series. Students must meet minimum competency requirements in writing and speaking to receive a grade of "C" or higher. (60-0)

**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 may be requested to use word processors and the Writer's Workbench analyses programs, the Writer's Workbench STEPS programs, and the structuring sentences video series. Students must meet minimum competency requirements in writing to receive a grade of "C" or higher. (45-0)

**30:102 Communication Skills II (4 s.h.)** Prerequisite: 30:101, Communication Skills I. Students must have earned a "C" or higher grade in Communication Skills I before enrolling in Communication Skills II. A continuation of 30:101 with an emphasis on argumentative and persuasive writing and speaking, on research methods, and on language. Students may be requested to use word processors, Writer's Workbench analyses, Writer's Workbench STEPS, and sentence structuring videos. Students must meet minimum competency requirements in writing and speaking to receive a grade of "C" or higher. (60-0)

**30:102C Communication Skills II (3 s.h.)** Prerequisite: 30:101C, Communication Skills I. Students must have earned a "C" or higher grade in Communication Skills I before enrolling in Communication Skills II. A continuation of 30:101C with an emphasis on argumentative and persuasive writing, on research methods, and on language. Students may be requested to use word processors, Writer's Workbench analyses, Writer's Workbench STEPS, and sentence structuring videos.

Students must meet minimum competency requirements in writing to receive a grade of "C" or higher. (45-0)

**40:151 College Algebra & Trigonometry I (4 s.h.)** Prerequisite: Two years of high school algebra with a "C" or higher or 40:120, Intermediate Algebra, with a "C" or higher. 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 can not 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)

**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.)** Corequisite: New students with entering ACT or COMPASS reading scores below college level will be required to co-enroll in 30:120, College Reading Skills. An introduction to the scientific study of behavior; a brief history of psychology as a science, and topics fundamental to human behavior including developmental issues, sensory abilities, cognitive performance, social and emotional factors in behavior, and abnormal behavior and therapies. (45-0)

**89:150 Employment Strategies (1 s.h.)** Develop skills necessary to enter the job market and experience long-term career growth. Students learn basic job seeking techniques, job keeping skills, and strategies for continued growth. (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 CAD is designed to familiarize the student with microcomputer basics relating to occupations in the industrial/technical area. Topics include computer hardware, operating systems, commands and tasks, disk organization and access, word processing, spreadsheets, and two-dimensional computer-aided drafting (CAD). Multiple entry/multiple exit enrollment. See Electromechanical Systems Technology Multiple Entry/Multiple Exit Course Enrollment rules on page 107. (15-60)

**91:105 Industrial Control Systems (3 s.h.)** Prerequisite: 91:175, 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. Multiple entry/multiple exit enrollment. See Electromechanical Systems Technology Multiple Entry/Multiple Exit Course Enrollment rules on page 107. (15-69)

**91:110 Electromechanical Internship (2 s.h.)** Prerequisite: sophomore status in the Electromechanical Systems 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)

**91:175 DC/AC Theory (3 s.h.)** Prerequisite/Corequisite: 91:122, Occupational Math I, and 91:123, Occupational Math II. Study of the nature of electricity involving both 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 an application of electronic test equipment; oscilloscopes, meters, and power supplies. Multiple entry/multiple exit enrollment. See Electromechanical Systems Technology Multiple Entry/Multiple Exit Course Enrollment rules on page 107. (15-60)

**91:179 Analog Devices and Circuits (4 s.h.)** Prerequisite: 91:175, DC/AC Theory. Study of diodes, bipolar transistors and field effect transistors (JFETs and MOSFETs) as they are used in both AC and DC electronic circuits. Applications such as power supplies,

switching circuits and amplifier circuits are covered. Advanced topics in electronic devices including operational amplifiers (op amps), active filters, thyristors, and voltage regulation are covered. Computer simulation of the devices under study is covered. Both circuit analysis and measurement techniques using meters and oscilloscopes are stressed. Multiple entry/multiple exit enrollment. See Electromechanical Systems Technology Multiple Entry/Multiple Exit Course Enrollment rules on page 107. (15-91)

**91:204 Advanced Industrial Control Systems (7 s.h.)** Prerequisite: Level 3 Electromechanical Systems Technology Core. Introduction to programmable logic controllers (PLC's) using the Allen Bradley SLC500 and RSLogix 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. DeviceNET programming and integration using RSNetwork. PanelVIEW programming and integration using the Allen Bradley Panel 500. Projects involving practical field devices and program development. Multiple Entry/Multiple Exit enrollment. See Electromechanical Systems Technology Multiple Entry/Multiple Exit Course Enrollment Rules on page 107. (30-164)

**91:206 Computer Automated Manufacturing (3 s.h.)** Prerequisite/Corequisite: 92:118, Fluid Power; 91:204, Advanced Control Systems; and, 92:227, Automated Manufacturing Processes. Introduction to robotic fundamentals including the integration of robots, computers, and programmable logic controllers in the operation of a flexible manufacturing line (FML). Group dynamics, project structure, and troubleshooting techniques. (15-65)

**91:207 Industrial Instrumentation (4 s.h.)** Prerequisite/Corequisite: Level 4 Electromechanical Systems Technology Core. Modern instrumentation techniques as they apply to the manufacturing environment. Industrial sensors, transducers, and related components. Instrumentation programming using RS Logix 500, DeviceNet, and Panel Builder. Use of the PLC and personal computer for instrumentation and control purposes. Industrial process control theory, telemetry, and data communication. Multiple Entry/Multiple Exit enrollment. See Electromechanical Systems Technology Multiple Entry/Multiple Exit Course Enrollment Rules on page 107. (15-90)

**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: 91:175, 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. Multiple entry/multiple exit enrollment. See Electromechanical Systems Technology Multiple Entry/Multiple Exit Course Enrollment rules on page 107. (15-63)

**92:118 Fluid Power (3 s.h.)** Prerequisite/Corequisite: 91:122, Occupational Math I, and 91:123, Occupational Math II. Fluid Power gives students a solid foundation, and hands-on experience with, hydraulic and pneumatic components and circuits; the transmission of force through fluids; conversion of force to pressure; the control of power; and systematic methods of troubleshooting and testing hydraulic and pneumatic systems. Multiple Entry/Multiple Exit enrollment. Please see Electromechanical Systems Technology Multiple Entry/Multiple Exit Course Enrollment rules on page 107. (15-65)

**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)

**96:155 Facilities Maintenance (5 s.h.)** Prerequisite: 91:105, Motors, Controls, and Industrial Wiring. Overview of topics specific to maintenance of facilities. Topics include project estimating issues including installation, cost, and time. Practice reading building schematics and blueprints. Fundamentals of HVAC with lab exercises. Construction issues including sprinkler, electrical, and plumbing systems. General overview of facilities systems. (30-90)

**96:156 Maintenance Shop Operations (3 s.h.)** Introduction to shop equipment generally found in the industrial maintenance environment. Instruction and practice with metal saws, drills, grinders, elementary welding and cutting, thread repair, anchors and fasteners. Study of mechanical prints to identify parts in assembly

and repair situations. Use of catalogs to find and order repair parts, study of bearings and seals, applications, and failure analysis. (15-61)

**96:157 Servos and Drives (2 s.h.)** Prerequisite: 91:105, Industrial Control Systems. Study of direct and alternating current variable speed drives, closed loop control systems, and servo systems. Hands-on exercises provide experience with typical components and interconnections needed to implement various control systems. Concepts of system stability, frequency response, feedback, damping, position and speed control, and many others are covered. Multiple Entry/Multiple Exit enrollment. See Electromechanical Systems Technology Multiple Entry/Multiple Exit Course Enrollment Rules on page 107. (15-31)

## 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 in 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

91:122 Occupational Math I .....	2 s.h.
91:123 Occupational Math II .....	2 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

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>15 s.h.</b>
<b>Total Hours</b>	<b>33 s.h.</b>

## 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 in 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 numerical 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 in a specialty tool and die shop producing dies and molds for a large variety of production machines in our area.

### SUGGESTED SCHEDULE

#### First Term

91:122 Occupational Math I .....	2 s.h.
91:123 Occupational Math II .....	2 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

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>15 s.h.</b>

#### Third Term (Summer)

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.
96:173 3-D Modeling .....	2 s.h.
96:270 Computer-Aided Drafting (CAD).....	2 s.h.
	<b>12 s.h.</b>

#### Fourth Term

15:241 Human Relations.....	3 s.h.
89:150 Employment Strategies .....	1 s.h.
96:169 Welding .....	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>
<b>Total Hours</b>	<b>77 s.h.</b>

## Course Descriptions - General Machinist and Tool and Die

**15:241 Human Relations (3 s.h.)** The study of how people satisfy both personal growth needs and organizational goals in their careers. Although also interested in the why of human behavior, human relations goes further and looks at what can be done to anticipate problems, resolve them, or prevent them from happening. This field emphasizes knowledge that can be applied in practical ways to problems of interpersonal relations at work or in our personal life. Significant developments in recent years in the work place have increased the importance of interpersonal skills in almost every type of work setting; these trends provide support for the necessity of acquiring competence in human relations. (45-0)

**89:150 Employment Strategies (1 s.h.)** Develop skills necessary to enter the job market and experience long-term career growth. Students learn basic job seeking techniques, job keeping skills, and strategies for continued growth. (15-0)

**91:122 Occupational Math I (2 s.h.)** Prerequisite: Com pass Pre-Algebra Score greater than or equal to 49 or a score greater than or equal to 16 on the math portion of the ACT exam or completion of Basic Math with a C or better or completion of Career Math I with a C or better. This course covers essential topics in algebra, including ratio and proportion, and basic statistics. This course is offered during the first eight weeks of the fall semester and the first eight weeks of the spring semester. (30-0)

**91:123 Occupational Math II (2 s.h.)** Prerequisite: Completion of 91:122, Occupational Math I, with a C or better. This course covers essential topics in geometry and trigonometry. This course is offered during the second eight weeks of the fall semester and the second eight weeks of the spring semester. (30-0)

**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.)** Introduction to basic computer hardware and software functions. Emphasis on using the computer as a tool to create personal and business documents. Introductory windows, word processing, spreadsheet, presentation, and Internet units give students an opportunity to view software capabilities and use some of the features, (15-15)

**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: 91:122, Occupational Math I; and 96:163, Blueprint Reading I. Covers the 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; 91:123, Occupational 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. Students must obtain a grade of "C" or better in 96:165, Machine Tool Practices I. Covers computer numerical control (CNC) as it relates to milling machines, turning lathes, microcomputers, and related software. Emphasis on input language, codes, machine set-up and operation, inspection of parts, and communication of peripherals. (30-30)

**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: Students must obtain a grade of "C" or better in 96:167, Fundamentals of CNC, and 96:166, Machine Tool Practices II. This course is an introduction to the design of industrial tools and machining char-

acteristics of tool components. The student is introduced to additional machining skills that will be encountered in typical machine shops in the building of molds, 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. Students must obtain a grade of "C" or better in 96:167, Fundamentals of CNC. 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)

**96:173 3-D Modeling (2 s.h.)** Prerequisite: 96:270, Computer-Aided Drafting. Students are introduced to solid modeling as an essential tool, utilizing and enhancing design skills. This is accomplished through the generation of 3-D drawings created in the CAD environment. Operating systems commands, cursor manipulation, file storage and retrieval, entity manipulation, such as rotation, mirroring, editing, dimensioning, sections, sheet metal parts, and assemblies capabilities will be covered. (15-30)

**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 or 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 printers 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 or compound die. Emphasis is placed on the tool building procedures learned in Tool and Die I and to ward fabricating dies. Instruction is given on the considerations involved in developing die components, such as calculation of die clearances, bend allowance, cutting forces, press tonnage requirements, and practice in building a complete functional die. (45-225)

**96:272 Computer-Aided Manufacturing (CAM) (3 s.h.)** Prerequisite/Corequisite: 96:171, Tool & Die Making I, and 96:172, Fundamentals of EDM. Students must obtain a grade of "C" or better in 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, CNC lathes, and CNC EDM. 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, Plastics Materials and Methods. The student is introduced to the field of mold making for plastic injection molds, blow molds, compression and transfer molds, zinc and aluminum die casting molds. Focus is placed on mold theory, mold repair, identification and correction of mold problems, standardization of mold components, mold blueprint reading, and the machine shop skills necessary for mold making, as related to thermoplastic injection molds. In addition the student develops necessary basic skills for gating, venting, heating, cooling, stoning and polishing as well as other hands-on experiences necessary to manufacture mold plates, cores, cavities, and ejection systems. The student builds a prototype injection mold. (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)

## General Machinist Evening

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 in 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 blue print 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

91:122 Occupational Math I .....	2 s.h.
91:123 Occupational Math II .....	2 s.h.
95:130 Communications I.....	3 s.h.
96:150 Career Physics .....	4 s.h.
96:162 Computer Orientation.....	1 s.h.
96:163 Blueprint Reading I.....	1 s.h.
96:164 Blueprint Reading II.....	1 s.h.
96:167 Fundamentals of CNC.....	3 s.h.
96:180 Survey of Machine Tool Practices I.....	4 s.h.
96:181 Survey of Machine Tool Practices II.....	4 s.h.
96:182 Survey of Machine Tool Practices III.....	4 s.h.
96:193 Capstone Manufacturing Project .....	4 s.h.
<b>Total Hours</b>	<b>33 s.h.</b>

## Course Descriptions - General Machinist

**91:122 Occupational Math I (2 s.h.)** Prerequisite: Com pass Pre-Algebra Score greater than or equal to 49 or a score greater than or equal to 16 on the math portion of the ACT exam or completion of Basic Math with a C or better or completion of Career Math I with a C or better. This course covers essential topics in algebra, including ratio and proportion, and basic statistics. This course is offered during the first eight weeks of the fall semester and the first eight weeks of the spring semester. (30-0)

**91:123 Occupational Math II (2 s.h.)** Prerequisite: Completion of 91:122, Occupational Math I, with a C or better. This course covers essential topics in geometry and trigonometry. This course is offered during the second eight weeks of the fall semester and the second eight weeks of the spring semester. (30-0)

**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)

**96:162 Computer Orientation (1 s.h.)** Introduction to basic computer hardware and software functions. Emphasis on using the computer as a tool to create personal and business documents. Introductory windows, word processing, spreadsheet, presentation, and Internet units give students an opportunity to view software capabilities and use some of the features. (15-15)

**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)

**96:167 Fundamentals of CNC (3 s.h.)** Prerequisite/Corequisite: 96:180, Survey of Machine Tool Practices I, and 96:181, Survey of 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)

**96:180 Survey of Machine Tool Practices I (4 s.h.)**

The student safely uses basic measuring tools, machine tools, and layout/inpection tools. Emphasis is on turning machines, drills, and hand 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. (15-90)

**96:181 Survey of Machine Tool Practices II (4 s.h.)**

Continues Survey of Machine Tool Practices I. The student safely uses basic measuring tools, machine tools, and layout/inpection 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 (4 s.h.)**

Prerequisite: 96:180, Survey of Machine Tool Practices I; 96:181, Survey of Machine Tool Practices II. The student safely performs cylindrical grinder and surface grinder operations. Using the grinders, the student makes round and flat surfaces to conform to the specified tolerances. Emphasis is placed on safety, proper use of tools, and using correct terminology of the machinist trade. (15-90)

**96:193 Capstone Manufacturing Project (4 s.h.)**

Prerequisite: 96:180, Survey of Machine Tool Practices I - Pass with a "C" or better; 96:181, Survey of Machine Tool Practices II - Pass with a "C" or better; 96:182, Survey of Machine Tool Practices III - Pass with a "C" or better; 96:167, Fundamentals of CNC - Pass with a "C" or better. The goal is for the learner to build an approved multiple-part project using machine tools and communicate the successes and difficulties encountered in the project-building process. (15-90)

## 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

15:114 Computer Literacy.....	1 s.h.
15:241 Human Relations OR .....	3 s.h.
80:101 Gen Psychology (3 s.h.)	
90:121 Intro to Drafting.....	3 s.h.
90:122 Drafting I.....	3 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.
95:130 Communications I OR.....	3 s.h.
30:101 Comm Skills I (3 s.h. or 4 s.h.)	
	<b>19 s.h.</b>

#### 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.)	
	<b>18 s.h.</b>

#### Third Term

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 Principles of Physics (4 s.h.) OR	
70:140 Introductory Chemistry (4 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.
	<b>18 s.h.</b>

#### Fourth Term

89:150 Employment Strategies .....	1 s.h.
90:231 Machine Element Design .....	9 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.)	
91:212 Design Research Laboratory.....	2 s.h.
91:240 Fluid Mechanics.....	3 s.h.
	<b>19 s.h.</b>
<b>Total Hours</b>	<b>74 s.h.</b>

## Course Descriptions - Mechanical Design Technology

**15:114 Computer Literacy (1 s.h.) [Open Entry/Open Exit]** Prerequisite: None. Emphasis on using the computer as a tool to create personal and business documents. Introductory windows, word processing, spreadsheet, presentation, database, and Internet units give students an opportunity to view software capabilities and use some of the features. Students with little or no computer background are encouraged to take this course. This course has been designated as a pass/no pass course. (0-30)

**15:241 Human Relations (3 s.h.)** The study of how people satisfy both personal growth needs and organizational goals in their careers. Although also interested in the why of human behavior, human relations goes further and looks at what can be done to anticipate problems, resolve them, or prevent them from happening. This field emphasizes knowledge that can be applied in practical ways to problems of interpersonal relations at work or in our personal life. Significant developments in recent years in the workplace have increased the importance of interpersonal skills in almost every type of work setting; these trends provide support for the necessity of acquiring competence in human relations. (45-0)

**30:101 Communication Skills I (4 s.h.)** Improvement of skills in reading, writing, speaking, and listening, with an emphasis on expository methods of development and personal experience as supporting material. Students may be requested to use word processors and the Writer's Workbench analyses programs, the Writer's Workbench STEPS programs, and the structuring sentences video series. Students must meet minimum competency requirements in writing and speaking to receive a grade of "C" or higher. (60-0)

**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 may be requested to use word processors and the Writer's Workbench analyses programs, the Writer's Workbench STEPS programs, and the structuring sentences video series. Students must meet minimum competency requirements in writing to receive a grade of "C" or higher. (45-0)

**30:102 Communication Skills II (4 s.h.)** Prerequisite: 30:101, Communication Skills I. Students must have earned a "C" or higher grade in Communication Skills I before enrolling in Communication Skills II. A continuation of 30:101 with an emphasis on argumentative and persuasive writing and speaking, on research methods, and on language. Students may be requested to use word processors, Writer's Workbench analyses, Writer's Workbench STEPS, and sentence structuring videos. Students must meet minimum competency requirements in writing and speaking to receive a grade of "C" or higher. (60-0)

**30:102C Communication Skills II (3 s.h.)** Prerequisite: 30:101C, Communication Skills I. Students must have earned a "C" or higher grade in Communication Skills I before enrolling in Communication Skills II. A continuation of 30:101C with an emphasis on argumentative and persuasive writing, on research methods, and on language. Students may be requested to use word processors, Writer's Workbench analyses, Writer's Workbench STEPS, and sentence structuring videos. Students must meet minimum competency requirements in writing to receive a grade of "C" or higher. (45-0)

**40:151 College Algebra & Trigonometry I (4 s.h.)** Prerequisite: Two years of high school algebra with a "C" or higher or 40:120, Intermediate Algebra, with a "C" or higher. 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 can not 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 analytic 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. (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.)** Corequisite: New students with entering ACT or COMPASS reading scores below college level will be required to co-enroll in 30:120, College Reading Skills. An introduction to the scientific study of behavior; a brief history of psychology as a science, and topics fundamental to human behavior.

ior including developmental issues, sensory abilities, cognitive performance, social and emotional factors in behavior, and abnormal behavior and therapies. (45-0)

**89:150 Employment Strategies (1 s.h.)** Develop skills necessary to enter the job market and experience long-term career growth. Students learn basic job seeking techniques, job keeping skills, and strategies for continued growth. (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 I (3 s.h.)** Prerequisite: 90:121, Intro to Drafting. A continuation of AutoCAD and drafting fundamentals; multi view projections, rays, construction lines, auxiliaries, isometric drawings, the 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 fundamentals; array dimensioning (basic, intermediate, and advanced), Tolerancing, sections, threads and fasteners, isometric drawing, editing using grips, display options, editing polylines and splines, blocks, viewports, attributes, bill of materials, and assemblies. (60-195)

**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.)** Knowledge and skills in manufacturing materials and the procedures used to produce products in today's modern industry. Introduction to measurement and quality assurance with an emphasis on tolerances, measurement, and calibration. Final project, create a product using manual metal cutting processes. (15-30)

**91:121 Manufacturing Processes II (2 s.h.)** Prerequisite: 91:120, Manufacturing Processes I. Automation methods using (CNC) Computer Numerical Control, (CAD) Computer-Aided Design, (CAM) Computer-Aided Manufacturing and the integration of these technologies, (CIM) Computer Integrated Manufacturing, and (FMS) Flexible Manufacturing Systems. Final project, create a product using CAD, CAM, and CNC. (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, concurrent and non-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 datum plane, blends, hollow solid, tapers, holes, slot, groove, pocket, boss, threads, and in stance array. Adding orthographic views,

dimensioning, creating text, sectioning, GD&T symbols, surface finish symbols, move/copy and align views and detailed views. (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 model 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 the 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. Upon satisfactory completion of the prescribed curriculum with an average grade point of 2.00 (C), the student is awarded a certificate.

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

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

A student may take the program in either order.

### **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 set-up 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:

### INDUSTRIALELECTIVES:

90:128 Introduction to CAD  
 90:129 CAD II  
 90:299 Special Problems in Career Programs  
 91:128 Basic Electricity  
 91:129 Industrial Electricity I  
 91:164 Electrical Wiring I  
 91:171 Electrical Wiring II  
 92:202 C/C++ Programming  
 98:191 Shielded Metal Arc and Gas Metal Arc

## Course Descriptions

### Industrial Electives

**90:128 Introduction to CAD (2 s.h.)** Prerequisite/Corequisite: none. A class in Auto CAD Release 2000 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 multi view drawings, layers, linetypes, colors, basic and advanced dimensioning, blocks and attributes, sectional views, three-dimensional drawing techniques, plotting, and printing with Auto CAD 2000. (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. Course may be repeated for credit. (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. Course may be repeated for credit. (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 Academic Affairs, credit may be given upon satisfactory completion of the project. Course may be repeated for credit. (45-0)

**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. Lab 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)

**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 in industrial technology (manufacturing), construction management, electromechanical 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 125-149 in the catalog or speak with a NIACC advisor.