



## ENGINEERING/MANUFACTURING AND INDUSTRIAL TECHNOLOGY PATHWAY

This pathway includes careers related to technologies necessary to design, develop, install or maintain physical systems. These may include engineering and related technologies, manufacturing technology, precision production and construction.

### DEGREES/CERTIFICATES

- Automotive Service Technology
- Aviation Technology
- Climate Control Systems – heating, ventilation and air conditioning (HVAC)
- Customer Energy Specialist
- Electrician
- Electronic Technology/ELT
- Electronic Technology/Microcomputer Support
- Manufacturing Tech/Machining
- Manufacturing Tech/Maintenance
- Manufacturing Tech/Tool Room

### TRANSFER PROGRAMS

The first two years of a student's college education usually consists of general study courses, introductory courses in a major and/or program of study, and selected electives. Refer to page 37 for additional information on transfer and MACRAO. Academic advisors assist students in planning their transfer program. They can also provide transfer guide sheets indicating JCC courses that meet the requirements of various programs of study at four-year colleges. Sample curricula for a few popular transfer programs are included.

- Pre-Architecture
- Engineering

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## AUTOMOTIVE COLLISION REPAIR – ASSOCIATE IN APPLIED SCIENCE (ACRE.AAS)

JCC utilizes the Inter-industry Conference on Automotive Collision Repair (I-CAR) Enhanced Delivery Curriculum. Based on the tasks established by I-CAR, this two-year program provides students with skills to restore collision damaged vehicles to industry standards. The importance of certification and training continues to increase in the industry among body shops and insurance companies. In response to this demand, a graduate of the program has the potential to receive 70 I-CAR Gold Points and four ASE certifications. Graduates may also take the Michigan Motor Vehicle License exams for Unitized Body Structural Repair and Collision-Related Mechanical Repair. ASE certifications in body work and painting are also available.

Program graduates are trained in five major body repair groups:

- Collision repair fundamentals
- Non-Structural analysis & damage repair
- Structural analysis & damage repair
- Painting & refinishing
- Mechanical & electrical components repair

Upon completing the program, graduates are qualified for entry-level positions as collision repair technicians or automotive refinish technicians, with the option to pursue careers in management, estimating and sales. Students interested in earning an Associate in Applied Science Degree in collision repair technology will take all required automotive collision repair technology courses, plus electives, and general education courses.

Minimum credits: .....	68
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses:.....	2.0
Minimum JCC AUT credits: .....	44
Minimum JCC credits: .....	12
MACRAO Agreement:.....	No

**GENERAL EDUCATION REQUIREMENTS – (16 credits)**  
**ADO 1: Write clearly, concisely and intelligibly (3 credits)**  
**Take the following:**

ENG 131 Writing Experience I

**ADO 2: Speak clearly, concisely and intelligibly**  
 Program courses meet this requirement

**ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)****Choose one of the following:**

MTH 120 Beginning Algebra or higher

**ADO 4: Demonstrate scientific reasoning (4-5 credits)****Choose one of the following:**

BIO 110 Introductory Biology  
 BIO 131 General Biology  
 BIO 132 Human Biology  
 BIO 155 Anatomy & Physiology  
 BIO 220 Microbiology  
 BIO 253 Human Anatomy & Physiology I  
 CEM 131 Fundamentals of Chemistry  
 CEM 141 General Chemistry I  
 GEL 160 Introduction to Geology  
 NSC 131 Contemporary Science  
 PHY 131 Conceptual Physics  
 PHY 151 Astronomy  
 PHY 231 College Physics I  
 PHY 251 Modern University Physics I

**ADO 5: Understand human behavior and social systems, the principles which govern them, and their implications for the present and future (3-4 credits)****Choose one of the following:**

ECN 231 Macroeconomics  
 ECN 232 Microeconomics  
 HIS 131 Western Civilization to 1555  
 HIS 132 Western Civilization 1555 to Present  
 HIS 231 Development of the US through the Civil War  
 HIS 232 Development of the US from the Civil War  
 HIS 235 20th Century History  
 PLS 141 American National Government  
 PSY 140 Introduction to Psychology  
 SOC 231 Principles of Sociology

**ADO 6: Understand aesthetic experience and artistic creativity (3 credits)****Choose one of the following:**

ART 111 Art History: Prehistoric to 1400  
 ART 112 Art History: Renaissance to Present  
 ENG 210 Introduction to Film  
 ENG 246 Short Story & Novel  
 ENG 247 Poetry & Drama  
 ENG 252 Shakespeare

ENG 254 Children's Literature  
 ENG 255 American Literature - 19th Century  
 ENG 256 American Literature - 20th Century  
 HUM 131 Cultural Connections  
 MUS 131 Understanding Music  
 THR 116 Introduction to Theatre

**ADO 7: Think critically****Program courses meet this requirement****ADO 8: Make responsible decisions in personal and professional contexts****Program courses meet this requirement****ADO 9: Work productively with others, recognizing individual contributions to group success****Program courses meet this requirement****ADO 10: Understand and respect the diversity and interdependence of the world's peoples and cultures****Program courses meet this requirement****AUTOMOTIVE COLLISION REPAIR CORE REQUIREMENTS – (52 credits)****Take the following:**

AUT 184 Fundamentals of Collision Repair  
 AUT 186 Non-Structural Damage Repair  
 AUT 188 Welding & Cutting Steel/Aluminum  
 AUT 190 Structural Damage Repair  
 AUT 105 Braking Systems  
 AUT 106 Steering & Suspension  
 AUT 112 Electrical Systems I  
 AUT 113 Electrical Systems II  
 AUT 102 Engine Performance I  
 AUT 103 Engine Performance II  
 AUT 108 Air Conditioning & Heating  
 AUT 204 Manual Transmissions & Drivelines  
 AUT 290 Paint & Refinish I  
 AUT 292 Paint & Refinish II  
 AUT 210 Internship/Externship

**AUTOMOTIVE COLLISION REPAIR ELECTIVES – (4 credits)****Choose from the following:**

AUT 099 Jammin' Custom Cars  
 AUT 118 Diesel Fundamentals  
 AUT 119 Alternate Fuels

AUT 201 Engine Repair  
 AUT 202 Automatic Transmissions  
 AUT 203 Advanced Engine Performance  
 AUT 204 Manual Transmissions & Drivelines  
 AUT 211 Internship/Externship  
 AUT 212 Internship/Externship  
 AUT 214 Auto Lab Experience  
 AUT 240 Hybrid Technology  
 AUT 248 Diesel Engine Performance  
 AUT 294 Collision Shop Layout

**AUTOMOTIVE COLLISION REPAIR – CERTIFICATE (ACRE.CERT)**

In this real-world setting, students use modern equipment such as three electronic measuring systems, body and frame machines, two down-draft spray booths, computerized mixing systems, prep stations, MIG welders and a resistant spot welder. JCC utilizes the Inter-industry Conference on Automotive Collision Repair (I-CAR) Enhanced Delivery Curriculum.

The following sections are sequenced with prerequisites for student success. Those students wishing to further their education can apply these courses directly toward our Associate of Applied Science (AAS) program.

Minimum credits: .....54  
 Minimum cumulative GPA: .....2.0  
 Minimum grade in all courses: .....2.0  
 Minimum JCC credits: .....12  
 Minimum AUT credits: .....12  
 MACRAO Agreement: .....No

**AUTOMOTIVE COLLISION REPAIR GENERAL EDUCATION REQUIREMENTS – (6 credits)****Take the following:**

ENG 131 Writing Experience I  
 MTH 120 Beginning Algebra or higher

**AUTOMOTIVE COLLISION REPAIR CORE REQUIREMENTS –(48 credits)****Take the following:**

AUT 184 Fundamentals of Collision Repair  
 AUT 186 Non-Structural Damage Repair  
 AUT 188 Welding & Cutting Steel/Aluminum  
 AUT 190 Structural Damage

- AUT 105 Braking Systems
- AUT 106 Steering & Suspension
- AUT 112 Electrical Systems I
- AUT 113 Electrical Systems II
- AUT 102 Engine Performance I
- AUT 103 Engine Performance II
- AUT 108 Air Conditioning & Heating
- AUT 204 Manual Transmissions & Drivelines
- AUT 290 Paint & Refinish I
- AUT 292 Paint & Refinish II
- AUT 210 Internship/Externship

**COLLISION MECHANICAL & ELECTRICAL –  
CONCENTRATION (COME.CON)**

Minimum credits: .....	24
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

**REQUIRED COURSES – (24 credits)**

Take the following:

- AUT 105 Braking Systems
- AUT 106 Steering & Suspension
- AUT 112 Electrical Systems I
- AUT 113 Electrical Systems II
- AUT 102 Engine Performance I
- AUT 103 Engine Performance II
- AUT 108 Air Conditioning & Heating
- AUT 204 Manual Transmissions & Drivelines

**COLLISION BODY TECH – CONCENTRATION  
(COBT.CON)**

Minimum credits: .....	16
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

**REQUIRED COURSES – (16 credits)**

Take the following:

- AUT 184 Fundamentals of Collision Repair
- AUT 186 Non-Structural Damage Repair
- AUT 188 Welding & Cutting Steel/Aluminum
- AUT 190 Structural Damage Repair
- AUT 210 Internship/Externship

**COLLISION NON-STRUCTURAL  
TECH – SKILL SET (CONT.SSET)**

Minimum credits: .....	6
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	6
MACRAO Agreement: .....	No

**REQUIRED COURSES – (6 credits)**

Take the following:

- AUT 184 Fundamentals of Collision Repair
- AUT 186 Non-Structural Damage Repair

**COLLISION BODY TECH – SKILL SET (COBT.SSET)**

Minimum credits: .....	6
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	6
MACRAO Agreement: .....	No

**REQUIRED COURSES – (6 credits)**

Take the following:

- AUT 188 Welding & Cutting Steel/Aluminum
- AUT 190 Structural Damage Repair

**COLLISION REFINISHING TECH – SKILL SET  
(CORT.SSET)**

Minimum credits: .....	6
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	6
MACRAO Agreement: .....	No

**REQUIRED COURSES – (6 credits)**

Take the following:

- AUT 290 Paint & Refinish I
- AUT 292 Paint & Refinish II

**AUTOMOTIVE SERVICE TECHNOLOGY  
– ASSOCIATE IN APPLIED SCIENCE  
(AUTO.AAS)**

Designed for the student preparing for a career in the automotive field. Classroom activities provide students an opportunity to learn theory and test-taking skills to successfully pass the Michigan and/or ASE certification examinations. Shop activities provide students an opportunity to become proficient in testing, diagnosing and servicing the various systems of the automobile. All eight areas of an automotive certification are thoroughly covered, and when combined with general and related courses, lead to an Associate in Applied Science degree. This provides the background for employment and advancement in various automotive related occupations such as service technician, service writer, service manager, proving grounds testing technician, shop owner, parts specialist, automotive machinist, alternate fuel vehicle technician, technical sales and motor sports.

As part of the Toyota Technical Education Network, our Toyota corporate sponsored connection, students have the option to enter into the Toyota T-TEN program. This prepares students to work as a technician in a Toyota dealership. These students take the same automotive classes as other students with some important differences. T-TEN students must purchase an additional Toyota textbook for each course. Toyota provides T-TEN students with: Toyota work uniforms, web-based training materials, Toyota vehicles and special tools to work with in the shop, assistance in finding a sponsoring Toyota dealership to do paid co-ops, Toyota course exit exams and Toyota certification upon successful completion of the program.

As part of the Ford Maintenance and Light Repair network, our Ford corporate sponsored connection, students have the option to enter into the Ford MLR program. This prepares students to work as a technician in Ford, Lincoln or Mercury dealerships. These students take the same automotive classes as other students with some important differences. Ford MLR students concentrate on electrical systems, climate control, brakes, and suspension and steering. They utilize Ford training materials including service manuals, electrical/vacuum troubleshooting manuals, technical service bulletins, use Ford approved tools and equipment, work on Ford automobiles/light trucks and use Ford web-based training

with exit tests. Upon successful completion of the courses, students are Ford certified with Service Technician Specialty Training credentials. With these credentials students will receive assistance in obtaining Ford, Lincoln or Mercury dealership placement to work in the areas of certification.

Minimum credits: .....	62
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC AUT credits: .....	12
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

#### GENERAL EDUCATION REQUIREMENTS – (16 credits)

##### ADO 1: Write clearly, concisely and intelligibly (3 credits)

Take the following:

ENG 131 Writing Experience I

##### ADO 2: Speak clearly, concisely and intelligibly

Program courses meet this requirement

##### ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)

Choose one of the following:

MTH 120 Beginning Algebra or higher

##### ADO 4: Demonstrate scientific reasoning (4-5 credits)

Choose one of the following:

BIO 110 Introductory Biology  
 BIO 131 General Biology  
 BIO 132 Human Biology  
 BIO 155 Anatomy & Physiology  
 BIO 220 Microbiology  
 BIO 253 Human Anatomy and Physiology I  
 CEM 131 Fundamentals of Chemistry  
 CEM 141 General Chemistry I  
 GEL 160 Introduction to Geology  
 NSC 131 Contemporary Science  
 PHY 131 Conceptual Physics  
 PHY 151 Astronomy  
 PHY 231 College Physics I  
 PHY 251 Modern University Physics I

##### ADO 5: Understand human behavior and social systems, the principles which govern them, and their implications for the present and future (3-4 credits)

Choose one of the following:

ECN 231 Macroeconomics  
 ECN 232 Microeconomics  
 HIS 131 Western Civilization to 1555  
 HIS 132 Western Civilization 1555 to Present  
 HIS 231 Development of the US through the Civil War  
 HIS 232 Development of the US from the Civil War  
 HIS 235 20th Century History  
 PLS 141 American National Government  
 PSY 140 Introduction to Psychology  
 SOC 231 Principles of Sociology

##### ADO 6: Understand aesthetic experience and artistic creativity (3 credits)

Choose one of the following:

ART 111 Art History: Prehistoric to 1400  
 ART 112 Art History: Renaissance to Present  
 ENG 210 Introduction to Film  
 ENG 246 Short Story & Novel  
 ENG 247 Poetry & Drama  
 ENG 252 Shakespeare  
 ENG 254 Children's Literature  
 ENG 255 American Literature - 19th Century  
 ENG 256 American Literature - 20th Century  
 HUM 131 Cultural Connections  
 MUS 131 Understanding Music  
 THR 116 Introduction to Theatre

##### ADO 7: Think critically

Program courses meet this requirement

##### ADO 8: Make responsible decisions in personal and professional contexts

Program courses meet this requirement

##### ADO 9: Work productively with others, recognizing individual contributions to group success

Program courses meet this requirement

##### ADO 10: Understand and respect the diversity and interdependence of the world's peoples and cultures

Program courses meet this requirement

#### AUTOMOTIVE SERVICE TECHNOLOGY CORE REQUIREMENTS – (42 credits)

Take the following:

AUT 101 General Service  
 AUT 102 Engine Performance I  
 AUT 103 Engine Performance II  
 AUT 105 Automotive Brakes  
 AUT 106 Suspension & Steering  
 AUT 108 Automotive Air Conditioning /Heating  
 AUT 112 Electrical Systems I  
 AUT 113 Electrical Systems II  
 AUT 201 Engine Repair  
 AUT 202 Automatic Transmission  
 AUT 204 Manual Transmissions & Drivelines  
 AUT 210 Internship/Externship  
 AUT 234 Undercar Service

#### AUTOMOTIVE SERVICE TECHNOLOGY ELECTIVES – (4 credits)

Choose from the following:

AUT 099 Jammin' Custom Cars  
 AUT 118 Diesel Fundamentals  
 AUT 119 Alternate Fuels  
 AUT 203 Advanced Engine Performance  
 AUT 211 Internship/Externship  
 AUT 212 Internship/Externship  
 AUT 214 Auto Lab Experience  
 AUT 240 Hybrid Technology  
 AUT 248 Diesel Engine Performance



## **AUTOMOTIVE SERVICE TECHNOLOGY – CERTIFICATE (AUTO.CERT)**

Designed for the student preparing for a career in the automotive field. Classroom activities provide students an opportunity to learn theory and test-taking skills to successfully pass the Michigan and/or ASE certification examinations. Shop activities provide students an opportunity to become proficient in testing, diagnosing and servicing the various systems of the automobile. All eight areas of an automotive certification are thoroughly covered, and when combined with general and related courses, lead to an Associate in Applied Science degree.

Minimum credits: .....	48
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
Minimum AUT credits: .....	12
MACRAO Agreement: .....	No

### **GENERAL EDUCATION REQUIREMENTS – (6 credits)**

#### **Take the following:**

ENG 131 Writing Experience I  
MTH 120 Beginning Algebra or higher

### **AUTOMOTIVE SERVICE TECHNOLOGY CORE REQUIREMENTS – (42 credits)**

#### **Take the following:**

AUT 101 General Service  
AUT 105 Automotive Brakes  
AUT 106 Suspension & Steering  
AUT 102 Engine Performance I  
AUT 103 Engine Performance II  
AUT 108 Automotive Air Conditioning/Heating  
AUT 112 Electrical Systems I  
AUT 113 Electrical Systems II  
AUT 201 Engine Repair  
AUT 202 Automatic Transmission  
AUT 204 Manual Transmissions & Drivelines  
AUT 210 Internship/Externship  
AUT 234 Undercar Service

## **TOYOTA SERVICE – CERTIFICATE (TOSE.CERT)**

Minimum credits: .....	50
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### **GENERAL EDUCATION REQUIREMENTS – (6 credits)**

ENG 131 Writing Experience I  
MTH 120 Beginning Algebra or higher

### **REQUIRED COURSES – (44 credits)**

#### **Take the following:**

AUT 101 General Service  
AUT 102 Engine Performance I  
AUT 103 Engine Performance II  
AUT 105 Brakes  
AUT 106 Steering & Suspension  
AUT 108 Air Conditioning & Heating Systems  
AUT 112 Electrical Systems I  
AUT 113 Electrical Systems II  
AUT 201 Engine Repair  
AUT 202 Automatic Transmission  
AUT 204 Manual Transmission & Drivelines  
AUT 210 Internship/Externship  
or AUT 211 Internship/Externship  
AUT 234 Undercar Service  
AUT 240 Hybrid Technology

### **DRIVEABILITY – CONCENTRATION (DRAB.CON)**

Minimum credits: .....	21
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### **REQUIRED COURSES – (21 credits)**

#### **Take the following:**

AUT 102 Engine Performance I  
AUT 103 Engine Performance II  
AUT 108 Automotive Air Conditioning/Heating  
AUT 112 Electrical Systems I  
AUT 113 Electrical Systems II  
AUT 210 Internship/Externship

## **FORD SERVICE – CONCENTRATION (FOSE.CON)**

Minimum credits: .....	21
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### **REQUIRED COURSES – (21 credits)**

#### **Take the following:**

AUT 101 General Service  
AUT 105 Brakes  
AUT 106 Steering & Suspension  
AUT 108 Air Conditioning and Heating Systems  
AUT 112 Electrical Systems I  
AUT 113 Electrical Systems II  
AUT 234 Undercar Service  
AUT 240 Hybrid Technology

### **HIGH SPEED DIESEL SERVICE – CONCENTRATION (HSDS.CON)**

Minimum credits: .....	17
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### **REQUIRED COURSES – (18 credits)**

#### **Take the following:**

AUT 101 General Service  
AUT 102 Engine Performance I  
AUT 103 Engine Performance II  
AUT 112 Electrical Systems I  
AUT 118 Diesel Fundamentals  
AUT 248 Diesel Engine Performance

**HYBRID VEHICLES – CONCENTRATION (HYVE.CON)**

Minimum credits: .....	16
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

**REQUIRED COURSES – (16 credits)****Take the following:**

AUT 102	Engine Performance I
AUT 103	Engine Performance II
AUT 112	Electrical Systems I
AUT 113	Electrical Systems II
AUT 240	Hybrid Technology

**MAINTENANCE & LIGHT REPAIR – CONCENTRATION (MALR.CON)**

Minimum credits: .....	19
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

**REQUIRED COURSES – (19 credits)****Take the following:**

AUT 105	Brakes
AUT 106	Suspension & Steering
AUT 108	Air Conditioning and Heating Systems
AUT 112	Electrical Systems I
AUT 113	Electrical Systems II
AUT 210	Internship/Externship

**POWERTRAIN – CONCENTRATION (PWTR.CON)**

Minimum credits: .....	17
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

**REQUIRED COURSES – (17 credits)****Take the following:**

AUT 201	Engine Repair
AUT 202	Automatic Transmission
AUT 204	Manual Transmissions & Drivelines
AUT 210	Internship/Externship
AUT 234	Undercar Service

**UNDERCAR SERVICES – CONCENTRATION (UCSR.CON)**

Minimum credits: .....	17
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

**REQUIRED COURSES – (17 credits)****Take the following:**

AUT 101	General Service
AUT 105	Automotive Brakes
AUT 106	Suspension & Steering
AUT 108	Auto Air Conditioning/Heating
AUT 210	Internship/Externship
AUT 234	Undercar Service

**WHEEL SERVICE – CONCENTRATION (WHSR.CON)**

Minimum credits: .....	17
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

**REQUIRED COURSES – (17 credits)****Take the following:**

AUT 101	General Service
AUT 105	Automotive Brakes
AUT 106	Suspension & Steering
AUT 112	Electrical Systems I
AUT 210	Internship/Externship
AUT 234	Undercar Service

**HIGH SPEED DIESEL SERVICE – SKILL SET (HSDS.SSET)**

Minimum credits: .....	4
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	4
MACRAO Agreement: .....	No

**REQUIRED COURSES – (4 credits)****Take the following:**

AUT 118	Diesel Fundamentals
AUT 248	Diesel Engine Performance

**HYBRID VEHICLES – SKILL SET (HYVE.SSET)**

Minimum credits: .....	9
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	9
MACRAO Agreement: .....	No

**REQUIRED COURSES – (9 credits)****Take the following:**

AUT 102	Engine Performance I
AUT 112	Electrical Systems I
AUT 240	Hybrid Technology

**MAINTENANCE & LIGHT REPAIR – SKILL SET (MALR.SSET)**

Minimum credits: .....	15
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	15
MACRAO Agreement: .....	No

**REQUIRED COURSES – (15 credits)****Take the following:**

AUT 105	Brakes
AUT 106	Steering & Suspension
AUT 108	Air Conditioning and Heating Systems
AUT 112	Electrical Systems I
AUT 113	Electrical Systems II

**AIR CONDITIONING & HEATING – SKILL SET (ACAH.SSET)**

Minimum credits: .....	9
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	9
MACRAO Agreement: .....	No

**REQUIRED COURSES – (9 credits)****Take the following:**

AUT 108	Air Conditioning & Heating Systems
AUT 112	Electrical Systems I
AUT 113	Electrical Systems II

**WHEEL SERVICE – SKILL SET (WHSE.SSET)**

Minimum credits: .....	6
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	6
MACRAO Agreement: .....	No

**REQUIRED COURSES – (6 credits)****Take the following:**

- AUT 105 Brakes
- AUT 106 Steering & Suspension

**UNDERCAR SERVICE – SKILL SET (UCSR.SSET)**

Minimum credits: .....	8
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	8
MACRAO Agreement: .....	No

**REQUIRED COURSES – (8 credits)****Take the following:**

- AUT 105 Brakes
- AUT 106 Steering & Suspension
- AUT 234 Undercar Service

**POWERTRAIN – SKILL SET (PWTR.SSET)**

Minimum credits: .....	11
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	11
MACRAO Agreement: .....	No

**REQUIRED COURSES – (11 credits)****Take the following:**

- AUT 201 Engine Repair
- AUT 202 Automatic Transmission
- AUT 204 Manual Transmissions & Drivelines

**DRIVEABILITY – SKILL SET (DRAB.SSET)**

Minimum credits: .....	14
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	14
MACRAO Agreement: .....	No

**REQUIRED COURSES – (14 credits)****Take the following:**

- AUT 102 Engine Performance I
- AUT 103 Engine Performance II
- AUT 112 Electrical Systems I
- AUT 113 Electrical Systems II

**AVIATION FLIGHT TECHNOLOGY – ASSOCIATE IN APPLIED SCIENCE (AVFT.AAS)**

Basic ground school and flight instruction needed to meet the requirements of the Federal Aviation Administration's Commercial Pilot certificate with instrument ratings.\* Federal and/or Michigan law may require that enrollees in the aviation program undergo an FBI background check. Contact the director of aviation with questions.

Minimum credits: .....	61
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

**GENERAL EDUCATION REQUIREMENTS – (21 credits)****ADO 1: Write clearly, concisely and intelligibly (3 credits)****Take the following:**

- ENG 131 Writing Experience I

**ADO 2: Speak clearly, concisely and intelligibly (3 credits)****Choose one of the following:**

- COM 231 Communication Fundamentals
- COM 240 Interpersonal Communication

**ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)****Take the following:**

- MTH 131 Intermediate Algebra or higher

**ADO 4: Demonstrate scientific reasoning (4 credits)****Take the following:**

- PHY 231 College Physics I

ADO 5: Understand human behavior and social systems, the principles which govern them, and their implications for the present and future (4 credits)

- PSY 140 Introduction to Psychology

**ADO 6: Understand aesthetic experience and artistic creativity (3 credits)****Choose one of the following:**

- ART 111 Art History: Prehistoric to 1400
- ART 112 Art History: Renaissance to Present
- ENG 210 Introduction to Film
- ENG 246 Short Story & Novel
- ENG 247 Poetry & Drama
- ENG 252 Shakespeare
- ENG 254 Children's Literature
- ENG 255 American Literature - 19th Century
- ENG 256 American Literature - 20th Century
- HUM 131 Cultural Connections
- MUS 131 Understanding Music
- THR 116 Introduction to Theatre

**ADO 7: Think critically**

Program courses meet this requirement

**ADO 8: Make responsible decisions in personal and professional contexts (1-3 credits)****Choose one of the following:**

- HPF 160 Wellness
- HPF 186 Weight Training and Wellness
- HPF 277 Stress Management
- HPF 283 Managing Stress and Holistic Health
- PHL 236 Ethics

**ADO 9: Work productively with others, recognizing individual contributions to group success**

Program courses meet this requirement

**ADO 10: Understand and respect the diversity and interdependence of the world's peoples and cultures**

Program courses meet this requirement

**AVIATION FLIGHT TECHNOLOGY RELATED REQUIREMENTS – (6 credits)****Take the following:**

- CIS 101 Introduction to Computer Systems
- MTH 133 Introduction to Probability & Statistics

### AVIATION FLIGHT TECHNOLOGY CORE REQUIREMENTS – (34 credits)

#### Take the following:

AFT 110	Primary Ground School
AFT 112	Primary Flight I
AFT 114	Primary Flight II
AFT 116	Primary Flight III
AFT 125	Commercial Ground School
AFT 130	Commercial Flight I
AFT 135	Instrumental Ground School
AFT 140	Commercial Flight II
AFT 200	Commercial Flight III
AFT 205	Commercial Flight IV

*\*All enrollees must be capable of attaining the FAA class II medical certificate.*

### CLIMATE CONTROL TECHNOLOGY – ASSOCIATE IN APPLIED SCIENCE (CLCS.AAS)

Provides skills required for heating, air conditioning and refrigeration. Training areas include application techniques for basic and advanced air conditioning, heat pumps, fossil fuels, solar energy and refrigeration.

Minimum credits:	60
Minimum cumulative GPA:	2.0
Minimum grade in all courses:	2.0
Minimum JCC credits:	12
MACRAO Agreement:	No

### GENERAL EDUCATION REQUIREMENTS – (23 credits)

#### ADO 1: Write clearly, concisely and intelligibly (6 credits)

##### Take the following:

ENG 131	Writing Experience I
ENG 232	Technical & Business Writing

#### ADO 2: Speak clearly, concisely and intelligibly (3 credits)

##### Choose one of the following:

COM 231	Communication Fundamentals
COM 240	Interpersonal Communication

#### ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)

##### Take the following:

MTH 120	Beginning Algebra or higher
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#### ADO 4: Demonstrate scientific reasoning (4-5 credits)

##### Choose one of the following:

BIO 110	Introductory Biology
BIO 131	General Biology
BIO 132	Human Biology
BIO 155	Anatomy & Physiology
BIO 220	Microbiology
BIO 253	Human Anatomy and Physiology I
CEM 131	Fundamentals of Chemistry
CEM 141	General Chemistry I
GEL 160	Introduction to Geology
NSC 131	Contemporary Science
PHY 131	Conceptual Physics
PHY 151	Astronomy
PHY 231	College Physics I
PHY 251	Modern University Physics I

#### ADO 5: Understand human behavior and social systems, the principles which govern them and their implications for the present and future (3-4 credits)

##### Choose one of the following:

ECN 231	Macroeconomics
ECN 232	Microeconomics
HIS 131	Western Civilization to 1555
HIS 132	Western Civilization 1555 to Present
HIS 231	Development of the US through the Civil War
HIS 232	Development of the US from the Civil War
HIS 235	20th Century History
PLS 141	American National Government
PSY 140	Introduction to Psychology
SOC 231	Principles of Sociology

#### ADO 6: Understand aesthetic experience and artistic creativity (3 credits)

##### Choose one of the following:

ART 111	Art History: Prehistoric to 1400
ART 112	Art History: Renaissance to Present
ENG 210	Introduction to Film
ENG 246	Short Story & Novel
ENG 247	Poetry & Drama
ENG 252	Shakespeare
ENG 254	Children's Literature
ENG 255	American Literature - 19th Century
ENG 256	American Literature - 20th Century
HUM 131	Cultural Connections
MUS 131	Understanding Music
THR 116	Introduction to Theatre

#### ADO 7: Think critically

Program courses meet this requirement

#### ADO 8: Make responsible decisions in personal and professional contexts (1-3 credits)

##### Choose one of the following:

HPF 160	Wellness
HPF 186	Weight Training and Wellness
HPF 277	Stress Management
HPF 283	Managing Stress and Holistic Health
PHL 236	Ethics

#### ADO 9: Work productively with others, recognizing individual contributions to group success

Program courses meet this requirement

#### ADO 10: Understand and respect the diversity and interdependence of the world's peoples and cultures

Program courses meet this requirement (3 credits)

##### Take one of the following:

BUA 120	Human Relations in Business
CIS 101	Introduction to Computer Systems

### CLIMATE CONTROL TECHNOLOGY CORE REQUIREMENTS – (27 credits)

#### Take the following:

CCT 117	Beginning Sheet Metal
CCT 118	Advanced Sheet Metal
CCT 121	Introduction to HVAC
CCT 123	Application of HVAC Technology
CCT 131	Basic HVAC Electrical/Controls
CCT 135	Basic Refrigeration & Air Conditioning
CCT 136	Advanced Refrigeration & Air Conditioning
CCT 137	Advanced HVAC Electrical/Controls
CCT 141	Basic Heating
CCT 142	Advanced Heating
CCT 200	Mechanical Code
CCT 201	Refrigeration Certification

### CLIMATE CONTROL TECHNOLOGY ADDITIONAL REQUIREMENTS

EMS 110 CPR & First Aid or current Adult CPR & First Aid Certification

### ELECTIVES – (1-7 credits)

Select electives from courses (except those with prefixes CED, CEU, CFO, CSS and ESL) so that degree equals 60 credits.

## CLIMATE CONTROL TECHNOLOGY – CERTIFICATE (CLCS.CERT)

Climate control technology curriculum provides skills required for heating, air conditioning and refrigeration. Training areas include application techniques for basic and advanced air conditioning, heat pumps, fossil fuels, solar energy and refrigeration.

Minimum credits: .....	36
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### GENERAL EDUCATION REQUIREMENTS – (9 credits)

Take the following:

ENG 131	Writing Experience I
ENG 232	Technical & Business Writing
MTH 120	Beginning Algebra or higher

### CLIMATE CONTROL TECHNOLOGY CORE REQUIREMENTS – (27 credits)

Take the following:

CCT 117	Beginning Sheet Metal
CCT 118	Advanced Sheet Metal
CCT 121	Introduction to HVAC
CCT 123	Application of HVAC Technology
CCT 131	Basic HVAC Electricity/Controls
CCT 135	Basic Refrigeration & Air Conditioning
CCT 136	Advanced Refrigeration & Air Conditioning
CCT 137	Advanced HVAC Electricity/Controls
CCT 141	Basic Heating
CCT 142	Advanced Heating
CCT 200	Mechanical Code
CCT 201	Refrigeration Certification

### ADDITIONAL REQUIREMENTS

EMS 110	CPR & First Aid or current Adult CPR and First Aid Certification
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*This suggested course sequence is ONLY for students starting this program in the Fall semester. Because this program is set up for the student to be able to complete in one year, a student would need to begin in the Fall semester to complete all the prerequisites required for the Winter semester courses.*

## ELECTRICIAN – ASSOCIATE IN APPLIED SCIENCE (ELEC.AAS)

Minimum credits: .....	62
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### GENERAL EDUCATION REQUIREMENTS – (20 credits)

**ADO 1: Write clearly, concisely and intelligibly – (3 credits)**

Take the following:

ENG 131	Writing Experience I
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**ADO 2: Speak clearly, concisely and intelligibly – (3 credits)**

Choose one of the following:

COM 231	Communication Fundamentals
COM 240	Interpersonal Communication

**ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)**

Take the following:

MTH 120	Beginning Algebra or higher
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**ADO 4: Demonstrate scientific reasoning (4-5 credits)**

Choose one of the following:

BIO 110	Introductory Biology
BIO 131	General Biology
BIO 132	Human Biology
BIO 155	Anatomy & Physiology
BIO 220	Microbiology
BIO 253	Human Anatomy and Physiology I
CEM 131	Fundamentals of Chemistry
CEM 141	General Chemistry I
GEL 160	Introduction to Geology
NSC 131	Contemporary Science
PHY 131	Conceptual Physics
PHY 151	Astronomy
PHY 231	College Physics I
PHY 251	Modern University Physics I

**ADO 5: Understand human behavior and social systems, the principles which govern them, and their implications for the present and future (3-4 credits)**

Choose one of the following:

ECN 231	Macroeconomics
ECN 232	Microeconomics
HIS 131	Western Civilization to 1555
HIS 132	Western Civilization 1555 to Present
HIS 231	Development of the US through the Civil War
HIS 232	Development of the US from the Civil War
HIS 235	20th Century History
PLS 141	American National Government
PSY 140	Introduction to Psychology
SOC 231	Principles of Sociology

**ADO 6: Understand aesthetic experience and artistic creativity (3 credits)**

Choose one of the following:

ART 111	Art History: Prehistoric to 1400
ART 112	Art History: Renaissance to Present
ENG 210	Introduction to Film
ENG 246	Short Story & Novel
ENG 247	Poetry & Drama
ENG 252	Shakespeare
ENG 254	Children's Literature
ENG 255	American Literature - 19th Century
ENG 256	American Literature - 20th Century
HUM 131	Cultural Connections
MUS 131	Understanding Music
THR 116	Introduction to Theatre

**ADO 7: Think critically**

Program courses meet this requirement

**ADO 8: Make responsible decisions in personal and professional contexts (1-3 credits)**

Choose one of the following:

HPF 160	Wellness
HPF 186	Weight Training and Wellness
HPF 277	Stress Management
HPF 283	Managing Stress and Holistic Health
PHL 236	Ethics

**ADO 9: Work productively with others, recognizing individual contributions to group success**

Program courses meet this requirement

ADO 10: Understand and respect the diversity and interdependence of the world's peoples and cultures  
Program courses meet this requirement

#### ELECTRICIAN CORE REQUIREMENTS – (42 credits)

Take the following:

ELT 074 National Electric Code  
ELT 120 Circuit Analysis I  
ELT 125 Circuit Analysis II  
ELT 130 Electronics I  
ELT 140 Introduction to Digital Electronics  
ELT 148 Electrical Math I  
ELT 149 Electrical Math II  
ELT 150 Residential Wiring  
ELT 151 Commercial Wiring  
ELT 152 Industrial Wiring  
ELT 215 Electrical Troubleshooting  
ELT 220 Industrial Motion Control  
ELT 250 Electrical Motors & Controls  
ELT 260 Basic Programmable Controllers  
ELT 265 SLC 500 Programming and Troubleshooting

#### ADDITIONAL REQUIREMENTS

EMS 110 CPR & First Aid or current Adult CPR and First Aid Certification

#### ELECTRICIAN – CERTIFICATE (ELEC.CERT)

Minimum credits: .....46  
Minimum cumulative GPA: .....2.0  
Minimum grade in all courses: .....2.0  
Minimum JCC credits: .....12  
MACRAO Agreement: .....No

#### GENERAL EDUCATION REQUIREMENTS – (6 credits)

Take the following:

ENG 131 Writing Experience I  
MTH 120 Beginning Algebra or higher

#### ELECTRICIAN CORE REQUIREMENTS – (40 credits)

Take the following:

ELT 074 National Electric Code  
ELT 120 Circuit Analysis I  
ELT 125 Circuit Analysis II  
ELT 130 Electronics I  
ELT 140 Introduction to Digital Electronics  
ELT 148 Electrical Math I

ELT 149 Electrical Math II  
ELT 150 Residential Wiring  
ELT 151 Commercial Wiring  
ELT 152 Industrial Wiring  
ELT 215 Electrical Troubleshooting  
ELT 220 Industrial Motion Control  
ELT 250 Electrical Motors & Controls  
ELT 260 Basic Programmable Controllers

#### ADDITIONAL REQUIREMENTS

EMS 110 CPR & First Aid or current Adult CPR and First Aid Certification

#### ELECTRICAL BASICS – CONCENTRATION (ELEC.CON)

Completion of this program provides a solid electrical foundation for the person seeking electrical or industrial maintenance mechanic training.

Minimum credits: .....17  
Minimum cumulative GPA: .....2.0  
Minimum grade in all courses: .....2.0  
Minimum JCC credits: .....12  
MACRAO Agreement: .....No

#### REQUIRED COURSES – (17 credits)

Take the following:

ELT 120 Circuit Analysis I  
ELT 125 Circuit Analysis II  
ELT 150 Residential Wiring  
ELT 152 Industrial Wiring  
ELT 148 Electrical Math I  
ELT 260 Basic Programmable Controllers

#### ELECTRONIC TECHNOLOGY/ELT – ASSOCIATE IN APPLIED SCIENCE (ETGE.AAS)

Electronic technologists are employed in such fields as digital computer maintenance, voice and data communications, radio and television broadcasting, medical electronic instrumentation, high-tech manufacturing, research and development in laboratory settings. Students may also work to achieve A+ certification for employment as personal computer service professionals. A+ certification is the "journeyman's card" for computer technologists, which is recognized by CompTIA. The non-profit Computing Technology Industry Association (CompTIA) is widely recognized as the standard for qualified computer service professionals.

Minimum credits: .....64  
Minimum cumulative GPA: .....2.0  
Minimum grade in all courses: .....2.0  
Minimum JCC credits: .....12  
MACRAO Agreement: .....No

#### GENERAL EDUCATION REQUIREMENTS – (21 credits)

ADO 1: Write clearly, concisely and intelligibly (3 credits)

Take the following:

ENG 131 Writing Experience I

ADO 2: Speak clearly, concisely and intelligibly (3 credits)

Choose one of the following:

COM 231 Communication Fundamentals  
COM 240 Interpersonal Communication

ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)

Take the following:

MTH 131 Intermediate Algebra or higher

ADO 4: Demonstrate scientific reasoning (4-5 credits)

Choose one of the following:

BIO 110 Introductory Biology  
BIO 131 General Biology  
BIO 132 Human Biology  
BIO 155 Human Anatomy & Physiology  
BIO 220 Microbiology  
BIO 253 Human Anatomy and Physiology I  
CEM 131 Fundamentals of Chemistry  
CEM 141 General Chemistry I  
GEL 160 Introduction to Geology

- NSC 131 Contemporary Science
- PHY 131 Conceptual Physics
- PHY 151 Astronomy
- PHY 231 College Physics I
- PHY 251 Modern University Physics I

**ADO 5: Understand human behavior and social systems, the principles which govern them, and their implications for the present and future (3-4 credits)**

**Choose one of the following:**

- ECN 231 Macroeconomics
- ECN 232 Microeconomics
- HIS 131 Western Civilization to 1555
- HIS 132 Western Civilization 1555 to Present
- HIS 231 Development of the US through the Civil War
- HIS 232 Development of the US from the Civil War
- HIS 235 20th Century History
- PLS 141 American National Government
- PSY 140 Introduction to Psychology
- SOC 231 Principles of Sociology

**ADO 6: Understand aesthetic experience and artistic creativity (3 credits)**

**Choose one of the following:**

- ART 111 Art History: Prehistoric to 1400
- ART 112 Art History: Renaissance to Present
- ENG 210 Introduction to Film
- ENG 246 Short Story & Novel
- ENG 247 Poetry & Drama
- ENG 252 Shakespeare
- ENG 254 Children's Literature
- ENG 255 American Literature - 19th Century
- ENG 256 American Literature - 20th Century
- HUM 131 Cultural Connections
- MUS 131 Understanding Music
- THR 116 Introduction to Theatre

**ADO 7: Think critically**

**Program courses meet this requirement**

**ADO 8: Make responsible decisions in personal and professional contexts (1-3 credits)**

**Choose one of the following:**

- HPF 160 Wellness
- HPF 186 Weight Training and Wellness
- HPF 277 Stress Management
- HPF 283 Managing Stress and Holistic Health
- PHL 236 Ethics

**ADO 9: Work productively with others, recognizing individual contributions to group success**

**Program courses meet this requirement**

**ADO 10: Understand and respect the diversity and interdependence of the world's peoples and cultures**

**Program courses meet this requirement**

**ELECTRONIC TECHNOLOGY RELATED REQUIREMENTS – (7 credits)**

**And choose either Transfer or Non-Transfer:**

**For Transfer group take the following:**

- CIS 170 Programming C++  
or CIS 160 Programming in Visual Basic.NET
- MTH 151 Calculus I

**For Non-Transfer group take the following:**

- CIS 170 Programming C++  
or CIS 160 Programming in Visual Basic.NET

**Plus up to 4 credits from the following:**

Any ELT or CIS course that best meets your educational goals

**ELECTRONIC TECHNOLOGY CORE REQUIREMENTS – (37 credits)**

**Take the following:**

- CIS 101 Introduction to Computer Systems
- CIS 174 PC Repair/A+ Hardware Component
- CIS 175 PC Repair/A+ Software Component
- CIS 176 A+ Certification Exam Preparation
- CNS 101 Network+/Networking Fundamentals
- ELT 120 Circuit Analysis I
- ELT 125 Circuit Analysis II
- ELT 130 Electronics I
- ELT 140 Introduction to Digital Electronics
- ELT 250 Electric Motors & Controls
- ELT 260 Basic Programmable Controllers

**ELECTRONIC TECHNOLOGY/ELT – CERTIFICATE (ELTE.CERT)**

Minimum credits: .....	34
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

**GENERAL EDUCATION REQUIREMENTS – (6 credits)**

**Take the following:**

- ENG 131 Writing Experience I
- MTH 131 Intermediate Algebra or higher

**RELATED REQUIREMENTS – (3 credits)**

**Take one from the following:**

- CIS 160 Programming in Visual Basic.NET
- ELT 250 Electric Motors & Controls
- ELT 260 Basic Programmable Controllers
- ELT 280 Digital Systems

**ELECTRONIC TECHNICIAN CORE REQUIREMENTS – (25 credits)**

**Take the following:**

- CIS 101 Introduction to Computer Systems
- CIS 174 PC Repair/A+ Hardware Component
- CIS 175 PC Repair/A+ Software Component
- CIS 176 A+ Certification Exam Preparation
- ELT 120 Circuit Analysis I
- ELT 125 Circuit Analysis II
- ELT 130 Electronics I
- ELT 140 Introduction to Digital Electronics

## **ELECTRONIC TECHNOLOGY/MICROCOMPUTER – ASSOCIATE IN APPLIED SCIENCE (ETMS.AAS)**

Electronic technologists are employed in such fields as digital computer maintenance, voice and data communications, radio and television broadcasting, medical electronic instrumentation, high-tech manufacturing, research and development in laboratory settings. Students may also work to achieve A+ certification for employment as personal computer service professionals. A+ certification is the “journeyman’s card” for computer technologists, which is recognized by CompTIA. The non-profit Computing Technology Industry Association (CompTIA) is widely recognized as the standard for qualified computer service professionals.

Minimum credits: .....	62
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### **GENERAL EDUCATION REQUIREMENTS – (20 credits)**

#### **ADO 1: Write clearly, concisely and intelligibly (3 credits)**

##### **Take the following:**

ENG 131 Writing Experience I

#### **ADO 2: Speak clearly, concisely and intelligibly (3 credits)**

##### **Take the following:**

COM 240 Interpersonal Communication

#### **ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)**

##### **Take the following:**

MTH 120 Beginning Algebra or higher

#### **ADO 4: Demonstrate scientific reasoning (4-5 credits)**

##### **Choose one of the following:**

BIO 110 Introductory Biology  
 BIO 131 General Biology  
 BIO 132 Human Biology  
 BIO 155 Human Anatomy & Physiology  
 BIO 220 Microbiology  
 BIO 253 Human Anatomy and Physiology I  
 CEM 131 Fundamentals of Chemistry  
 CEM 141 General Chemistry I  
 GEL 160 Introduction to Geology

NSC 131 Contemporary Science  
 PHY 131 Conceptual Physics  
 PHY 151 Astronomy  
 PHY 231 College Physics I  
 PHY 251 Modern University Physics I

#### **ADO 5: Understand human behavior and social systems, the principles which govern them, and their implications for the present and future (3-4 credits)**

##### **Choose one of the following:**

ECN 231 Macroeconomics  
 ECN 232 Microeconomics  
 HIS 131 Western Civilization to 1555  
 HIS 132 Western Civilization 1555 to Present  
 HIS 231 Development of the US through the Civil War  
 HIS 232 Development of the US from the Civil War  
 HIS 235 20th Century History  
 PLS 141 American National Government  
 PSY 140 Introduction to Psychology  
 SOC 231 Principles of Sociology

#### **ADO 6: Understand aesthetic experience and artistic creativity (3 credits)**

##### **Choose one of the following:**

ART 111 Art History: Prehistoric to 1400  
 ART 112 Art History: Renaissance to Present  
 ENG 210 Introduction to Film  
 ENG 246 Short Story & Novel  
 ENG 247 Poetry & Drama  
 ENG 252 Shakespeare  
 ENG 254 Children’s Literature  
 ENG 255 American Literature - 19th Century  
 ENG 256 American Literature - 20th Century  
 HUM 131 Cultural Connections  
 MUS 131 Understanding Music  
 THR 116 Introduction to Theatre

#### **ADO 7: Think critically**

Program courses meet this requirement

#### **ADO 8: Make responsible decisions in personal and professional contexts (1-3 credits)**

##### **Choose one of the following:**

HPF 160 Wellness  
 HPF 186 Weight Training and Wellness  
 HPF 277 Stress Management

HPF 283 Managing Stress and Holistic Health  
 PHL 236 Ethics

#### **ADO 9: Work productively with others, recognizing individual contributions to group success** Program courses meet this requirement

#### **ADO 10: Understand and respect the diversity and interdependence of the world’s peoples and cultures** Program courses meet this requirement

### **MICROCOMPUTER RELATED REQUIREMENTS – (7 credits)**

#### **Take the following:**

CIS 170 Programming in C++

#### **And choose 4 credits from the following:**

Any ELT or CIS course that best meets your educational goals.

### **MICROCOMPUTER CORE REQUIREMENTS – (35 credits)**

#### **Take the following:**

BUA 120 Human Relations in Business  
 CIS 012 Windows® Workshop  
 CIS 013 Operating Systems: UNIX  
 CIS 016 Microsoft® DOS® Workshop  
 CIS 101 Introduction to Computer Systems  
 CIS 160 Programming in Visual Basic.Net  
 CIS 174 PC Repair/A+ Hardware Component  
 CIS 175 PC Repair/A+ Software  
 CIS 176 A+ Certification Exam Preparation  
 CIS 179 Network+ Certification Exam Preparation  
 CNS 101 Network+/Networking Fundamentals  
 ELT 120 DC Fundamentals  
 ELT 124 AC Fundamentals  
 ELT 129 Semiconductor Devices  
 ELT 139 Digital Electronic Fundamentals

## **ELECTRONIC TECHNOLOGY/MICROCOMPUTER – CERTIFICATE (ETMS.CERT)**

Minimum credits: .....	37
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses: .....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### **GENERAL EDUCATION REQUIREMENTS – (6 credits)**

#### **Take the following:**

ENG 131	Writing Experience I
MTH 120	Beginning Algebra or higher

### **RELATED REQUIREMENTS – (3 credits)**

#### **Take one of the following:**

CIS 160	Programming in Visual Basic.NET
ELT 250	Electric Motors & Controls
ELT 260	Basic Programmable Controllers
ELT 280	Digital Systems

### **MICROCOMPUTER CORE REQUIREMENTS – (28 credits)**

#### **Take the following:**

CIS 012	Windows® Workshop
CIS 013	Operating Systems: UNIX
CIS 016	Microsoft® DOS® Workshop
CIS 101	Introduction to Computer Systems
CIS 174	PC Repair/A+ Hardware Component
CIS 175	PC Repair/A+ Software Component
CIS 176	A+ Certification Exam Preparation
CNS101	Network+/Networking Fundamentals
ELT 120	DC Fundamentals
ELT 124	AC Fundamentals
ELT 129	Semiconductor Devices
ELT 139	Digital Electronic Fundamentals

## **MANUFACTURING TECH/MACHINING – ASSOCIATE IN APPLIED SCIENCE (MAMA.AAS)**

This Associate in Applied Science degree program is designed to provide the theoretical knowledge and the hands-on experience necessary to be successful in the increasingly technical area of manufacturing and/or production machining. Many of the courses in this curriculum coincide with the Academy for Manufacturing Careers BAT certificate program making this an ideal continuation after completion of your journeyman's certificate.

Minimum credits: .....	63
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses:.....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### **GENERAL EDUCATION REQUIREMENTS – (23 credits)**

#### **ADO 1: Write clearly, concisely and intelligibly (6 credits)**

##### **Take the following:**

ENG 131	Writing Experience I
ENG 232	Technical & Business Writing

#### **ADO 2: Speak clearly, concisely and intelligibly (3 credits)**

##### **Choose one of the following:**

COM 231	Communication Fundamentals
COM 240	Interpersonal Communication

#### **ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)**

##### **Take the following:**

MTH 120	Beginning Algebra or higher
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#### **ADO 4: Demonstrate scientific reasoning (4-5 credits)**

##### **Choose one of the following:**

BIO 110	Introductory Biology
BIO 131	General Biology
BIO 132	Human Biology
BIO 155	Anatomy & Physiology
BIO 220	Microbiology
BIO 253	Human Anatomy and Physiology I
CEM 131	Fundamentals of Chemistry
CEM 141	General Chemistry I
GEL 160	Introduction to Geology
NSC 131	Contemporary Science
PHY 131	Conceptual Physics
PHY 151	Astronomy

PHY 231	College Physics I
PHY 251	Modern University Physics I

#### **ADO 5: Understand human behavior and social systems, the principles which govern them, and their implications for the present and future (3-4 credits)**

##### **Choose one of the following:**

ECN 231	Macroeconomics
HIS 131	Western Civilization to 1555
HIS 132	Western Civilization 1555 to Present
HIS 231	Development of the US through the Civil War
HIS 232	Development of the US from the Civil War
HIS 235	20th Century History
PSY 140	Introduction to Psychology
SOC 231	Principles of Sociology

#### **ADO 6: Understand aesthetic experience and artistic creativity (3 credits)**

##### **Choose one of the following:**

ART 111	Art History: Prehistoric to 1400
ART 112	Art History: Renaissance to Present
ENG 210	Introduction to Film
ENG 246	Short Story & Novel
ENG 247	Poetry & Drama
ENG 252	Shakespeare
ENG 255	American Literature - 19th Century
ENG 256	American Literature - 20th Century
HUM 131	Cultural Connections
MUS 131	Understanding Music
THR 116	Introduction to Theatre

#### **ADO 7: Think critically**

Program courses meet this requirement

#### **ADO 8: Make responsible decisions in personal and professional contexts (1-3 credits)**

##### **Choose one of the following:**

HPF 160	Wellness
HPF 186	Weight Training and Wellness
HPF 277	Stress Management
HPF 283	Managing Stress and Holistic Health
PHL 236	Ethics

#### **ADO 9: Work productively with others, recognizing individual contributions to group success**

Program courses meet this requirement

**ADO 10: Understand and respect the diversity and interdependence of the world's peoples and cultures**  
Program courses meet this requirement

**MANUFACTURING TECH RELATED REQUIREMENTS – (6 credits)**

Take the following:

ECN 232 Microeconomics  
PLS 141 American National Government

**MANUFACTURING TECH MACHINING CORE REQUIREMENTS – (32 credits)**

Take the following:

MFG 005 Technical Problem Solving  
MFG 025 Basic Computer Skills  
MFG 060 Geometry for Manufacturing  
MFG 065 Trigonometry for Manufacturing  
MFG 105 Blueprint Reading  
MFG 115 GD and T  
MFG 150 Machining Theory & Methods  
MFG 155 Machinery Handbook  
MFG 160 Materials/Metallurgy  
MFG 165 Precision Machining Methods  
MFG 175 CNC Theory & Programming  
MFG 180 EDM Theory  
MFG 200 Basic Gauges & Measurement

**MANUFACTURING TECHNOLOGY/MAINTENANCE – ASSOCIATE IN APPLIED SCIENCE (MAMT.AAS)**

This Associate in Applied Science degree program is designed to provide the theoretical knowledge and the hands-on experience necessary to be successful in the increasingly technical area of manufacturing and/or industrial maintenance. Many of the courses in this curriculum coincide with the Academy for Manufacturing Careers BAT certificate program making this an ideal continuation after completion of your journeyman's certificate.

Minimum credits: .....60  
Minimum cumulative GPA: .....2.0  
Minimum grade in all courses: .....2.0  
Minimum JCC credits: .....12  
MACRAO Agreement: .....No

**GENERAL EDUCATION PREREQUISITE REQUIREMENTS – (23 credits)**

**ADO 1: Write clearly, concisely and intelligibly (6 credits)**

Take the following:

ENG 131 Writing Experience I  
ENG 232 Technical & Business Writing

**ADO 2: Speak clearly, concisely and intelligibly (3 credits)**

Choose one of the following:

COM 231 Communication Fundamentals  
COM 240 Interpersonal Communication

**ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)**

Take the following:

MTH 120 Beginning Algebra or higher

**ADO 4: Demonstrate scientific reasoning (4-5 credits)**

Choose one of the following:

BIO 110 Introductory Biology  
BIO 131 General Biology  
BIO 132 Human Biology  
BIO 155 Human Anatomy & Physiology  
BIO 220 Microbiology  
BIO 253 Human Anatomy and Physiology I  
CEM 131 Fundamentals of Chemistry  
CEM 141 General Chemistry I  
GEL 160 Introduction to Geology  
NSC 131 Contemporary Science  
PHY 131 Conceptual Physics  
PHY 151 Astronomy  
PHY 231 College Physics I  
PHY 251 Modern University Physics I

**ADO 5: Understand human behavior and social systems, the principles which govern them, and their implications for the present and future (3-4 credits)**

Choose one of the following:

ECN 231 Macroeconomics  
ECN 232 Microeconomics  
HIS 131 Western Civilization to 1555  
HIS 132 Western Civilization 1555 to Present  
HIS 231 Development of the US through the Civil War  
HIS 232 Development of the US from the Civil War  
HIS 235 20th Century History  
PSY 140 Introduction to Psychology  
SOC 231 Principles of Sociology

**ADO 6: Understand aesthetic experience and artistic creativity (3 credits)**

Choose one of the following:

ART 111 Art History: Prehistoric to 1400  
ART 112 Art History: Renaissance to Present  
ENG 210 Introduction to Film  
ENG 246 Short Story & Novel  
ENG 247 Poetry & Drama  
ENG 252 Shakespeare  
ENG 254 Children's Literature  
ENG 255 American Literature - 19th Century  
ENG 256 American Literature - 20th Century  
HUM 131 Cultural Connections  
MUS 131 Understanding Music  
THR 116 Introduction to Theatre

**ADO 7: Think critically**

Program courses meet this requirement

**ADO 8: Make responsible decisions in personal and professional contexts (1-3 credits)**

Choose one of the following:

HPF 160 Wellness  
HPF 186 Weight Training and Wellness  
HPF 277 Stress Management  
HPF 283 Managing Stress and Holistic Health  
PHL 236 Ethics

**ADO 9: Work productively with others, recognizing individual contributions to group success**  
Program courses meet this requirement

**ADO 10: Understand and respect the diversity and interdependence of the world's peoples and cultures**  
Program courses meet this requirement

**MANUFACTURING TECH/MAINTENANCE RELATED REQUIREMENTS – (2 credits)**

Take the following:

ELT 070 Basic Industrial Electricity

**MANUFACTURING TECH/MAINTENANCE CORE REQUIREMENTS – (35 credits)**

Take the following:

MFG 005 Technical Problem Solving  
MFG 020 Robotics & Material Handling  
MFG 025 Basic Computer Skills

- MFG 060 Geometry for Manufacturing
- MFG 065 Trigonometry for Manufacturing
- MFG 105 Blueprint Reading
- MFG 115 GD and T
- MFG 160 Materials/Metallurgy
- MFG 170 Hydraulics/Pneumatics
- MFG 185 Maintenance & Troubleshooting
- MFG 190 Drive Components & Bearings
- MFG 200 Basic Gauges & Measurement
- MFG 255 Basic PLC
- MFG 260 Industrial Wiring

**MANUFACTURING TECHNOLOGY/TOOL ROOM – ASSOCIATE IN APPLIED SCIENCE (MATR.AAS)**

This Associate in Applied Science degree program is designed to provide the theoretical knowledge and the hands-on experience necessary to be successful in the increasingly technical area of manufacturing tool room operations. Many of the courses in this curriculum coincide with the Academy for Manufacturing Careers BAT certificate program making this an ideal continuation after completion of your journeyman's certificate.

- Minimum credits: .....61
- Minimum cumulative GPA: .....2.0
- Minimum grade in all courses: .....2.0
- Minimum JCC credits: .....12
- MACRAO Agreement: .....No

**GENERAL EDUCATION REQUIREMENTS – (23 credits)**

**ADO 1: Write clearly, concisely and intelligibly (6 credits)**

Take the following:

- ENG 131 Writing Experience I
- ENG 232 Technical & Business Writing

**ADO 2: Speak clearly, concisely and intelligibly (3 credits)**

Choose one of the following:

- COM 231 Communication Fundamentals
- COM 240 Interpersonal Communication

**ADO 3: Demonstrate computational skills and mathematical reasoning (3-5 credits)**

Take the following:

- MTH 120 Beginning Algebra or higher

**ADO 4: Demonstrate scientific reasoning (4-5 credits)**

Take the following:

- PHY 131 Conceptual Physics

**ADO 5: Understand human behavior and social systems, the principles which govern them, and their implications for the present and future (3-4 credits)**

Choose one of the following:

- ECN 231 Macroeconomics
- ECN 232 Microeconomics
- HIS 131 Western Civilization to 1555
- HIS 132 Western Civilization 1555 to Present
- HIS 231 Development of the US through the Civil War
- HIS 232 Development of the US from the Civil War
- HIS 235 20th Century History
- PSY 140 Introduction to Psychology
- SOC 231 Principles of Sociology

**ADO 6: Understand aesthetic experience and artistic creativity (3 credits)**

Choose one of the following:

- ART 111 Art History: Prehistoric to 1400
- ART 112 Art History: Renaissance to Present
- ENG 210 Introduction to Film
- ENG 246 Short Story & Novel
- ENG 247 Poetry & Drama
- ENG 252 Shakespeare
- ENG 255 American Literature - 19th Century
- ENG 256 American Literature - 20th Century
- HUM 131 Cultural Connections
- MUS 131 Understanding Music
- THR 116 Introduction to Theatre

**ADO 7: Think critically**

Program courses meet this requirement

**ADO 8: Make responsible decisions in personal and professional contexts (1-3 credits)**

Choose from the following:

- HPF 160 Wellness
- HPF 186 Weight Training and Wellness
- HPF 277 Stress Management
- HPF 283 Managing Stress and Holistic Health
- PHL 236 Ethics

**ADO 9: Work productively with others, recognizing individual contributions to group success**

Program courses meet this requirement

**ADO 10: Understand and respect the diversity and interdependence of the world's peoples and cultures**

Program courses meet this requirement

**MANUFACTURING/TOOL ROOM RELATED REQUIREMENTS – (6 credits)**

Take the following:

- ECN 232 Microeconomics
- PLS 141 American National Government

**MANUFACTURING/TOOL ROOM CORE REQUIREMENTS – (32 credits)**

Take the following:

- MFG 005 Technical Problem Solving
- MFG 025 Basic Computer Skills
- MFG 060 Geometry for Manufacturing
- MFG 065 Trigonometry for Manufacturing
- MFG 105 Blueprint Reading
- MFG 115 GD and T
- MFG 120 Jig and Fixture Design
- MFG 125 Die Theory and Design
- MFG 150 Machining Theory & Methods
- MFG 160 Materials/Metallurgy
- MFG 175 CNC Theory & Programming
- MFG 180 EDM Theory
- MFG 200 Basic Gauges & Measurement





## PROCESS TECHNOLOGY CONCENTRATION (PRTE.CON)

A process technician is a key member of a team responsible for planning, analyzing and controlling production in a variety of process industries. The duties of a process technician including maintaining a safe work environment, controlling, monitoring and troubleshooting equipment, analyzing, evaluating and communicating about data concerning the process. The Process Technology Concentration will prepare the student for entry into the process industry by introducing the knowledge and skill sets necessary for each of the major process functions.

Minimum credits: .....	21
Minimum cumulative GPA: .....	2.0
Minimum grade in all courses:.....	2.0
Minimum JCC credits: .....	12
MACRAO Agreement: .....	No

### REQUIRED COURSES – (22 credits)

#### Take the following:

PTC 100	PTEC I-Introduction to Process Technology
PTC 110	PTEC II-Process Technology Equipment
PTC 120	PTEC III-Process Technology Systems
PTC 200	PTEC IV-Process Technology Operations
PTC 210	PTEC V-Safety, Health & Environment
PTC 220	PTEC VI-Quality Systems
PTC 230	PTEC VII-Instrumentation

## APPRENTICESHIP INFORMATION

Apprenticeship programs are available in many trades in cooperation with an employer or a joint apprenticeship committee representing labor and management. The U.S. Department of Labor/Bureau of Apprenticeship and Training registers and monitors the programs to ensure quality in apprenticeship programs nationwide.

Apprenticeship training involves classroom and on-the-job training over a span of usually four years. The process of applying knowledge on the job provides the apprentice with the opportunity to develop the necessary skills for a particular trade.

Upon completion of all employer-specified coursework and the required hours of on-the-job instruction, the employer may recommend that the apprentice receive a completion certificate from the U.S. Department of Labor/Bureau of Apprenticeship and Training.

For more information call Jackson Area Manufacturing Association (JAMA) 517.782.8268.

## TRANSFER PROGRAMS – PRE-ARCHITECTURE

Architects design buildings and other structures. These buildings must be attractive as well as functional, safe and economical, and must suit the needs of the people who use them. Architects take all these things into consideration when they design buildings and other structures.

Architects provide a wide variety of professional services to individuals and organizations planning a construction project. They may be involved in all phases of development, from the initial discussion of general ideas with the client through the entire life of the facility. Their duties require a number of skills – design, engineering, managerial, communication and supervisory.

## ENGINEERING

Engineers apply science, mathematics, and professional judgment to solve technical problems in industry and society. Today engineers are expected to contribute more than their technical competence. They are concerned with the impact of their work on society.