ENGINEERING/MANUFACTURING & 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 (HVAC)
- Customer Energy Specialist
- Electrician
- Electronic Technology/ELT
- Electronic Technology/Microcomputer Support
- Manufacturing Tech/Machining
- Manufacturing Tech/Maintenance
- Manufacturing Tech/Tool Room

SKILL SET CREDENTIAL

The "Skill Set Credentials" process is a building block approach to completing a trade certificate program. Students can choose to complete the skill set credentials depending upon the level of skill and knowledge desired. Students can apply for a skill set credential upon completion of the required courses.

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 36 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

AUTOMOTIVE SERVICE TECHNOLOGY – ASSOCIATE IN APPLIED SCIENCE

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 of 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. Toyota provides T-TEN students with: Toyota work uniforms, Toyota 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 upon successful completion of the course and the Ford Multimedia Training exit exam, 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: 63
Minimum cumulative GPA: 2.0
Minimum grade in all courses: 2.0
Minimum JCC credits: 12
MACRAO agreement: .....No

Contact program staff, Les Coxon at 517-796-8541 or Dan Livingston at 517-796-8540.

GENERAL EDUCATION REQUIREMENTS — (17 credits)
ENGLISH – (3 credits)
ENG 131 Writing Experience 3

MATHEMATICS — (3 credits)
MTH 120 Beginning Algebra or higher 3

SCIENCE — (4 credits)
Choose one of the following:
BIO 131 General Biology 4
BIO 132 Human Biology 4
BIO 151 General Botany 4
BIO 152 General Zoology 4
BIO 155 Human Anatomy 5
CEM 131 Fundamentals of Chemistry 4
CEM 132 Fundamentals of Organic Biological Chemistry 4
CEM 137 Chemistry of Life 4
CEM 141 General Chemistry I 5
CEM 142 General Chemistry II 5
GEL 160 Introduction to Geology 4
NSC 131 Contemporary Science 4
PHY 131Conceptual Physics 4
PHY 151 Astronomy 4
PHY 231 College Physics I 4
PHY 251 Modern University Physics I 5

SOCIAL SCIENCE (3 credits)
Choose one of the following:
ANT 131 Introduction to Anthropology 3
CRJ 101 Criminal Law 3
CRJ 104 Criminal Justice Psychology 3
CRJ 111 Introduction to Criminal Justice 3
CRJ 120 Human Relations for Corrections 3
CRJ 127 Corrections Law 3
ECN 231 Macroeconomics 3
ECN 232 Microeconomics 3
GEO 131 Physical Geography 3
HIS 120 Ancient History 3
HIS 131 Western Civilization to 1555 4
HIS 132 Western Civilization 1955 to Present 4
HIS 231 Development of the US through the Civil War 3
HIS 232 Development of the US from the Civil War 3
PLS 141 American National Government 3
PSY 140 Introduction to Psychology 4
PSY 152 Social Psychology 3
PSY 251 Abnormal Psychology 3
PSY 252 Developmental Psychology 3
SOC 152 Social Psychology 3
SOC 231 Principles of Sociology 3
SOC 236* Women in a Changing Society 3

HUMANITIES — (3 credits)
Choose one of the following:
ART 111 Art History: Prehistoric to 1400 3
ART 112 Art History: Renaissance to Present 3
ENG 210 Introduction to Film 3
ENG 236* Women in a Changing Society 3
ENG 246 Short Story & Novel 4
ENG 247 Poetry and Drama 3
ENG 249 African-American Literature 3
ENG 254 Children's Literature 3
ENG 255 American Literature 19th Century 3
ENG 256 American Literature 20th Century 3
ENG 257 World Literature I 3
HUM 131 Cultural Connections 3
MUS 130 Survey of Non-Western Music 3
MUS 131 Understanding Music 3
MUS 132 History of American Popular Music 3
MUS 133 Music Education 3
MUS 151 Music Theory I 4
MUS 152 Music Theory II 4
PHL 231 Intro to Philosophy 3
PHL 232 Logic 3
THR 116 Introduction to Theatre 3

HEALTH/PHYSICAL FITNESS — (1 credit)
Choose one of the following:
HPF 160 Wellness 1
HPF 168 Weight Training & Conditioning 2
HPF 221 Jazz Techniques 3
HPF 268 Advanced Weight Training 2
HPF 277 Stress Management 2

AUTOMOTIVE SERVICE TECHNOLOGY CORE REQUIREMENTS— (38 credits)
AUT 102 Engine Performance I 4
AUT 103 Engine Performance II 4
AUT 105 Automotive Brakes 3
AUT 106 Suspension and Steering 3
AUT 108 Automotive Air Conditioning/Heating 3
AUT 112 Electrical Systems I 3
AUT 113 Electrical Systems II 3
AUT 201 Engine Repair 4
AUT 202 Automatic Transmission 4
AUT 204 Manual Drivetrain 3
AUT 210 Co-op Experience 4

ELECTIVES— (8 credits)
AUT 101 General Service 2
AUT 118 Diesel Fundamentals 2
AUT 211 Co-Op Experience 4
AUT 212 Co-Op Experience 4
AUT 214 Auto Lab Experience 4
AUT 234 Undercar Service 2
or select electives from classes in BUA or ELT

AUTOMOTIVE SERVICE TECHNOLOGY — CERTIFICATE

This program provides classroom and laboratory experiences that prepare the student for entry-level employment in the automotive service field. It also prepares students for the Michigan and/or Automotive Service Excellence (ASE) certification tests.

Minimum credits: 38
Minimum cumulative GPA: 2.0
Minimum grade in all courses: 2.0
Minimum JCC credits: 12
MACRAO agreement: .....No

Contact program staff Les Coxon at 517-796-8541 or Dan Livingston at 517-796-8540

AUTOMOTIVE SERVICE TECHNOLOGY CORE REQUIREMENTS — (34 credits)

AUT 105 Automotive Brakes 3
AUT 106 Suspension and Steering 3
AUT 102 Engine Performance I 4
AUT 103 Engine Performance II 4
AUT 108 Automotive Air Conditioning/Heating 3
AUT 112 Electrical Systems I 3
AUT 113 Electrical Systems II 3
AUT 201 Engine Repair 4
AUT 202 Automatic Transmission 4
AUT 204 Manual Drivetrain 3

RELATED REQUIREMENTS — (4 credits)

AUT 210 Co-op 4
AUT 211 Co-op 4
AUT 212 Co-op 4

SKILL SET CREDENTIAL — WHEEL SERVICE

Contact program staff, Les Coxon at 517-796-8541 or Dan Livingston at 517-796-8540.

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

REQUIRED COURSES — (12 credits)

AUT 101 General Service 2
AUT 105 Automotive Brakes 3
AUT 106 Suspension and Steering 3
AUT 210 Co-op 4

SKILL SET CREDENTIAL — DRIVEABILITY

Contact program staff, Les Coxon at 517-796-8541 or Dan Livingston at 517-796-8540.

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)

AUT 102 Engine Performance I 4
AUT 103 Engine Performance II 4
AUT 108 Automotive Air Conditioning/Heating 3
AUT 112 Electrical Systems I 3
AUT 113 Electrical Systems II 3
AUT 211 Co-op 4

SKILL SET CREDENTIAL — POWERTRAIN

Contact program staff, Les Coxon at 517-796-8541 or Dan Livingston at 517-796-8540.

Minimum credits: 15
Minimum cumulative GPA: 2.0
Minimum grade in all courses: 2.0
Minimum JCC credits: 12
MACRAO agreement: .....No

REQUIRED COURSES — (15 credits)

AUT 201 Engine Repair 4
AUT 202 Automatic Transmission 4
AUT 204 Manual Drivetrain 3
AUT 212 Co-op 4

AVIATION FLIGHT TECHNOLOGY— ASSOCIATE IN APPLIED SCIENCE

Basic ground school and flight instruction needed to meet the requirements of the Federal Aviation Administration's Commercial Pilot certificate with instrument and flight instructor 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: 60
Minimum cumulative GPA: 2.0
Minimum grade in all courses: 2.0
Minimum JCC credits: 12
MACRAO agreement: .....No

GENERAL EDUCATION REQUIREMENTS — (19 credits)
ENGLISH — (3 credits)
ENG 131 Writing Experience 3

MATHEMATICS — (4 credits)
MTH 131 Intermediate Algebra 4

SCIENCE — (4 credits)
PHY 231 College Physics 4

SOCIAL SCIENCE — (4 credits)
PSY 140 Introduction to Psychology 4

HUMANITIES — (3 credits)
Choose one of the following:
ART 111 Art History: Prehistoric to 1400 3
ART 112 Art History: Renaissance - Present 3
ENG 210 Introduction to Film 3
ENG 236* Women in a Changing Society 3
ENG 246 Short Story and Novel 3
ENG 247 Poetry and Drama 3
ENG 249 African American Literature 3
ENG 252 Shakespeare 3
ENG 255 American Literature 19th Century 3
ENG 256 American Literature 20th Century 3
ENG 257 World Literature I 3
HUM 131 Cultural Connections 3
MUS 130 Survey of Non-Western Music 3
MUS 131 Understanding Music 3
MUS 132 History of American Popular Music 3
MUS 133 Music Education 3
MUS 151 Music Theory I 4
MUS 152 Music Theory II 4
PHL 231 Introduction to Philosophy 3
PHL 232 Logic 3
THR 116 Introduction to Theatre 3

HEALTH/PHYSICAL FITNESS— (1 credit)
Choose one of the following:
HPF 160 Wellness 1
HPF 168 Weight Training & Conditioning 2
HPF 277 Stress Management 2

RELATED REQUIREMENTS - (6 credits)
MTH 133 Introduction to Probability & Statistics 3
CIS 101 Introduction to Computer Systems 3

AVIATION TECHNOLOGY CORE REQUIREMENTS — (35 credits)
AFT 100 Basic Maneuvers 2
AFT 110 Primary Ground School 3
AFT 115 Primary Flight I 4
AFT 120 Primary Flight II 4
AFT 125 Commercial Ground School 3
AFT 130 Commercial Flight I 4
AFT 135 Instrument Ground School 3
AFT 140 Commercial Flight II 4
AFT 200 Commercial Flight III 4
AFT 205 Commercial Flight IV 4

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

CLIMATE CONTROL TECHNOLOGY — ASSOCIATE IN APPLIED SCIENCE

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 — (17 credits)

ENGLISH — (3 credits)
ENG 131 Writing Experience 3

MATHEMATICS — (3 credits)
MTH 120 Beginning Algebra or higher 4

SCIENCE — (4 credits)
Choose one of the following:
BIO 131 General Biology 4
BIO 132 Human Biology 4
CEM 131 Fundamentals of Chemistry 4
CEM 141 General Chemistry I 5
GEL 160 Introduction to Geology 4
NSC 131 Contemporary Science 4
PHY 131 Conceptual Physics 4
PHY 151 Astronomy 4

SOCIAL SCIENCE — (3 credits)
Choose one of the following:
ANT 131 Introduction to Anthropology 3
CRJ 104 Criminal Justice Psychology 3
ECN 231 Macroeconomics 3
ECN 232 Microeconomics 3
GEO 131 Physical Geography 3
HIS 131 Western Civilization to 1555 4
HIS 132 Western Civilization 1955 to Present 4
PLS 141 American National Government 3

HUMANITIES — (3 credits)
Choose one of the following:
ART 111 Art History: Prehistoric to 1400 3
ART 112 Art History: Renaissance to Present 3
ENG 210 Introduction to Film 3
ENG 236 Women in a Changing Society 3
ENG 246 Short Story & Novel 3
ENG 247 Poetry and Drama 3
ENG 249 African American Literature 3
ENG 252 Shakespeare 3
ENG 254 Children's Literature 3
ENG 255 American Literature-19th Century 3
ENG 256 American Literature-20th Century 3
ENG 257 World Literature I 3
HUM 131 Cultural Connections 3
MUS 130 Survey of Non-Western Music 3
MUS 131 Understanding Music 3
MUS 132 History of American Popular Music 3
MUS 133 Music Education 3
MUS 151 Music Theory I 4
MUS 152 Music Theory II 4
PHL 231 Introduction to Philosophy 3
PHL 232 Logic 3
THR 116 Introduction to Theatre 3

HEALTH/PHYSICAL FITNESS - (1 credit)
Choose one of the following:
HPF 160 Wellness 1
HPF 168 Weight Training & Conditioning 2
HPF 221 Jazz Techniques 3
HPF 277 Stress Management 2

RELATED REQUIREMENTS – (6 credits)
Choose two of the following:
BUA 120 Human Relations in Business 3
ENG 232 Technical & Business Writing 3
CIS 101 Introduction to Computer Systems 3

CLIMATE CONTROL CORE REQUIREMENTS — (27 credits)
CCT 117 Beginning Sheet Metal 2
CCT 118 Advanced Sheet Metal 2
CCT 121 Introduction to HVAC 3
CCT 123 Application of HVAC Technology 3
CCT 131 Basic HVAC Electricity/Controls 2
CCT 135 Refrigeration/Air Conditioning I 3
CCT 136 Refrigeration/Air Conditioning II 3
CCT 137 Advanced HVAC Electricity/Controls 2
CCT 141 Basic Heating 2
CCT 142 Advanced Heating 2
CCT 200 Mechanical Code 2
CCT 201 Refrigeration Certification 1

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

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

SUGGESTED COURSE SEQUENCE
First Year, Fall Semester
CCT 121, CCT 117, CCT 118, ENG 131, MTH 120 or higher

First Year, Winter Semester
CCT 123, CIS 101, Science and HPF requirements

First Year, Spring Semester
Social Science and Humanities requirements

Second Year, Fall Semester
CCT 131, CCT 137, CCT 141, CCT 142, EMS 110, ENG 232

Second Year, Winter Semester
CCT 135, CCT136, CCT 200, CCT 201

CLIMATE CONTROL SYSTEMS — CERTIFICATE

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: 33
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 232 Technical & Business Writing 3
MTH 120 Beginning Algebra or higher 3

CLIMATE CONTROL SYSTEMS CORE REQUIREMENTS — (27 credits)
CCT 117 Beginning Sheet Metal 2
CCT 118 Advanced Sheet Metal 2
CCT 121 Introduction to HVAC 3
CCT 123 Application of HVAC Technology 3
CCT 131 Basic HVAC Electricity/Controls 2
CCT 135 Refrigeration/Air Conditioning I 3
CCT 136 Refrigeration/Air Conditioning II 3
CCT 137 Advanced HVAC Electricity/Controls 2

CCT 141 Basic Heating 2
CCT 142 Advanced Heating 2
CCT 200 Mechanical Code 2
CCT 201 Refrigeration Certification 1

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

SUGGESTED COURSE SEQUENCE
First Year, Fall Semester
CCT 117, CCT 118, CCT 121, CCT 131, CCT 137, CCT 141, CCT 142

First Year, Winter Semester
CCT 123, CCT 135, CCT 136, CCT 200, CCT 201, ENG 131

First Year, Spring Semester
MTH 120 or higher, ENG 232, EMT 110

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 prerequistites required for theWinter semester courses.

CUSTOMER ENERGY SPECIALIST — CERTIFICATE

This program is designed to provide students with the competencies, knowledge and skills to function as a beginning Customer Energy Specialist for Consumers Energy. Completion does not guarantee employment.
Minimum credits: 48
Minimum cumulative GPA: 2.0
Minimum grade in all courses: 2.0
Minimum JCC credits: 12
MACRAO agreement: .....No

GENERAL EDUCATION REQUIREMENTS — (12 credits)
ENG 131 Writing Experience 3
ENG 232 Technical & Business Writing 3
MTH 120 Beginning Algebra or higher 3
SPH 231 Communication Fundamentals 3

RELATED BUSINESS REQUIREMENTS — (16 credits)
ACC 216 Financial Counting Concepts or
ACC 231 Principles of Accounting I 4
BUA 230 Principles of Marketing or
BUA 100 Contemporary Business 3
BUA 121 Leadership or
BUA 120 Human Relations in Business 3
BUA 250 Business Law I 3
CIS 101 Introduction to Computer Systems 3

TECHNICAL CORE REQUIREMENTS — (15 credits)
CAD 131 Computer Assisted Drafting I (AutoCAD) 3
CAD 132 Computer Assisted Drafting II (AutoCAD) 3
PHY 131 Conceptual Physics or
PHY 161 Industrial Physics 2
ELT 120 Circuit Analysis I 4
ELT 125 Circuit Analysis II 3

ELECTIVES
Select electives from any of the following disciplines: BIO, CEM, EGR, GEO, NSC, CPS, CIS or choose from the following courses: ELT 150, ELT 152, ELT 215 or from any additional MTH course at a higher level than used for the general education requirement to meet the 48 credits required for the certificate.

ELECTRICIAN — ASSOCIATE IN APPLIED SCIENCE

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 — (17 credits)
ENGLISH — (3 credits)
ENG 131 Writing Experience 3

MATHEMATICS — (3 credits)
MTH 131 Intermediate Algebra or higher 3

SCIENCE — (4 credits)
Choose one of the following:
BIO 131 General Biology 4
BIO 132 Human Biology 4
CEM 131 Fundamentals of Chemistry 4
CEM 141 General Chemistry I 5
GEL 160 Introduction to Geology 4
NSC 131 Contemporary Science 4
PHY 131 Conceptual Physics 4
PHY 151 Astronomy 4

SOCIAL SCIENCE — (3 credits)
Choose one of the following:
ANT 131 Introduction to Anthropology 3
CRJ 104 Criminal Justice Psychology 3
ECN 231 Macroeconomics 3
ECN 232 Microeconomics 3
GEO 131 Physical Geography 3
HIS 131 Western Civilization to 1555 4
HIS 132 Western Civilization 1555 to Present 4
PLS 141 American National Government 3

HUMANITIES — (3 credits)
Choose one of the following:
ART 111 Art History: Prehistoric to 1400 3
ART 112 Art History: Renaissance to Present 3
ENG 210 Introduction to Film 3
ENG 236 Women in a Changing Society 3
ENG 246 Short Story & Novel 3
ENG 247 Poetry and Drama 3
ENG 249 African American Literature 3
ENG 252 Shakespeare 3
ENG 254 Children's Literature 3
ENG 255 American Literature-19th Century 3
ENG 256 American Literature-20th Century 3
ENG 257 World Literature I 3
HUM 131 Cultural Connections 3
MUS 130 Survey of Non-Western Music 3
MUS 131 Understanding Music 3
MUS 132 History of American Popular Music 3
MUS 133 Music Education 3
MUS 151 Music Theory I 4
MUS 152 Music Theory II 4
PHL 231 Introduction to Philosophy 3
PHL 232 Logic 3
THR 116 Introduction to Theatre 3

HEALTH/PHYSICAL FITNESS — (1 credit)
Choose one of the following:
HPF 160 Wellness 1
HPF 168 Weight Training & Conditioning 2
HPF 221 Jazz Techniques 3
HPF 277 Stress Management 2

ELECTRICAN CORE REQUIREMENTS – (40 credits)
ELT 074 National Electric Code 2
ELT 120 Circuit Analysis I 4
ELT 125 Circuit Analysis II 3
ELT 130 Electronics I 4
ELT 140 Introduction to Digital Electronics 4
ELT 148 Electrical Math I 2
ELT 149 Electrical Math II 2
ELT 150 Residential Wiring 2
ELT 151 Commercial Wiring 2
ELT 152 Industrial Wiring 2
ELT 215 Electrical Troubleshooting 2
ELT 220 Industrial Motion Control 3
ELT 250 Electrical Motors and Controls 4
ELT 260 Basic Programmable Controllers 4

ADDITIONAL REQUIREMENTS
EMS 110 CPR & First Aid or Adult CPR & First Aid Certification

ELECTIVES
Select electives from classes in ELT or CIS so that degree equals 60 credits.

ELECTRICIAN — CERTIFICATE

Minimum credits: 40
Minimum cumulative GPA: 2.0
Minimum grade in all courses: 2.0
Minimum JCC credits: 12
MACRAO agreement: ..... No

ELECTRICIAN CORE REQUIREMENTS – (40 credits)
ELT 074 National Electric Code 2
ELT 120 Circuit Analysis I 4
ELT 125 Circuit Analysis II 3
ELT 130 Electronics I 4
ELT 140 Introduction to Digital Electronics 4
ELT 148 Electrical Math I 2
ELT 149 Electrical Math II 2
ELT 150 Residential Wiring 2
ELT 151 Commercial Wiring 2
ELT 152 Industrial Wiring 2
ELT 215 Electrical Troubleshooting 2
ELT 220 Industrial Motion Control 3
ELT 250 Electrical Motors and Controls 4
ELT 260 Basic Programmable Controllers 4

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

SKILL SET CREDENTIAL — ELECTRICAL BASICS

Completion of this program provides solid electrical foundation for the person seeking electrical or industrial maintenance mechanic training.
Minimum credits: 13
Minimum cumulative GPA: 2.0
Minimum grade in all courses: 2.0
Minimum JCC credits: 12
MACRAO agreement: ..... No

REQUIRED COURSES — (13 credits)
ELT 120 Circuit Analysis I 4
ELT 125 Circuit Analysis II 3
ELT 150 Residential Wiring 2
ELT 152 Industrial Wiring 2
ELT 148 Electrical Math I 2

ELECTRONIC TECHNOLOGY/ELT — ASSOCIATE IN APPLIED SCIENCE

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: 70
Minimum cumulative GPA: 2.0
Minimum grade in all courses: 2.0
Minimum JCC credits: 12
MACRAO agreement: .....No

GENERAL EDUCATION REQUIREMENTS — (19 credits)
ENGLISH — (3 credits)
ENG 131 Writing Experience 3

MATHEMATICS — (5 credits)
MTH 140 Pre-calculus 5

SCIENCE — (4 credits)
Choose one of the following:
BIO 131 General Biology 4
BIO 132 Human Biology 4
CEM 131 Fundamentals of Chemistry 4
CEM 141 General Chemistry I 5
GEL 160 Introduction to Geology 4
NSC 131 Contemporary Science 4
PHY 131 Conceptual Physics 4
PHY 231 College Physics 4
PHY 151 Astronomy 4

SOCIAL SCIENCE — (3 credits)
Choose one of the following:
ANT 131 Introduction to Anthropology 3
CRJ 104 Criminal Justice Psychology 3
ECN 231 Macroeconomics 3
ECN 232 Microeconomics 3
GEO 131 Physical Geography 3
HIS 131 Western Civilization to 1555 4
HIS 132 Western Civilization 1555 to Present 4
PLS 141 American National Government 3

HUMANITIES — (3 credits)
Choose one of the following:
ART 111 Art History: Prehistoric to 1400 3
ART 112 Art History: Renaissance to Present 3
ENG 210 Introduction to Film 3
ENG 236 Women in a Changing Society 3
ENG 246 Short Story & Novel 3
ENG 247 Poetry and Drama 3
ENG 249 African American Literature 3
ENG 252 Shakespeare 3
ENG 254 Children's Literature 3
ENG 255 American Literature-19th Century 3
ENG 256 American Literature-20th Century 3
ENG 257 World Literature I 3
HUM 131 Cultural Connections 3
MUS 130 Survey of Non-Western Music 3
MUS 131 Understanding Music 3
MUS 132 History of American Popular Music 3
MUS 133 Music Education 3
MUS 151 Music Theory I 4
MUS 152 Music Theory II 4
PHL 231 Introduction to Philosophy 3
PHL 232 Logic 3
THR 116 Introduction to Theatre 3

HEALTH/PHYSICAL FITNESS — (1 credit)
Choose one of the following:
HPF 160 Wellness 3
HPF 168 Weight Training & Conditioning 3
HPF 221 Jazz Techniques 3
HPF 277 Stress Management 2

RELATED REQUIREMENTS — (11 credits)
Choose either TRANSFER GROUP or NON-TRANSFER GROUP:

TRANSFER GROUP
CIS 170 Programming in C++ or
CIS 160 Programming in Visual Basic.NET 3
MTH 151 Calculus I 4
PHY 232 College Physics II 4

OR
NON-TRANSFER GROUP
CIS 170 Programming in C++ or
CIS 160 Programming in Visual Basic.NET 3

AND
Choose up to 8 credits from the following: Any ELT or CIS course that best meet your educational goals.

ELECTRONIC TECHNICIAN CORE REQUIREMENTS – (40 credits)
CIS 101 Introduction to Computer Systems 3
CIS 174 PC Repair/A+ Hardware Component 3
CIS 175 PC Repair/A+ Software Component 3
CIS 176 A+ Certification Exam Preparation 3
CIS 177 Network+ Network Fundamental Component 3

ELT 120 Circuit Analysis I 4
ELT 125 Circuit Analysis II 3
ELT 130 Electronics I 4
ELT 140 Introduction to Digital Electronics 4
ELT 250 Electric Motors and Controls 4
ELT 260 Basic Programmable Controllers 4
ELT 280 Digital Systems 4

ELECTRONIC TECHNOLOGY/ELT – CERTIFICATE

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)
ENG 131 Writing Experience 3
MTH 131 Intermediate Algebra or higher 3

RELATED REQUIREMENTS – (3 credits)
Choose one from the following:
CIS 160 Programming in Visual Basic.NET 3
ELT 250 Electric Motors and Controls 4
ELT 260 Basic Programmable Controllers 4
ELT 280 Digital Systems 4

ELECTRONIC TECHNICIAN CORE REQUIREMENTS – (25 credits)
CIS 101 Introduction to Computer Systems 3
CIS 174 PC Repair/A+ Hardware Component 3
CIS 175 PC Repair/A+ Software Component 3
CIS 176 A+ Certification Exam Preparation 1
ELT 120 Circuit Analysis I 4
ELT 125 Circuit Analysis II 3
ELT 130 Electronics I 4
ELT 140 Introduction to Digital Electronics 4

ELECTRONIC TECHNOLOGY/ MICROCOMPUTER — ASSOCIATE IN APPLIED SCIENCE

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 technologist, 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: 65
Minimum cumulative GPA: 2.0
Minimum grade in all courses: 2.0
Minimum JCC credits: 12
MACRAO agreement: ....No

GENERAL EDUCATION REQUIREMENTS — (19 credits)
ENGLISH — (3 credits)
ENG 131 Writing Experience 3

MATHEMATICS — (3 credits)
MTH 131 Intermediate Algebra or higher 3

SCIENCE — (4 credits)
Choose one from the following:
BIO 131 General Biology 4
BIO 132 Human Biology 4
CEM 131 Fundamentals of Chemistry 4
CEM 141 General Chemistry I 5
GEL 160 Introduction to Geology 4
NSC 131 Contemporary Science 4
PHY 131 Conceptual Physics 4
PHY 151 Astronomy 4

SOCIAL SCIENCE — (3 credits)
Choose one of the following:
ANT 131 Introduction to Anthropology 3
CRJ 104 Criminal Justice Psychology 3
ECN 231 Macroeconomics 3
ECN 232 Microeconomics 3
GEO 131 Physical Geography 3
HIS 131 Western Civilization to 1555 4
HIS 132 Western Civilization 1955 to Present 4
PLS 141 American National Government 3

HUMANITIES — (3 credits)
Choose one of the following:
ART 111 Art History: Prehistoric to 1400 3
ART 112 Art History: Renaissance to Present 3
ENG 210 Introduction to Film 3
ENG 236 Women in a Changing Society 3
ENG 246 Short Story & Novel 3
ENG 247 Poetry and Drama 3
ENG 249 African American Literature 3
ENG 252 Shakespeare 3
ENG 254 Children's Literature 3
ENG 255 American Literature-19th Century 3
ENG 256 American Literature-20th Century 3
ENG 257 World Literature I 3
HUM 131 Cultural Connections 3

MUS 130 Survey of Non-Western Music 3
MUS 131 Understanding Music 3
MUS 132 History of American Popular Music 3
MUS 133 Music Education 3
MUS 151 Music Theory I 4
MUS 152 Music Theory II 4
PHL 231 Introduction to Philosophy 3
PHL 232 Logic 3
THR 116 Introduction to Theatre 3

HEALTH/PHYSICAL FITNESS — (1 credit)
Choose one of the following:
HPF 160 Wellness 1
HPF 168 Weight Training & Conditioning 2
HPF 221 Jazz Techniques 3
HPF 277 Stress Management 2

RELATED REQUIREMENTS — (11 credits)
CIS 170 Programming in C++ 3

AND choose up to 8 credits from the following: Any ELT or CIS course that best meet your educational goals.

MICROCOMPUTER CORE REQUIREMENTS – (37 credits)
BUA 120 Human Relations in Business 3
CIS 012 Windows® Workshop 1
CIS 013 Operating Systems: UNIX 1
CIS 016 MS DOS® Workshop 1
CIS 101 Introduction to Computer Systems 3
CIS 160 Programming in Visual Basic.Net 3
CIS 174 PC Repair/A+ Hardware Component 3
CIS 175 PC Repair/A+ Software Component 3
CIS 176 A+ Certification Exam Preparation 1
CIS 177 Network+ Networking Fundamentals Component ...3
CIS 179 Network+ Certification Exam Preparation 1
ELT 119 DC Fundamentals 3
ELT 124 AC Fundamentals 2
ELT 129 Semiconductor Devices 2
ELT 139 Digital Electronic Fundamentals 3
ELT 280 Digital Systems 4

ELECTRONIC TECHNOLOGY/ MICROCOMPUTER — CERTIFICATE

Minimum credits: 35
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 3
MTH 131 Intermediate Algebra or higher 3

RELATED REQUIREMENTS – (3 credits)
Choose one of the following:
CIS 160 Programming in Visual Basic.NET 3
ELT 250 Electric Motors and Controls 4
ELT 260 Basic Programmable Controllers 4
ELT 280 Digital Systems 4

MICROCOMPUTER CORE REQUIREMENTS— (26 credits)
CIS 012 Windows® Workshop 1
CIS 013 Operating Systems: UNIX 1
CIS 016 Microsoft® DOS® Workshop 1
CIS 101 Introduction to Computer Systems 3
CIS 174 PC Repair/A+ Hardware Component 3
CIS 175 PC Repair/A+ Software Component 3
CIS 176 A+ Certification Exam Preparation 1
CIS 177 Network+ Networking Fundamentals Component ...3
ELT 119 DC Fundamentals 3
ELT 124 AC Fundamentals 2
ELT 129 Semiconductor Devices 2
ELT 139 Digital Electronic Fundamentals 3

MANUFACTURING TECH / MACHINING — ASSOCIATE IN APPLIED SCIENCE

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: 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)
ENGLISH — (3 credits)
ENG 131 Writing Experience 3

MATHEMATICS — (3 credits)
MTH 120 Beginning Algebra or higher 4

SCIENCE — (4 credits)
PHY 131 Conceptual Physics 4

SOCIAL SCIENCE — (9 credits)
ECN 232 Microeconomics 3
PLS 141 American National Government 3
SOC 231 Principles of Sociology 3

HUMANITIES — (3 credits)
PHL 231 Introduction to Philosophy 3

HEALTH/PHYSICAL FITNESS — (1 credit)
HPF 160 Wellness 1

MANUFACTURING TECH / MACHINING RELATED REQUIREMENTS — (25 credits)
ENG 232 Technical & Business Writing 3
MFG 060 Geometry for Manufacturing 2
MFG 065 Trigonometry for Manufacturing 2
MFG 150 Machining Theory & Methods 4
MFG 155 Machining Handbook 2
MFG 165 Precision Machining Methods 4
MFG 175 CNC Theory & Programming 2
MFG 180 EDM Theory 3
SPH 231 Communication Fundamentals 3

MANUFACTURING TECH/MACHINING CORE REQUIREMENTS — (13 credits)
MFG 005 Technical Problem Solving 2
MFG 025 Basic Computer Skills 3
MFG 105 Blueprint Reading 2
MFG 115 GD&T 2
MFG 160 Materials/Metallurgy 2
MFG 200 Basic Gauges and Measurement 2

MANUFACTURING TECH / MAINTENANCE — ASSOCIATE IN APPLIED SCIENCE

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: 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)
ENGLISH — (3 credits)
ENG 131 Writing Experience 3

MATHEMATICS — (3 credits)
MTH 120 Beginning Algebra or higher 4

SCIENCE — (4 credits)
PHY 131 Conceptual Physics 4

SOCIAL SCIENCE — (9 credits)
ECN 232 Microeconomics 3
PLS 141 American National Government 3
SOC 231 Principles of Sociology 3

HUMANITIES — (3 credits)
PHL 231 Introduction to Philosophy 3

HEALTH/PHYSICAL FITNESS — (1 credit)
HPF 160 Wellness 1

MANUFACTURING TECH/ MAINTENANCE RELATED REQUIREMENTS— (27 credits)
ENG 232 Technical & Business Writing 3
ELT 070 Basic Industrial Electricity 2
MFG 020 Robotics & Material Handling 2
MFG 060 Geometry for Manufacturing 2
MFG 065 Trigonometry for Manufacturing 2
MFG 170 Hydraulics/Pneumatics 4
MFG 185 Maintenance & Troubleshooting 2
MFG 190 Drive Components & Bearings 2
MFG 255 Basic PLC 2
MFG 260 Industrial Wiring 3
SPH 231 Communication Fundamentals 3

MANUFACTURING TECH/ MAINTENANCE CORE REQUIREMENTS — (13 credits)
MFG 005 Technical Problem Solving 2
MFG 025 Basic Computer Skills 3
MFG 105 Blueprint Reading 2
MFG 115 GD&T 2
MFG 160 Materials/Metallurgy 2
MFG 200 Basic Gauges and Measurement 2

MANUFACTURING TECH / TOOL ROOM — ASSOCIATE IN APPLIED SCIENCE

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: 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)
ENGLISH — (3 credits)
ENG 131 Writing Experience 3

MATHEMATICS — (3 credits)
MTH 120 Beginning Algebra or higher 4

SCIENCE — (4 credits)
PHY 131 Conceptual Physics 4

SOCIAL SCIENCE — (9 credits)
ECN 232 Microeconomics 3
PLS 141 American National Government 3
SOC 231 Principles of Sociology 3

HUMANITIES — (3 credits)
PHL 231 Introduction to Philosophy 3

HEALTH/PHYSICAL FITNESS — (1 credit)
HPF 160 Wellness 1

MANUFACTURING TECH/ TOOL ROOM RELATED REQUIREMENTS — (24 credits)
ENG 232 Technical & Business Writing 3
MFG 060 Geometry for Manufacturing 2
MFG 065 Trigonometry for Manufacturing 2
MFG 120 Jig & Fixture Design 2
MFG 125 Die Theory & Design 3
MFG 150 Machining Theory & Methods 4
MFG 175 CNC Theory & Programming 2
MFG 180 EDM Theory 3
SPH 231 Communication Fundamentals 3

MANUFACTURING TECH/ TOOL ROOM CORE REQUIREMENTS — (13 credits)
MFG 005 Technical Problem Solving 2
MFG 025 Basic Computer Skills 3
MFG 105 Blueprint Reading 2
MFG 115 GD&T 2
MFG 160 Materials/Metallurgy 2
MFG 200 Basic Gauges and Measurement 2

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.

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.

SUGGESTED COURSE SEQUENCE
First Year, Fall Semester
ENG 131, MTH 140, ART 103, ART 112, MACRAO Social Science course

First Year, Winter Semester
ENG 132 or 232, MTH 151, ART 152, PHL 232

Second Year, Fall Semester
PHY 231, HUM 131, MACRAO Social Science course, electives

Second Year, Winter Semester
PHY 232, MACRAO Social Science course, electives

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.

SUGGESTED COURSE SEQUENCE
First Year, Fall Semester
ENG 131, MTH 151, CEM141, CPS 177, EGR 153*

First Year, Winter Semester***
ENG 132, MTH 154, PHL 232, CPS 177

First Year, Spring Semester
ECN 231, Social Science and/or Humanities courses

Second Year, Fall Semester
MTH 251, PHY 251, EGR 261 Second Year, Winter Semester
MTH 254, PHY 252, EGR 262

**Not required but strongly recommended*
****Students transferring to Michigan State University take BIO 131*