Trenholm State COMMUNITY COLLEGE
The College for Real Careers

Automotive/Advanced Manufacturing Robotics/Mechatronics

Program Information

The Automotive/Advanced Manufacturing program with a concentration in Robotics/Mechatronics will prepare graduates for entry-level employment in industrial automation. Concepts covered in the curriculum concentration will include a Mechatronic approach to training; programmable logic controllers; digital fundamentals; interfacing microcomputers to electro-mechanical devices; flexible manufacturing cells; and networking the multiple disciplines into an Advanced Manufacturing process.

Occupational Choices

Individuals who graduate with an associate's degree in robotics might be qualified for careers in industries where robotic devices are used, such as manufacturing, defense, electronics, construction and space industries. Individuals can also pursue positions as electronic engineering technicians; manufacturing technicians; robotics technicians and/or quality technicians

Source: Bureau of Labor and Statistics Occupational Outlook Handbook, 2016-2026 Edition, 2018 Survey

Average Full-Time Wage

Robotics technicians had an average annual wage of $61,420 as of 2019. A skill in machine programming, maintenance and manufacturing is associated with high pay for this job.

Source: Bureau of Labor and Statistics Occupational Outlook Handbook, 2016-2026 Edition, 2019 Survey

Additional Requirements

- Student must be at least 16 years of age.
- Student must have an official copy of high school transcript or GED certificate and transcript from other colleges on file in the admissions office.
- Student must take the ACCUPLACER test.
- Student must be able to perform simple mathematical computations correctly.

Awards Available

Associate of Applied Science
Automotive/Advanced Manufacturing
Robotics/Mechatronics

Certificate
Automotive/Advanced Manufacturing
Robotics/Mechatronics

Short Term Certificate
Automotive/Advanced Manufacturing
Robotics/Mechatronics
Industrial Automation Concentration

Program Contact

Edward Abrasley
Program Coordinator/Instructor
334-420-4369
Location: Patterson Site - Bldg. M

As part of ongoing planning and evaluation, the College regularly evaluates student learning outcomes for each program.

Estimated Program Length & Cost *

Award	Length	Credit Hours	Tuition/Fees	Books	Tools	Supplies
Associate Degree	6 Terms	68	$10,812	$1,920	$600	$300
Certificate	5 Terms	57	$9,063	$1,920	$600	$300
Short Term Certificate	3 Terms	26	$4,134	$1,000	$600	$200

* Tax not included. Prices are subject to change without prior notice; cost of books may vary considerably among suppliers. Cost of general education books is in addition to the total listed above. The length of the program is based on full-time status of 12-15 credit hours per term. Enrollment in transitional level general education courses will alter the length of the program.

Associate of Applied Science
Automotive/Advanced Manufacturing
Robotics/Mechatronics

General Education Requirements (16 hours)

Area I - Written Composition (3 hours)

ENG-101	English Composition I	3
ENG-102	English Composition II	3
ENG-130	Technical Report Writing	3

Area II - Humanities & Fine Arts (3 hours)
(Humanities and Arts disciplines include but are not limited to: Area/Ethnic Studies, Art and Art History, Foreign Languages, Music and Music History, Philosophy, Ethics, Religious Studies, Theater and Dance.)

Note: If SPH-106, SPH-107, SPA-101 or SPA-102 has been taken an additional 3 semester hours in Humanities and Fine Arts must be taken to satisfy requirements in Area II.

Arts:

ART-100	Art Appreciation	3
MUS-101	Music Appreciation	3

Humanities:

PHL-106	Intro to Philosophy	3
PHL-206	Ethics & Society	3
REL-100	History of World Religions	3
REL-151	Survey of Old Testament	3
REL-152	Survey of New Testament	3
SPA-101	Intro Spanish I	3
SPA-102	Intro Spanish II	3
SPH-106	Fundamentals of Oral Comm	3
SPH-107	Fundamentals of Public Speaking	3

Literature:

ENG-251	American Literature I	3
ENG-252	American Literature II	3
ENG-261	English Literature I	3
ENG-262	English Literature II	3
ENG-271	World Literature I	3
ENG-272	World Literature II	3

Area III - Natural Science & Mathematics (6-7 hours)
(In addition to Mathematics, disciplines in the Natural Sciences include: Astronomy, Biological Sciences, Chemistry, Geology, Physical Geography, Earth Science, Physics, and Physical Science.)

Note: 3 semester hours in MTH must be completed. Additional hours can be taken in the Natural Science area.

Mathematics:

MTH-100	Intermediate Algebra	3
MTH-103	Intro to Technical Mathematics	3
MTH-104	Plane Trigonometry	3
MTH-110	Finite Mathematics	3
MTH-112	Precalculus Algebra	3
MTH-116	Mathematical Applications	3

Natural Sciences:

BIO-101	Introduction to Biology I	4
BIO-102	Introduction to Biology II	4
BIO-103	Principles of Biology I	4
BIO-104	Principles of Biology II	4
PHS-111	Physical Science I	4
PHS-112	Physical Science II	4
PHY-120	Introduction to Physics	4

Area IV - History, Social & Behavioral Sciences (3 hours):
(Social and Behavioral Sciences include, but are not limited to: Anthropology, Economics, Geography, Political Science, Psychology, and Sociology.)

Note: Must complete 3 semester hours.

History:

HIS-101	Western Civilization I	3
HIS-102	Western Civilization II	3
HIS-121	World History I	3
HIS-122	World History II	3
HIS-201	United States History I	3
HIS-202	United States History II	3

Social and Behavioral Sciences:

PSY-200	General Psychology	3
PSY-210	Human Growth and Development	3
SOC-200	Introduction to Sociology	3
POL-200	Introduction to Political Science	3
POL-211	American National Government	3

Area V: Pre-Professional/College Requirements:
(Courses appropriate to the degree requirements and major of the individual student and electives.)

College Requirements:

ORI-101	Orientation to College	1
CIS-146	Microcomputer Applications	3
ADM-111	Manufacturing Safety Practices OR ELT-206 OSHA Safety Standards	3
ADM-120	DC Fundamentals	3
ADM-121	AC Fundamentals	3
ADM-234	Applied Industrial Robotics (FANUC)	3
ADM-250	Intro to Flexible Manufacturing Cells	4
ELT-110	Wiring Methods	3
ELT-117	AC/DC Machines	3
ELT-119	Concepts of Solid State Electronics	5
ELT-121	Concepts of Digital Electronics	5
ELT-209	Motor Controls I	3
ELT-212	Motor Controls II	3
ELT-231	Programmable Controls I	3
ELT-232	Adv Programmable Controllers	3
ELT-286	Co-op	1
MTT-147	Intro to Machine Shop I	3

Area V Credit Hours: 52
Total Credit Hours: 68

Certificate
Automotive/Advanced Manufacturing
Robotics/Mechatronics

General Education Requirements (9 hours)

Area I - Written Composition (3 hours)

ENG-101	English Composition I	3
ENG-102	English Composition II	3
ENG-130	Technical Report Writing	3

Area II - Humanities & Fine Arts (0 hours)
(Humanities and Arts disciplines include but are not limited to: Area/Ethnic Studies, Art and Art History, Foreign Languages, Music and Music History, Philosophy, Ethics, Religious Studies, Theater and Dance.)

Note: If SPH-106, SPH-107, SPA-101 or SPA-102 has been taken an additional 3 semester hours in Humanities and Fine Arts must be taken to satisfy requirements in Area II.

Arts:

ART-100	Art Appreciation	3
MUS-101	Music Appreciation	3

Humanities:

PHL-106	Intro to Philosophy	3
PHL-206	Ethics & Society	3
REL-100	History of World Religions	3
REL-151	Survey of Old Testament	3
REL-152	Survey of New Testament	3
SPA-101	Intro Spanish I	3
SPA-102	Intro Spanish II	3
SPH-106	Fundamentals of Oral Comm	3
SPH-107	Fundamentals of Public Speaking	3

Literature:

ENG-251	American Literature I	3
ENG-252	American Literature II	3
ENG-261	English Literature I	3
ENG-262	English Literature II	3
ENG-271	World Literature I	3
ENG-272	World Literature II	3

Area III - Natural Science & Mathematics (6-7 hours)
(In addition to Mathematics, disciplines in the Natural Sciences include: Astronomy, Biological Sciences, Chemistry, Geology, Physical Geography, Earth Science, Physics, and Physical Science.)

Note: 3 semester hours in MTH must be completed. Additional hours can be taken in the Natural Science area.

Mathematics:

MTH-100	Intermediate Algebra	3
MTH-103	Intro to Technical Mathematics	3
MTH-104	Plane Trigonometry	3
MTH-110	Finite Mathematics	3
MTH-112	Precalculus Algebra	3
MTH-116	Mathematical Applications	3

Natural Sciences:

BIO-101	Introduction to Biology I	4
BIO-102	Introduction to Biology II	4
BIO-103	Principles of Biology I	4
BIO-104	Principles of Biology II	4
PHS-111	Physical Science I	4
PHS-112	Physical Science II	4
PHY-120	Introduction to Physics	4

Area IV - History, Social & Behavioral Sciences (0 hours):
(Social and Behavioral Sciences include, but are not limited to: Anthropology, Economics, Geography, Political Science, Psychology, and Sociology.)

Note: Must complete 3 semester hours.

History:

HIS-101	Western Civilization I	3
HIS-102	Western Civilization II	3
HIS-121	World History I	3
HIS-122	World History II	3
HIS-201	United States History I	3
HIS-202	United States History II	3

Social and Behavioral Sciences:

PSY-200	General Psychology	3
PSY-210	Human Growth and Development	3
SOC-200	Introduction to Sociology	3
POL-200	Introduction to Political Science	3
POL-211	American National Government	3

Area V: Pre-Professional/College Requirements:
(Courses appropriate to the degree requirements and major of the individual student and electives.)

College Requirements:

ORI-101	Orientation to College	1
CIS-146	Microcomputer Applications	3
ADM-111	Manufacturing Safety Practices OR ELT-2016 OSHA Safety Standards	3
ADM-120	DC Fundamentals	3
ADM-121	AC Fundamentals	3
ADM-234	Applied Industrial Robotics (FANUC)	3
ADM-250	Intro to Flexible Manufacturing Cells	4
ELT-110	Wiring Methods	3
ELT-117	AC/DC Machines	3
ELT-119	Concepts of Solid State Electronics	5
ELT-121	Concepts of Digital Electronics	5
ELT-209	Motor Controls I	3
ELT-212	Motor Controls II	3
ELT-231	Programmable Controls I	3
MTT-147	Intro to Machine Shop I	3

Area V Credit Hours: 48
Total Credit Hours: 57

Short Term Certificate
Automotive/Advanced Manufacturing
Robotics/Mechatronics

General Education Requirements (3 hours)

Area III - Natural Science & Mathematics (3 hours)
(In addition to Mathematics, disciplines in the Natural Sciences include: Astronomy, Biological Sciences, Chemistry, Geology, Physical Geography, Earth Science, Physics, and Physical Science.)

Note: 3 semester hours in MTH must be completed. Additional hours can be taken in the Natural Science area.

Mathematics:

MTH-103	Intro to Technical Mathematics	3

Area V: Pre-Professional/College Requirements:
(Courses appropriate to the degree requirements and major of the individual student and electives.)

College Requirements:

ORI-101	Orientation to College	1
ADM-120	DC Fundamentals	3
ADM-121	AC Fundamentals	3
ADM-234	Applied Industrial Robotics (FANUC)	3
ADM-250	Intro to Flexible Manufacturing Cells	4
ELT-209	Motor Controls I	3
ELT-231	Programmable Controls I	3
ELT-232	Adv Programmable Controllers	3

Area V Credit Hours: 23
Total Credit Hours: 26

Short Term Certificate
Automotive/Advanced Manufacturing
Robotics/Mechatronics
Industrial Automation Concentration

General Education Requirements (3 hours)

Area III - Natural Science & Mathematics (3 hours)
(In addition to Mathematics, disciplines in the Natural Sciences include: Astronomy, Biological Sciences, Chemistry, Geology, Physical Geography, Earth Science, Physics, and Physical Science.)

Note: 3 semester hours in MTH must be completed. Additional hours can be taken in the Natural Science area.

Mathematics:

MTH-103	Intro to Technical Mathematics	3

Area V: Pre-Professional/College Requirements:
(Courses appropriate to the degree requirements and major of the individual student and electives.)

College Requirements:

ORI-101	Orientation to College	1
ADM-111	Manufacturing Safety Practices	3
ADM-120	DC Fundamentals	3
ADM-121	AC Fundamentals	3
ADM-200	Industrial Robotics Safety	3
ADM-234	Applied Industrial Robotics (FANUC)	3
ADM-250	Intro to Flexible Manufacturing Cells	4
MTT-147	Intro to Machine Shop I	3

Area V Credit Hours: 23
Total Credit Hours: 26

Course Descriptions
Automotive/Advanced Manufacturing
Robotics/Mechatronics

Course #	Course Title	Credit Hours

ADM-111 MANUFACTURING SAFETY PRACTICES **3**
PREREQUISITE: None
This course is an introduction to general issues, concepts, procedures, hazards, and safety standards found in an industrial environment. This safety course is to make technicians aware of safety issues associated with their changing work environment and attempt to eliminate industrial accidents. This course will offer credentialing for NCCER Core and OSHA 10 hour.

ADM-120 DC FUNDAMENTALS **3**
PREREQUISITE: None
This course is designed to provide students with a working knowledge of basic direct current (DC) electrical principles. Topics include safety, basic atomic structure and theory, magnetism, conductors, insulators, use of Ohm's law to solve for voltage, current, resistance, electrical sources, power, inducers and capacitors. Students will perform lockout/tagout procedures, troubleshoot circuits and analyze series, parallel, and combination DC circuits using the electrical laws and basic testing equipment to determine unknown electrical quantities. CORE

ADM-121 AC FUNDAMENTALS **3**
PREREQUISITE: AUT-110
This course is designed to provide students with a working knowledge of basic alternating current (AC) electrical principles. Topics include basic concepts of electricity, electrical components, basic circuits, measurement instruments, the laws of alternating current, and electrical safety with lockout procedures. Hands-on laboratory exercises are provided to analyze various series, parallel, and combination alternating current circuit configurations containing resistors, inductors and capacitors. Upon course completion, students will be able to describe and explain alternating current circuit fundamentals, such as RLC circuits, impedance, phase relationships and power factors. They should also be able to perform fundamental tasks associated with troubleshooting, repairing and maintaining industrial AC systems. This is a CORE course.

ADM-200 INDUSTRIAL ROBOTICS SAFETY **3**
PREREQUISITE: None
This course covers safety aspects associated with industrial robots and the procedures to follow when working around them. The topics are approached from maintenance/repair and engineering perspectives. Students have the opportunity to learn common types of accidents associated with robot work and the sources of these accidents. North American and European safety standards including new ANSI/RIA safety standards for Industrial Robots (15.06), risk assessment methodologies, risk reduction methods and the application of various safety products are also covered.

ADM-234 APPLIED INDUSTRIAL ROBOTICS (FANUC) **3**
PREREQUISITE: None
This course covers the basic techniques used to write, execute, test, and modify a basic robotic program for an application-specific operation. Topics covered are related safety, robotic systems, computer terminal programming, teach pendant programming, and input/output interfacing. Upon completion, a student should be able to write, test, and evaluate a robotic program.

ADM-250 INTRODUCTION TO FLEXIBLE MANUFACTURING CELLS **4**
PREREQUISITE: None
This course covers techniques involved when grouping related machines for the purpose of completing a series of manufacturing processes in a flexible manufacturing cell. The student will be involved with the computerized integration of programmable control systems such as robotics, machine tools, and other peripheral equipment to emulate real-world manufacturing concepts employed in flexible manufacturing cells.

ELT-110 WIRING METHODS **3**
PREREQUISITE: None
This course is a study of various tasks, wiring methods, materials, and associated NEC requirements that students will be required to work with in residential and commercial wiring courses. This is a CORE course.

ELT-117 AC/DC MACHINES **3**
PREREQUISITE: ELT-108 and ELT-109
This course covers the theory and operation of DC motors single and three phase AC motors and the labs will reinforce this knowledge. Emphasis is placed on the various types of single and three phase motors, wiring diagrams, starting devices, and practical application in the lab. This is a CORE course.

Course #	Course Title	Credit Hours

ELT-119 CONCEPTS OF SOLID STATE ELECTRONICS 5
PREREQUISITE: ELT-112
This course is an introduction to semiconductor fundamentals and applications to the electronic devices. Course covers the basic operations and applications to include rectifier circuits, transistors, and thyristors. Coverage is given to safety, use, and care with hazardous materials and personal as well as material and environmental considerations. Upon completion students will be able to construct and test for proper operation of various types of solid state devices.

ELT-121 CONCEPTS OF DIGITAL ELECTRONICS 5
PREREQUISITE: ELT-112
This course provides instruction in digital electronics. Topics include: number systems and codes, a review of Boolean algebra, logic elements, digital circuits, programmable logic circuits, and memory and computing circuits. This course provides laboratory exercises to analyze, construct, test and troubleshoot digital circuits.

ELT-206 OSHA SAFETY STANDARDS 3
PREREQUISITE: None
This course provides the student with the knowledge of OSHA safety standards as required by this organization, and as it related to the job site. Emphasis is placed on overall safety practices, construction site safety practices and safety procedures required by Federal/State laws. Upon completion, students should be able to understand the requirements of OSHA as it relates to general and specific construction sites.

ELT-209 MOTOR CONTROLS I 3
PREREQUISITE: ELT-108 and ELT-109
This course is a study of the construction, operating characteristics, and installation of different motor control circuits and devices. Emphasis is placed on the control of three phase AC motors. This course covers the use of motor control symbols, magnetic motor starters, running overload protection, pushbutton stations, multiple control stations, two wire control, three wire control, jogging control, sequence control, and ladder diagrams of motor control circuits. Upon completion, students should be able to understand the operation of motor starters, overload protection, interpret ladder diagrams using pushbutton stations and understand complex motor control diagrams. This is a CORE course.

ELT-212 MOTOR CONTROLS II 3
PREREQUISITE: ELT-108, ELT-109, ELT-209, ELT-117, and MTH-103
This course covers complex ladder diagrams of motor control circuits and the uses of different motor starting techniques. Topics include wye-delta starting, part start winding, resistor starting and electronic starting devices. Upon completion, the students should be able to understand and interpret the more complex motor control diagrams and understand the different starting techniques of electrical motors.

ELT-231 INTRODUCTION TO PROGRAMMABLE CONTROLLERS 3
PREREQUISITE: ELT-108 and ELT-109
This course provides an introduction to programmable logic controllers. Emphasis is placed on, but not limited to, the following: PLC hardware and software, numbering systems, installation, and programming. Upon completion, students must demonstrate their ability by developing, loading, debugging, and optimizing PLC programs.

ELT-232 ADVANCED PROGRAMMABLE CONTROLLERS 3
PREREQUISITE: ELT-108 and ELT-109
This course includes the advanced principals of PLC's including hardware, programming, and troubleshooting. Emphasis is placed on developing advanced working programs, and troubleshooting hardware and software communication problems. Upon completion, students should be able to demonstrate their ability in developing programs and troubleshooting the system.

ELT-286 CO-OP 1
PREREQUISITE: As required by program.
These courses constitute a series wherein the student works on a part-time basis in a job directly related to electrical technology. In these courses the employer evaluates the student's productivity and the student submits a descriptive report of his work experiences. Upon completion, the student will demonstrate skills learned in an employment setting.

MTT-147 INTRODUCTION TO MACHINE SHOP I 3
PREREQUISITE: None
This course introduces machining operations as they relate to the metalworking industry. Topics include machine shop safety, measuring tools, lathes, saws, milling machines, bench grinders, and layout instruments. Upon completion, students will be able to perform the basic operations of measuring, layout, drilling, sawing, turning, and milling. This is a CORE course. MTT-100 is a suitable substitute for MTT-147/148. This course is also taught as AUT-150.