

Advanced Manufacturing

Mechatronics

Program Description

Mechatronics is the study of electronics, mechanics, electrical, and computers to produce a well-rounded technician capable of handling the complex maintenance and operations tasks demanded by modern manufacturing, transportation, communication, and other industries. The modularization of electro-mechanical devices no longer requires in-depth specialization of a single field of study as more emphasis is placed on troubleshooting and replacement skills for maintenance and generalized knowledge of how systems work together for operations and purchasing and planning.

Individuals with well-rounded knowledge of how electronic, mechanical, electrical, and computer systems work are in high demand in the grouping manufacturing, transportation, communication, and other industries in and around Solano County. Workers in these industries have traditionally been trained in only one of the trades, becoming specialists. The new trend is to train generalists with basic knowledge of all aspects of the industry. The modularization of electro-mechanical devices no longer requires in-depth specialization of a single field of study as more emphasis is placed on troubleshooting and replacement skills for maintenance and generalized knowledge of how systems work together for operations and purchasing and planning.

Opportunities exist throughout the greater San Francisco Bay area to the Sacramento Valley. Companies are using high tech equipment and systems automation for everything from maintenance to manufacturing to services to research and development. Work may be with a private firm, business under government contract, or civil service. Workers may work in one of the highly automated factories in the area or be called upon to provide services at businesses, hospitals, or even homes. Some graduates with a degree or certificate can expect to earn a starting salary in excess of \$2000 per month. Extensive experience and further education may more than double this amount.

Certificate of Achievement and Associate in Science Degree

A Certificate of Achievement can be obtained upon completion of the 39-40-unit major. The Associate in Science Degree can be obtained by completing the 39-40-unit major, and general education requirements.

Program Outcomes

Students who complete the Mechatronics Certificate of Achievement/ Associate Degree will be able to:

1. Demonstrate ability to work in a team to solve problems, exhibit key occupational soft skills (on-time, attendance, appropriate use of technology, professional communication) and promote a professional attitude.
2. Demonstrate safe work habits around mechanical and electrical industrial equipment.
3. Troubleshoot and solve basic problems involving electrical wiring, connections, and distribution at both the component level (0-24 V) and at the industrial level (100-400 V).
4. Troubleshoot and solve basic problems involving mechanical and fluid power systems.
5. Demonstrate proficiency in relating and integrating math and science concepts with basic systems found in industry.
6. Demonstrate proficiency in integrating computer use with industrial machinery and control systems.

REQUIRED COURSES	Units
CIS 001 Introduction to Computer Science	3
IT 101 Introduction to Mechatronics	3
IT 151 Vocational Mathematics	3
MT 120 Principles of Analog Electronics	3
MT 122 Principles of Digital Electronics	3
MT 130 Principles of Mechanical Power Systems	3
MT 132 Principles of Fluid Power Systems	3
MT 140 Principles of Industrial Electrical Systems	3
MT 142 Principles of Electrical Machinery	3
MT 162 Robotic Manufacturing Systems	3
MT 164 Programmable Logic Controllers	3
6 -7 units from List A	6-7
Required Major Total Units	39-40

List A: (select 6-7 units)	Units
DRFT 045 Introduction to Computer-Aided Drafting (CAD).....	4
DRFT 050 Basic Drafting	1.5
DRFT 079 Blueprint Reading.....	3
DRFT 151 3D Modeling with Fusion 360.....	1.5
IT 050 Alternative Energy Technologies	3
IT 120 Electrical Safety.....	3
IT 140 Industrial Materials.....	3
IT 174 Making Things 4 – Basic Electronics	1
OCED 070 Occupational Soft Skills	1.5
OCED 090 Occupational Work Experience	1-6

Solano General Education	21
Electives (as needed to reach 60 units)	0
Total Degree Units Solano GE	60-61

This is a Gainful Employment Program. For additional information, please visit http://www.solano.edu/gainful_employment/ and select "Mechatronics."

Advanced Manufacturing

Industrial Technology

IT 050 Alternative Energy Technologies 3.0 Units

Course Advisory: SCC minimum English and Math standards.

Transferable to CSU

Hours: 48-54 lecture.

Introduces the topics of power generation, transmission, and consumption of both conventional and alternative energy sources. Students will be exposed to an in-depth analysis of the design and use of fossil fuel based systems and then compare those systems to alternatives. Energy use in transportation, industrial, commercial, and residential applications will be examined.

IT 101 Introduction to Mechatronics 3.0 Units

Course Advisory: SCC minimum English and Math standards.

Hours: 32-36 lecture, 48-54 lab.

Provides an understanding of how mechatronic technology in our lives works using only basic science and math concepts. This course explores basic mechatronic systems commonly found in industry and focuses on their principles of operation, histories, and relationships to one another. Topics will include an exploration of and science behind basic mechanics, fluid power, electrical power, and control systems. Students will learn about these mechatronic technologies through lecture, classroom discussion, and laboratory experiments and projects.

IT 110 Modern Welding 3.0 Units

Course Advisory: SCC minimum English standard.

Hours: 32-36 lecture, 48-54 lab.

Acquaints the student with MIG and TIG welding methods and knowledge necessary to weld in all positions utilizing the mild steel, low hydrogen electrodes, metal inert gas and tungsten inert gas techniques.

IT 111 Modern Welding 3.0 Units

Prerequisite: IT 110.

Hours: 32-36 lecture, 48-54 lab.

Acquaints the student with MIG and TIG welding methods and knowledge necessary to weld in all positions utilizing the mild steel, low hydrogen electrodes, metal inert gas and tungsten inert gas techniques.

IT 120 Electrical Safety 1.0 to 3.0 Units

Course Advisory: SCC minimum English and Math standards.

Hours: 16-54 lecture.

A survey of the proper use, handling, and hazards associated with electrical and electronic equipment. The student will be introduced to the current generally accepted (National Electrical Safety Code) safety practices and procedures associated with power transmission, industrial, and consumer electrical and electronic equipment. This is an Open Entry/Open Exit course. Students may take this course up to the maximum number of units over multiple semesters.

IT 130 Fundamentals of Wire Cabling 1.0 Unit

Course Advisory: SCC minimum English and Math standards.

Hours: 16-18 lecture, 16-18 lab.

Presents the principles and practices of copper cable wiring technology. Includes instruction in the design, installation, and maintenance of copper wiring systems for intelligent control systems, lighting and appliance control devices, communication, and networking. Also includes instruction in household and institutional power wiring.

IT 132 Fundamentals of Fiber Optics 1.0 Unit

Course Advisory: SCC minimum English and Math standards.

Hours: 16-18 lecture, 16-18 lab.

Presents the principles and practices of fiber optics and optoelectronic technology. Includes instruction in the design, installation, and maintenance of fiber optic cabling and control systems and optoelectronic control systems for computer communication and networking systems.

IT 134 1.0 Unit

Fundamentals of Wireless Communication

Course Advisory: SCC minimum English and Math standards.

Hours: 16-18 lecture, 16-18 lab.

Presents the principles and practices of wireless communication technology. Includes instruction in the design, installation, and maintenance of wireless communication and network systems. Emphasis is placed on system reliability, security, and cost containment concerns.

IT 140 Industrial Materials 3.0 Units

Course Advisory: SCC minimum English standard.

Hours: 32-36 lecture, 48-54 lab.

A broad overview of the characteristics and comparative qualities of naturally occurring, alloyed and man-made materials used in industry. Testing and practical use of materials are required.

Advanced Manufacturing

IT 151 Vocational Mathematics

3.0 Units

*Course Advisory: SCC minimum English and Math standards.
Hours: 48-54 lecture.*

Focuses on mathematical functions, plane and solid geometry, measurement systems, algebra, and trigonometry applied to specific vocational areas.

IT 171 Making Things 1 - 3D Technology

1.0 Unit

*Course Advisory: SCC minimum English and Math standards.
Hours: 16-18 lecture, 8-9 lab.*

A hands-on course using 3-Dimensional Computer Aided Drafting (CAD) tools to create objects with a 3D printer and Computer Numeric Controlled (CNC) machine. Students will gain a basic understanding of design to product workflow as well as the basics of 3D printing and CNC machines, including applications and use in industry.

IT 172 Making Things 2 - 2D Technology

1.0 Unit

*Course Advisory: SCC minimum English and Math standards.
Hours: 16-18 lecture, 8-9 lab.*

A hands-on course using 2-Dimensional Computer Aided Drafting (CAD) tools to create objects with a laser cutter and vinyl cutter. Students will gain a basic understanding of safety, design, and project workflow as well as the basics of each machine's uses in industry.

IT 173 Making Things 3 - Tool Use and Safety

1.0 Unit

*Course Advisory: SCC minimum English and Math standards.
Hours: 16-18 lecture, 8-9 lab.*

Introduction to Maker Space terminology and safety standards for hand and power tools in a laboratory setting. Students learn proper usage and applications of common hand and power tools pertinent to Maker Space laboratory and some industrial settings.

IT 174 Making Things 4 - Basic Electronics

1.0 Unit

*Course Advisory: SCC minimum English and Math standards.
Hours: 16-18 lecture, 8-9 lab.*

A hands-on introduction to basic electronics and microcontrollers used in a Maker Space environment. Students will learn basic soldering techniques, electronic terminology and circuitry, and simple programming of devices such as Arduino and Raspberry Pi.

IT 175 Maker Space Technology Lab

3.0 Units

*Prerequisite: A minimum grade of C in IT 171, IT 172, IT 173, and IT 174;
DRFT 045 or DRFT 145 with a minimum grade of C or may be taken concurrently; DRFT 058 or DRFT 151 with a minimum grade of C or may be taken concurrently.*

Hours: 16-18 lecture, 96-108 lab.

The full range use of Maker Space equipment to create and design projects in the Maker Space laboratory. An emphasis will be given to multiple tooled projects (3D printing and electronics or laser cutting and woodworking, for example). Students will create designs using instructor-given parameters, plan projects and analyze results.

Advanced Manufacturing

Maintenance Technology

MT 120 Principles of Analog Electronics 3.0 Units

*Course Advisory: SCC minimum English and Math standards.
Hours: 32-36 lecture, 48-54 lab.*

Introduces the topic of analog electronics as it applies to mechatronics. Studies include an introduction to DC and AC circuitry as well as advanced electronic components, instruments used in the operation, installation, and troubleshooting of electronic systems, schematic diagrams, and breadboarding. Students will construct several kits as part of the class.

MT 121 Electronics 4.0 Units

*Course Advisory: SCC minimum English and Math standards.
Hours: 40-45 lecture, 72-81 lab.*

Introduces the topics of analog and digital electronics. Studies include an introduction to DC and AC circuitry as well as specific analog and digital electronic components, circuits, and instruments used in the operation, installation, and troubleshooting of electronic systems.

MT 122 Principles of Digital Electronics 3.0 Units

*Course Advisory: SCC minimum English and Math standards.
Hours: 32-36 lecture, 48-54 lab.*

Introduces the topic of digital electronics as it applies to mechatronics. Studies include an introduction to digital numbering systems, digital codes and logic, registers, memories, Boolean Algebra, and integrated circuits as well as advanced topics in computerized control systems. Students will construct several kits as part of the class.

MT 130 3.0 Units

Principles of Mechanical Power Systems

*Course Advisory: SCC minimum English and Math standards.
Hours: 32-36 lecture, 48-54 lab.*

Introduces the topic of mechanical power systems and mechanical power transmission as it applies to mechatronics. Studies include mechanical theory, mechanical power, thermal systems, hand tools, precision measuring instruments, and mathematics applied to mechanical power systems. Includes studies in manufacturing technology using modern manufacturing equipment and software simulators.

MT 132 Principles of Fluid Power Systems 3.0 Units

*Course Advisory: SCC minimum English and Math standards.
Hours: 32-36 lecture, 48-54 lab.*

Introduces the topic of hydraulic and pneumatic systems as they apply to mechatronics. Studies include fluid power systems theory, pumps, actuators, accumulators, filters, meters, valves, control devices, and mathematics applied to fluid power systems. Includes studies in manufacturing technology using modern manufacturing equipment and software simulators.

MT 140 3.0 Units

Principles of Industrial Electrical Systems

*Course Advisory: SCC minimum English and Math standards.
Hours: 32-36 lecture, 48-54 lab.*

Introduces the topic of DC, single-phase and three-phase AC circuits as they apply to mechatronics. Introduces commercial/industrial electrical installations that meet National Electrical Code requirements. Students will complete labs and wiring projects. Lab, electrical and worksite safety is emphasized.

MT 142 Principles of Electrical Machinery 3.0 Units

*Prerequisite: MT 120 or MT 140 with a minimum grade of C
Hours: 32-36 lecture, 48-54 lab.*

Introduces the topic of electrical machinery as it applies to mechatronics. Studies include direct-current and alternating-current generators, alternators, transmission equipment, and motors. Students will complete labs and electrical machinery projects. Lab, electrical and worksite safety is emphasized.

MT 162 Robotic Manufacturing Systems 3.0 Units

*Course Advisory: SCC minimum English and Math standards.
Hours: 32-36 lecture, 48-54 lab.*

Presentation of physical principles applied to automated manufacturing systems. Students will develop solutions to manufacturing problems using robots, programmable logic controllers (PLC) and computer numerical control (CNC) manufacturing machines. Students will also apply safety-oriented work habits to the completion of laboratory projects while working individually and in groups.

Advanced Manufacturing

MT 163

Advanced Robotics Manufacturing Systems

Prerequisite: MT 162 with a minimum grade of C.

Hours: 32-36 lecture, 48-54 lab.

Advanced programming, vision recognition systems, PLC and HMI integration, and hardware concepts associated with industrial robots. Students in this course will program several robots to work together and with other common automation systems to increase the efficiency and throughput of industrial automation processes. Robot safety procedures including Dual Check Safety (DCS) and other industry standards will be emphasized throughout the course.

3.0 Units

MT 165

Advanced Programmable Logic Controllers

Prerequisite: MT 164 with a minimum grade of C.

Hours: 32-36 lecture, 48-54 lab.

For PLC (Programmable Logic Controllers) programmers, electricians, maintenance and instrumentation technicians, automation students and professionals that have some experience with basic PLC programming. Topics include Tag-Based programming with ControlLogix PLCs along with the RSLogix 5000 programming suite, process control methods, variable frequency drives, SCADA (Supervisory Control and Data Acquisition), and HMI's (Human Machine Interface).

3.0 Units

MT 164 Programmable Logic Controllers

3.0 Units

Course Advisory: SCC minimum English and Math standards.

Hours: 32-36 lecture, 48-54 lab.

Introduces the student to process control via Programmable Logic Controllers (PLC's). Content includes the popular Allen-Bradley PLC systems and the most common command instructions for the RSLogix 5, RSLogix 500, RSLogix 5000, Micrologix 1000, SLC5 and SLC 500 as well as ControlLogix processors. Troubleshooting and electrical safety are emphasized.

MT 166 CNC Programming

3.0 Units

Prerequisite: DRFT 151 with a minimum grade of C.

Course Advisory: SCC minimum English and Math standards.

Hours: 32-36 lecture, 48-54 lab.

Operational and theory of Computer Numerical Control (CNC) machinery, with a focus on skill building, safety practices and maintenance to work as an operator. Includes integration of Computer-Aided Design and Computer-Aided Manufacturing (CAM) as well as manual programming techniques.