

# Mechatronics Engineering Tech (MECH)

## MECH 1010 Fundamentals of Mechatronics 3

Covers the fundamental skills and theory of the Mechatronics discipline. Covers integrated system design which includes electrical, mechanical, and microprocessor programming theory. Discusses the fundamentals of materials science, manufacturing processes, and the application of automation systems in a production environment. Course fee of \$20 for materials applies. Lab access fee of \$45 applies.

## MECH 1200 Electronics in Automation Design 3

\* Corequisite(s): MECH 1205  
\* Prerequisite(s) or Corequisite(s): MAT 1010

Teaches basic DC and AC electronics theory including voltage, current, resistance, reactance, and complex impedance as well as basic electronic components such as resistors, capacitors, and inductors. Includes the analysis of series, parallel, and complex circuits as well as troubleshooting and measurement techniques. Teaches principles of algebra and trigonometry which will be utilized for circuit analysis. Emphasizes the application of electronic theory and analysis in the design of automation systems. Course Lab fee of \$40 for materials, lab applies.

## MECH 1205 Electronics in Automation Design Laboratory 2

\* Corequisite(s): MECH 1200

Applies basic DC and AC electronics theory including voltage, current, resistance, reactance, and impedance as well as basic electronic components such as resistors, capacitors, and inductors. Includes the analysis of series, parallel, and complex circuits as well as troubleshooting and measurement techniques. Presents the fundamentals of digital logic using combinational and sequential logic. Teaches number systems, binary arithmetic, logic gates, Boolean algebra, truth tables and logic simplification. Introduces computer architecture. Emphasizes the application of electronic theory and analysis in the design of automation systems. Lab access fee of \$45 applies. Course Lab fee of \$44 for materials applies.

## MECH 1300 Industrial Wiring for Mechatronic Systems 1

\* Corequisite(s): MECH 1305  
\* Prerequisite(s) or Corequisite(s): MECH 1010

Covers National Electrical Code and International Electrical Code using electrical prints, installation methods, and system requirements in mechatronic systems. Covers the creation and use of electrical diagrams for design and troubleshooting. Lab access fee of \$45 applies.

## MECH 1305 Industrial Wiring for Mechatronic Systems Laboratory 2

\* Corequisite(s): MECH 1300  
\* Prerequisite(s) or Corequisite(s): MECH 1010

Applies the use of National Electrical Code and International Electrical Code using electrical prints, installation methods, and system requirements in mechatronic systems. Explains how to create and use electrical diagrams for design and troubleshooting.

## MECH 2200 Semiconductors in Mechatronic Systems 3

\* Prerequisite(s): MECH 1200  
\* Corequisite(s): MECH 2205

Teaches the theory of semiconductor PN junctions and discrete semiconductors such as diodes, bipolar junction transistors, and MOSFET's applied to automation control. Also introduces the utilization of opto-isolators, triacs, and SCR's in controlling automation power devices. Course Lab fee of \$25 for materials, lab applies.

## MECH 2205 Semiconductors in Mechatronic Systems Lab 1

\* Prerequisite(s): MECH 1200, MECH 1205  
\* Corequisite(s): MECH 2200

Applies the theory of semiconductor PN junctions and discrete semiconductors such as diodes, bipolar junction transistors, and MOSFET's applied to automation control. Introduces the utilization of opto-isolators, triacs, and SCR's in controlling automation power devices. Lab access fee of \$45 applies.

## MECH 2300 Microcontroller Architecture and Programming 3

\* Corequisite(s): MECH 2305  
\* Prerequisite(s) or Corequisite(s): MECH 2200 and MECH 2205 or AET 2110 and AET 2115

Teaches computer architecture and the fundamentals of computer programming in C language. Uses an IDE to develop, compile and debug C code. Introduces structured top down design and program documentation. Teaches the organization of I/O ports including alternate functions. Utilizes microcontroller communications, functions and I/O methods to interface to sensors and actuators. Course Lab fee of \$50 for materials, lab applies.

## MECH 2305 Microcontroller Architecture and Programming Lab 2

\* Prerequisite(s): MECH 1205  
\* Corequisite(s): MECH 2300  
\* Prerequisite(s) or Corequisite(s): MECH 2200 and MECH 2205 or AET 2110 and AET 2115

Applies computer architecture and the fundamentals of computer programming in C language. Uses an IDE to develop, compile and debug C code. Introduces structured top down design and program documentation. Teaches the organization of I/O ports including alternate functions. Utilizes microcontroller communications, functions and I/O methods to interface to sensors and actuators. Course Lab fee of \$387 for materials applies. Lab access fee of \$45 applies.

## MECH 2400 Mechanical Components 4

\* Prerequisite(s): MECH 1010

Teaches students how to select, design, and analyze mechanical components that are used in manufacturing automation systems. Reviews and reinforces the concepts of the structure of metals, metals selection, and mechanical properties. Focuses on the selection of belt and chain drives, gear and gearbox selection, design of shafts, specification of rolling element bearings, and the use of threaded fasteners. Integrates the selection and design of mechanical components into a design project. Lab access fee of \$45 applies

# Course Descriptions

## **MECH 2500**

### **Introduction to PLCs in Mechatronic Design**

**2**

\* Prerequisite(s): MECH 1200, MECH 2300

\* Corequisite(s): MECH 2505

Covers the theory and programming of industrial control systems and programmable logic controllers (PLC). Introduces PLC programming stressing Ladder Logic and PLC programming, troubleshooting, and maintenance. Covers connection of PLCs to external components. Presents the fundamentals of digital logic using ladder logic. Covers number systems and Boolean algebra. Course Lab fee of \$15 for materials, lab applies. Software fee of \$29 applies.

## **MECH 2505**

### **Introduction to PLCs in Mechatronic Design Laboratory**

**2**

\* Prerequisite(s): MECH 1200, MECH 2300

\* Corequisite(s): MECH 2500

Applies the theory and programming of industrial control systems and programmable logic controllers (PLC). Applies PLC programming stressing Ladder Logic and PLC programming, troubleshooting, and maintenance. Applies connection of PLCs to external components. Lab access fee of \$45 applies.

## **MECH 2510**

### **Fundamentals of Automation Controls**

**2**

\* Corequisite(s): MECH 2515

\* Prerequisite(s) or Corequisite(s): MECH 2500

Covers how to select, install, and troubleshoot sensors in a manufacturing environment. Emphasizes the application of proximity sensors in automation equipment as well as the use of encoders to measure speed and position, pressure transducers, and the use of thermocouples and thermistors to measure temperature. Covers signal conditioning methods to interface sensors to microprocessors and PLC's. Course Lab fee of \$20 for lab notebook, lab applies.

## **MECH 2515**

### **Fundamentals of Automation Controls Laboratory**

**1**

\* Corequisite(s): MECH 2510

\* Prerequisite(s) or Corequisite(s): MECH 2500

Applies methods for proper selection, installation, and troubleshooting of sensors in a manufacturing environment. Emphasizes the application of proximity sensors in automation equipment as well as the use of encoders to measure speed and position, pressure transducers, and the use of thermocouples and thermistors to measure temperature. Utilizes signal conditioning methods to interface sensors to microprocessors and PLC's. Lab access fee of \$45 applies. Course Lab fee of \$16 applies.

## **MECH 2550**

### **Advanced PLC Programming and Applications**

**2**

\* Prerequisite(s): MECH 2500

\* Corequisite(s): MECH 2555

Covers the principles of program structure, subroutines, interrupts, debugging, and simplifying. Illustrates the measurement and scaling of analog signals. Covers networking principles such as Ethernet and serial. Course Lab fee of \$15 for materials, lab applies. Software fee of \$29 applies.

## **MECH 2555**

### **Advanced PLC Programming and Applications Laboratory**

**2**

\* Prerequisite(s): MECH 2500

\* Corequisite(s): MECH 2550

Applies the principles of program structure, subroutines, interrupts, debugging, and simplifying using a PLC. Applies the use of PLCs in the measurement and scaling of analog signals. Applies networking principles such as Ethernet and serial to communicate with a PLC. Lab access fee of \$45 applies.

## **MECH 2600**

### **Introduction to Fluid Power Systems**

**2**

\* Prerequisite(s): MECH 2400

\* Corequisite(s): MECH 2605

Develops the concepts used to design, build, and control a fluid power system that is used in an industrial automation process. Covers the the fundamental principles of fluid power. Course Lab fee of \$15 for materials, lab applies. Lab access fee of \$45 applies. Software fee of \$50 applies.

## **MECH 2605**

### **Introduction to Fluid Power Systems Laboratory**

**1**

\* Prerequisite(s): MECH 2400

\* Corequisite(s): MECH 2600

Applies the concepts used to design, build, and control a fluid power system that is used in an industrial automation process. Employs laboratory exercises to illustrate the selection and use of actuators, valves, and controls to sequentially control a process.

## **MECH 2700**

### **Industrial Motor Control Mechatronic Systems**

**2**

\* Prerequisite(s): MECH 1300, MECH 1305

\* Corequisite(s): MECH 2705

Covers installation, troubleshooting, preventive maintenance, and theory on DC/AC motors, generators, and associated industrial control circuitry. Discusses ladder logic, controls, sensors, motor starters, overloads, and electronic devices used to control and protect DC/AC Machines. Describes three phase systems, transformers, and delta-wye connections. Introduces AC variable speed drives.

## **MECH 2705**

### **Industrial Motor Control Mechatronic Systems Laboratory**

**2**

\* Prerequisite(s): MECH 1300, MECH 1305

\* Corequisite(s): MECH 2700

Applies the principles of Installation, troubleshooting, preventive maintenance, and theory on DC/AC motors, generators, and associated industrial control circuitry. Uses ladder logic, controls, sensors, motor starters, overloads, and electronic devices used to control and protect DC/AC Machines. Lab activities include the wiring of transformers, and three phase systems in both delta and wye configurations.

## **MECH 3060**

### **Mechatronics Management**

**3**

\* Prerequisite(s): MECH 2550 and University Advanced Standing

Provides management principles, processes, and standards commonly used in manufacturing and other industries. Covers basic concepts in project management, operations management, quality management, and safety management. Familiarizes students with applicable software tools. Lab access fee of \$45 applies.

## **MECH 3220**

### **Motion Control for Mechatronic Systems**

**3**

\* Prerequisite(s): (MECH 2550 or AET 2270 or Department Approval) and University Advanced Standing

\* Corequisite(s): MECH 3225

Presents the selection and application of AC and DC servo motors and how to control the speed and position in automation systems. Covers variable frequency drives and servo drives in automation system design. Applies algebra, trigonometry, integrals, and derivatives. Course Lab fee of \$15 for materials, lab applies.

## **MECH 3225**

### **Motion Control for Mechatronic Systems Laboratory**

**1**

\* Prerequisite(s): (MECH 2550 or AET 2270 or Department Approval) and University Advanced Standing

\* Corequisite(s): MECH 3220

Applies the standards for the selection of AC and DC servo motors and the use of programming to control speed and position in automation systems. Implements variable frequency drives and servo drives in automation system design. Lab access fee of \$45 applies.

**MECH 3300  
Industrial Networks**

**2**  
\* Prerequisite(s): AET 2270 OR AET 2160 OR MECH 2550 and University Advanced Standing  
\* Corequisite(s): ENGT 3305

Covers the principles of designing, configuring, integrating, and maintaining an industrial network. Discusses the use of software to integrate PLC's, computers, managed switches, and smart devices into an industrial data network. Covers a broad spectrum from legacy networks to modern Ethernet based networks. Course Lab fee of \$25 for materials, lab applies. Software fee of \$29 applies.

**MECH 3305  
Industrial Networks Laboratory**

**1**  
\* Prerequisite(s): (AET 2270, AET 2275) OR (AET 2160, AET 2165) OR (MECH 2550, MECH 2555) and University Advanced Standing  
\* Corequisite(s): MECH 3300

Applies the principles of designing, configuring, and integrating and maintaining an industrial network. Applies the use of software to integrate PLC's, computers, managed switches, and smart devices into an industrial data network. Lab access fee of \$45 applies.

**MECH 3400  
Statics and Material Properties for  
Mechatronics**

**4**  
\* Prerequisite(s): University Advanced Standing  
\* Corequisite(s): MECH 3405

Teaches the concept of forces as vectors, the equations of equilibrium, calculation of internal forces, and the calculation of centroids and area moments of inertia. Teaches how to calculate tensile and shear stress in machine components and compare the resultant forces to standard theories of failure using the principles of statics. Teaches algebra, trigonometry, and elementary calculus in terms of the application of statics.

**MECH 3405  
Statics and Material Properties for  
Mechatronics Laboratory**

**1**  
\* Prerequisite(s): University Advanced Standing  
\* Corequisite(s): MECH 3400

Applies the concept of forces as vectors, the equations of equilibrium, calculation of internal forces, and the calculation of centroids and area moments of inertia. Covers how to calculate tensile and shear stress in machine components and compare the resultant forces to standard theories of failure by using the principles of statics. Lab access fee of \$45 applies.

**MECH 3500  
Industrial Robots**

**2**  
\* Prerequisite(s): AET 2250 and AET 2255, or MECH 2550 and MECH 2555, University Advanced Standing. It is also recommended that students in the AET program take AET 2270 and AET 2275  
\* Corequisite(s): MECH 3505

Covers the principles of industrial robotics, programming, and the application of vision systems using industry created curriculum. Course Lab fee of \$11 for flat ribbon cable, lab applies. Lab access fee of \$45 applies Software fee of \$50 applies.

**MECH 3505  
Industrial Robots Laboratory**

**1**  
\* Prerequisite(s): AET 2250 and AET 2255, or MECH 2550 and MECH 2555, University Advanced Standing. It is also recommended that students in the AET program take AET 2270 and AET 2275  
\* Corequisite(s): MECH 3500

Applies the principles of industrial robotics, programming, and the application of vision systems using industrial robots. Lab access fee of \$45 applies.

**MECH 3570  
Design Analysis and Rapid Prototyping WE**

**3**  
\* Prerequisite(s): MECH 3220 and University Advanced Standing

Covers the fundamentals of geometric dimensioning and tolerancing based on the ASME Y14.5 standard. Explores how a design is affected by manufacturing tolerances and how to specify the fit of parts on a detail print. Emphasizes assembly analysis using SolidWorks Motion and rapid prototyping to verify the form, fit, and function of a design. Lab access fee of \$45 applies.

**MECH 3700  
CNC Machines in Mechatronic Design**

**2**  
\* Prerequisite(s): MECH 3220, University Advanced Standing  
\* Corequisite(s): MECH 3705

Covers the application, programming, and maintenance of CNC machines. Emphasizes the integration of CNC machines into automation systems. Covers specifications, performance, interfacing with industrial robots, tooling, programming, and integrating the CNC machine into factory system. Course lab fee of \$35 for materials applies. Software fee of \$29 applies

**MECH 3705  
CNC Machines in Mechatronic Design  
Laboratory**

**1**  
\* Prerequisite(s): MECH 3220, University Advanced Standing  
\* Corequisite(s): MECH 3700

Applies the application, programming, and maintenance of CNC machines. Emphasizes the integration of CNC machines into automation systems. Applies specifications, performance, interfacing with industrial robots, tooling, programming, and integrating the CNC machine into a factory system. Lab access fee of \$45 applies.

**MECH 4300  
Capstone I**

**2**  
\* Prerequisite(s): MECH 3220 and University Advanced Standing  
\* Corequisite(s): MECH 4305

Integrates the concepts of the Mechatronics Engineering Technology curriculum into a semester-long capstone proposal. Requires students to conceive, define, design, and document a capstone proposal. Course lab fee of \$15 for equipment applies.

**MECH 4305  
Capstone I Laboratory**

**1**  
\* Prerequisite(s): MECH 3220 and MECH 3225, University Advanced Standing  
\* Corequisite(s): MECH 4300

Integrates the concepts of the Mechatronics Engineering Technology curriculum into a semester-long capstone proposal. Requires students to prototype and test key components of their capstone proposal. Lab access fee of \$45 applies.

**MECH 4400  
Polymers/Composites and Processes**

**3**  
\* Prerequisite(s): MECH 3400, University Advanced Standing.

Teaches students the selection of polymers, design of polymer products and manufacturing processes associated with polymer based products. Also teaches types of composites and design of composite products. Course lab fee of \$18 for supplies applies. Lab access fee of \$45 applies.

**MECH 4500  
Advanced Automation Controls**

**3**  
\* Prerequisite(s): MECH 4300, University Advanced Standing  
\* Corequisite(s): MECH 4505

Introduces methods of advanced control of high speed components, analog controls, temperature, pressure, and time delay processes using digital and analog methods of control. Covers algebra, trigonometry, and basic applied calculus in the context of complex control systems. Course lab fee of \$45 for equipment applies. Lab access fee of \$45 applies.

# Course Descriptions

## **MECH 4505**

### **Advanced Automation Controls Laboratory**

**1**

\* Prerequisite(s): MECH 4300, University

Advanced Standing

\* Corequisite(s): MECH 4500

Integrates methods of advanced control of high speed components, analog controls, temperature, pressure, and time delay processes using digital and analog methods of control. Implements practical applications of the concepts discussed in the lecture portion of the class. Lab access fee of \$45 applies.

## **MECH 4800**

### **Capstone II WE**

**3**

\* Prerequisite(s): MECH 3570, MECH 4300

with a C- or better, University Advanced

Standing

Builds on Capstone I and integrates project management into a semester-long capstone project. Requires students to construct, validate, document, and present their capstone project. Lab access fee of \$45 applies. Software fee of \$29 applies.

## **MECH 481R**

### **Mechatronics Internship**

**1 to 3**

\* Prerequisite(s): Matriculation into

Mechatronics Engineering Technology,

Instructor Approval, and University Advanced

Standing

Provides opportunity to use work experience to add to educational background and academic experience. A maximum of 6 credit hours may be counted towards graduation. May be graded credit/no credit.

## **MECH 490R**

### **Topics in Mechatronics**

**3**

\* Prerequisite(s): University Advanced

Standing

Covers a chosen topic in the mechatronics discipline. May be taken more than once for different topics and for a maximum of 6 credit hours toward graduation. Lab access fee of \$45 applies.