# MTR-Mechatronics

## MTR300 - Manufacturing Processes

This course covers various methods of processing metals, plastics, ceramics, and composite materials with emphasis to the major processes used in manufacturing today: casting and molding, forming, separating, conditioning, assembling, and finishing. A final section provides students with an introduction to product design and process selection.

## MTR310 - Principles of Automatic Control

This course covers key concepts of industrial control. The purpose of this course is to provide the student with an understanding knowledge of industrial control principles including: instruments, circuits, components and control techniques. The primary focus is on operation principles and the measurement devices. The student will have already learned basic electronic principles in Circuits I, II, and Digital Fundamentals.

## MTR320 - Statics

This course will emphasize the study of forces acting on rigid bodies at rest. Concepts of force, moment, couple, force components, force resultants, concentrated and distributed loads, basics of static equilibrium of machines and structures, friction, centroids and moments of inertia will be covered. Emphasis will be placed on the concept of developing free body diagrams for simple mechanical structures and their resultant force equilibrium solutions.

## MTR325 - Fundamentals of Programmable Logic Controllers

The course provides students with an introduction to programmable logic controllers through the design, troubleshooting, improvement, and optimization of mechatronic control systems. The course covers the component parts of a programmable logic controller, their function, and their interrelationship. PLC input/output

systems and requirements are examined. Ladder logic programming using I/O instructions, logic instructions, timers, counters, and sequential control are covered in-depth. Sequence of PLC operation, hardware installation, networking PLC systems and peripherals, troubleshooting, safety requirements, and industrial applications of PLCs are also introduced.

# MTR330 - Dynamics

This course will cover the dynamics of particles and rigid (planar) bodies. Topics will include kinematic equations, Newton's Second Law, work and energy solutions, and impact and momentum solutions. Emphasis will be on particle analysis, with coverage of rigid bodies as appropriate, as assessed by course instructor. Students will hone problem-solving skills through dynamic system analysis, and learn professional preparation skills. Three hours of lecture

# MTR335 - Advanced PLCs and Integration

The course provides students with additional and more advanced skills in Programmable Logic Controllers (PLCs). Students will learn how to program and apply zone control techniques, data transfer, math functions, and data communications. Also covered are sequencers, analog I/O, the use of HMIs (Human Machine Interface), programming special function modules, process control, and I/O bus networks. In addition to ladder logic programming, sequential function chart and function block programming will be used to program a PLC.

# MTR340 - Fluid Power

Topics covered will include: fluid properties; manometry laws; fluid statics; fluid statics; buoyancy and stability of submerged objects; continuity equations; Bernoulli's principle and modifications for pumps and turbines; viscosity; Reynolds's number; Darcy's equation; Moody's diagram; series pipeline system, and pressure and flow measuring techniques. All lecture topics will be complemented by appropriate lab experiments, and/ or hydraulic, and pneumatic (fluid) system design circuits.

# MTR370 - Properties and Strength of Materials

This course will provide survey of materials used in industry and their physical and chemical principles as they relate to structure, properties, corrosion, and engineering applications. An introductory level in stress analysis will include: shear and bending moment diagrams, Hook's Law as it relates to normal and shear stress and strain, stresses in bolted connections, shear stress and angle of twist in shafts, normal and shear stress in beams, and the concept of factor of safety. Additional topics covered will include bending stresses, shear stresses, combined stresses, Mohr circle, beam deflection, stress concentration factors and fluctuating loads (qualitative discussion only). All lecture topics will be complemented by appropriate lab experiments.

# MTR400 - Machine Design Elements and Kinematics

This course covers the methods and theory of practical machine design with basic kinematics. The course will integrate the knowledge of statics, dynamics, strength of materials and engineering materials in the design process. The topics will include materials selection, load, stress, strain, deflection, fatigue and failure theories, design of shafts, keys, couplings, bearings, springs, screws, fasteners, and linkages. All design topics will be supplemented by appropriate case problems. The application of computer-aided design software to analyze design problems will be demonstrated. An introduction to finite element analysis software and application will be presented in this course.

# MTR410 - Process Control

This course introduces students to the mathematical theory governing process control, and develops an understanding of the dynamic behavior of process control systems, including system stability. Simulation and practice are used to reinforce theory and apply it to practical industrial applications of varying complexity. Methods are presented for designing and tuning process controllers.

# MTR420 - Computer-Integrated Manufacturing

This course will cover conventional and computer-integrated manufacturing processes. Students will develop an understanding of the manufacturing systems used to make products, the application and potential benefits of automation, and Computer-Integrated Manufacturing (CIM) concepts. This course provides the student with information on the way computer based systems support the operation of a manufacturing business. The course is designed to give students an integrated hands-on experience with tools and systems used in industry. Special attention is given to the roles of computer-aided design (CAD), computer-aided manufacturing (CAM), computer-aided process planning (CAPP), Manufacturing Resource Planning (MRP II), programmable logic controllers (PLCs), industrial robots, and supporting technologies including automated data capture as they apply to the modern manufacturing facility. Concepts will be reinforced using simulation, analog, and hardware.

# MTR445 - Senior Project Proposal

A capstone course in the mechatronics engineering technology area where the students are required to propose a mechatronics engineering technology related project (problem statement and solution) they wish to pursue for completion later in their program of study. In this course, the students will research various design and/ or manufacturing issues connected with mechatronics engineering technology. This course is intended to help students formulate a problem statement in the mechatronics engineering technology area for solution in a later class. An interdisciplinary approach with other engineering technology programs is highly recommended with the problem statement formulation.

# MTR450 - Senior Project

This course is a continuation of MTR 445 where a proposal was submitted to address a mechatronics engineering project. Students will work in teams on “open-ended” design or manufacturing project proposed earlier. Students are given the opportunity in this course to realize original and creative solution to engineering problems. Students are encouraged to adopt an interdisciplinary approach to problem solving and may want to perform the project

under direction of one or more faculty. Course requirement will include oral presentations on progress throughout the semester with a required final comprehensive technical report in the end.

# MTR495 - Mechatronics Engineering Technology - Internship

Student interns are placed with an industrial, corporate or governmental organization that most nearly approximates their goals for mechatronics engineering technology employment. The intent of the internship is to provide students with practical work experience solving actual problems in a dynamic environment, yielding enhanced job opportunities upon graduation. Students must follow the step-by-step procedure as outlined at the Cal U Intern site.