COURSES FOR MECHANICAL ENGINEERING

Mechanical Engineering Courses

ME121 Introduction to Mechanical Engineering
Hours 1

An introduction to the discipline of mechanical engineering and the role of the mechanical engineer, including both mechanical and thermal/fluid stems. Focus is on learning about the discipline through a series of student hands-on activities.

Prerequisite(s): UA Math Placement Test Score of 370-439 or ACT Math Subscore of 28 or old SAT Math Subscore of 630 or new SAT Math Subscore of 650 or MATH 112

Prerequisite(s) with concurrency: MATH 113 or MATH 115 or MATH 125 or MATH 126 or MATH 145 or MATH 146 or MATH 227 or MATH 238 - Course MATH 113 or MATH 115 or MATH 125 or MATH 126 or MATH 145 or MATH 146 or MATH 227 or MATH 238

ME215 Thermodynamics I
Hours 3

Introduction to engineering thermodynamics. Topics include units and measures, thermodynamic system, property, and surroundings, closed, open and isolated systems, first law of thermodynamics for closed systems including calculations of boundary work and heat transfer interactions, properties of pure substances including determination of thermodynamic state using the state postulate, introduction to thermodynamic tables, ideal gases, first law of thermodynamics for open systems, second law of thermodynamics, absolute temperature scale, heat engine and refrigeration cycles, Carnot cycle, Kelvin-Planck and Claussius statements of the second law, determination of allowable, reversible, and impossible thermodynamic processes and cycles using the second law, introduction to entropy as a thermodynamic property using the second law, calculation of entropy change and entropy generation for closed and open systems. Introduction to isentropic processes and isentropic efficiencies of devices.

Prerequisite(s): MATH 126 or MATH 146

ME216 Thermal Engineering Survey
Hours 3

Survey of thermal engineering topics for engineers outside mechanical engineering. To include an overview of subjects typically covered in courses about thermo-dynamics I and II and heat transfer. An emphasis is placed on qualitative concepts of transport and conservation as they relate to thermal-fluids in order to increase the understanding of thermal engineering applications.

Prerequisite(s): MATH 126 or MATH 146

ME226 Introduction to Automotive Systems
Hours 3

This course covers a high-level view of the main automotive systems and their interactions including motive power conversion (both combustion and electric), power transmission and delivery, electrical systems, suspension and chassis, body, and driver assistance and automation systems.

Prerequisite(s): PH 101, PH 105, or PH 125

Prerequisite(s) with concurrency: MATH 121 or MATH 125 or MATH 145

ME305 Thermodynamics II
Hours 3

Introduction and analysis of different thermodynamic cycles and factors impacting these cycles. Topics include thermodynamic cycle analysis, thermodynamics of non-reacting and reacting mixtures, power cycles: basic considerations, gas power cycles, vapor and combined power cycles, gas mixtures, air-water vapor mixtures and air conditioning, and chemical reactions from thermodynamics point of view.

Prerequisite(s): ME 215

Prerequisite(s) with concurrency: MATH 227 or MATH 247

ME309 Heat Transfer
Hours 3

Introduction to heat transfer including how to predict and engineer such transfer. Topics to be covered include: conservation laws, conduction, convection, and radiation. Problems and examples include theory and applications drawn from nature and a spectrum of engineering applications.

Prerequisite(s): MATH 238 and ME 215 and AEM 311

ME349 Engineering Analysis
C

Hours 3

This course covers fundamental concepts in mathematics and computer programming, which will be the tools for mechanical engineering analysis. It includes Linear Algebra and Numerical Analysis with application to engineering problems with elements of Programming, Statistics, and Engineering Economics. MATLAB is utilized as the programming software with students exposed to basics of coding and high-level functions for solving specific mathematical problems. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): MATH 238. Students are expected to have basic knowledge about the linear algebra problems and ordinary differential equations. Although programming will be taught as a part of the course, knowledge of Excel and MATLAB learned in previous course will be used in the class.

Computer Science

ME350 Static Machine Components
Hours 3

This course covers the analysis of stresses and deflections in machine elements like beam supports, rods, and drive shafts. Methods for describing the stresses through von Mises and various failure criteria are also covered. The topics of fatigue, fatigue strength, and endurance limit are also discussed. Also included is the design of connected joints covering both bolted and welded joints.

Prerequisite(s): AEM 250, AEM 251, and ENGR 161 or ENGR 171

ME351 Finite Element Lab
Hours 1

This lab provides a working knowledge of finite element (FE) simulation. Upon completion each student will have the ability to set up and run a FE analysis of a realistic engineering assembly, while (a) optimizing computation efficiency,(b) optimizing result fidelity, and (c) employing sound engineering judgment in their assumptions.

Prerequisite(s): ENGR 161 and AEM 250

Prerequisite(s) with concurrency: ME 350

ME360 Contrl Instrumnt Components
W

Hours 3

Introduction to selection and use of electrical, pneumatic, and other components of mechanical system instrumentation and control. Specific components include modern electrical measurement devices, signal conditioning, force and torque measurement, proximity sensors, AC and DC motors, etc. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course.

Prerequisite(s): AEM 250; and ECE 320 or ECE 225

Writing

ME364 Vehicle Dynamics
Hours 3

Dynamics of four-wheeled vehicles, including acceleration and braking performance, road loads, ride comfort, steady-state cornering, suspensions, steering systems, and rollover. Vehicle dynamics system modeling programs are introduced and used for detailed investigations of the effect of system design parameters on performance.

Prerequisite(s): AEM 264

ME372 Dynamic Systems
C

Hours 3

An introduction to the modeling, analysis and control of dynamic systems. The course takes the student from initial modeling through analysis of the system response and finally into the control of the system. Specific systems include mechanical devices, electrical circuits, and electromechanical systems. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): MATH 238 and AEM 264 and ME 349; and ECE 320 or ECE 225

Computer Science

ME377 Noise Control
Hours 3

Physical properties of noise; hearing and noise criteria measurement techniques; and noise-control fundamentals applied to practical problems are covered in this course. Both sound and vibration topics are discussed, including the spectral description of these phenomena. Applications of various estimation methods for characterizing room acoustics, such as reverberation time and room modes, are presented. Industrial applications are discussed throughout the course.

Prerequisite(s): MATH 238, and PH 106 or PH 126

ME380 Engineering Leadership I
Hours 1

Organizational leadership fundamentals for leaders of COE organizations regarding recruiting, motivating team members, managing resources and time, sponsor outreach, fundraising, scheduling, presentations, and budgeting. This is achieved through student led discussion, workshop service and project analysis. Intended that students follow up with Engineering Leadership II (ME 480).

ME383 Modern Manufacturg Processes
Hours 3

A survey of classical and modern manufacturing processes. Emphasis is on technical fundamentals and practical applications. Components include geometric and service attributes of manufactured products, metal casting processes, forming processes, machine processes, joining processes, and additive manufacturing.

Prerequisite(s): AEM 250, MTE 271 and (ENGR 161 or ENGR 171)

ME406 Thermal Power Systems
Hours 3

Study of thermal systems emphasizing large power generation systems. Topics include Rankine and gas turbine cycles, fossil fuels combustion, boiler characteristics, cogeneration, combined cycle plants, environmental effects of power generation, and alternative energy concepts.

Prerequisite(s): ME 305

ME407 Heatg Ventilat Air-Condg
Hours 3

Fundamentals and practice associated with heating, ventilating and air conditioning; study of heat and moisture flow in structures, energy consumption, human comfort and health; and design of practical systems.

Prerequisite(s): ME 309 and ME 305

ME408 Non-Equilibrium Gas Dynamics
Hours 3

This course covers basics of kinetic theory and direct simulations Monte Carlo (DSMC) method for modeling non#equilibrium gas flows. The students will learn how to use the DSMC method to understand gas dynamics effects in both technological processes such as additive manufacturing and aerospace applications such as reentry problem.

Prerequisite(s): AEM 311 and ME 349

ME410 Engineering in a Social and Global Context
W

Hours 3

This course expose students to cultural and societal issues and perspectives and lay the foundation for responsible participation in a diverse society by preparing students to make informed decisions in the complex cultural contexts of both the U.S. and global communities.

Prerequisite(s): ME 305 or MFE 332

Writing

ME411 Computational Heat Transfer and Fluid Flow
Hours 3

Computational techniques to solve conservation equations representing heat transfer, mass transfer, and fluid flow processes. Topics include discretization methods for multi-dimensional diffusion and convection problems, programming and numerical techniques, and pressure-correction algorithms. Use of computer software for practical applications is also covered.

Prerequisite(s): ME 309

ME414 Principles of Combustion I
Hours 3

Energy sources, combustion systems, fuels and emissions, combustion thermodynamics, chemical kinetics, 1D reactors, combustion phenomena (ignition, flashback, blow-off, deflagration, detonation, etc.), laminar and turbulent premixed and non-premixed flames, and heterogeneous combustion.

Prerequisite(s): ME 309

ME416 Energy Conservtn & Manag
Hours 3

Analysis of energy systems with focus on evaluating baseline energy usage and best practices for efficiency. Topics include overview of utility rate schedules and fuel sources and supplies, economic analysis, lighting systems, industrial energy systems, heating, ventilation, air-conditioning systems.

Prerequisite(s): ME 309 and ME 305 and ECE 320 or ECE 225

ME417 Sustainable Energy
Hours 3

Contemporary issues surrounding the challenge of providing energy for societal and economic development are examined. Depletion of fossil fuel resources and the impact of fossil fuel use on the environment and climate are considered. Alternative Sustainable sources of energy production are explored.

Prerequisite(s): ME 305

ME420 Gas Turbines
Hours 3

Build understanding of aviation and industrial gas turbines, their components, design, and performance. The course will also cover improvements being made in the industry to make gas turbines environment friendly and a discussion of future options.

Prerequisite(s): ME 305

ME421 Reliability and Maintainability Engineering
Hours 3

This course is designed to introduce upper-level undergraduate engineering students to reliability and maintainability measures, models, and prediction methods. The course also covers preventive maintenance techniques and philosophies such as FMEA and Reliability Centered Maintenance.

Prerequisite(s): GES 255 or GES 400 or ME 349, or permission of the instructor

ME424 Automotive Manufacturing
Hours 3

This course is designed to introduce engineering students to automotive manufacturing processes, technologies, and systems. Topics include current status of automotive manufacturing as well as methods of material processing, material handling systems, production facilities and fundamentals of robotics and automation as they relate to automotive manufacturing.

Prerequisite(s): ME 383 (with grade of C or better)

ME426 Internal Combustion Engines
Hours 3

This course introduces how internal-combustion engines work, and links analysis and testing techniques used for their design and development to subjects presented within the mechanical engineering curriculum. Laboratory activities serve to reinforce and illustrate analysis application as well as provide visual reference to common internal-combustion engine components.

Prerequisite(s): ME 305

ME430 Fuzzy Set Theory & Application
Hours 3

The course covers the basic concepts in fuzzy set theory, fuzzy logic, and approximate reasoning. Relation between fuzzy set theory, probability theory, and possibility theory is discussed. Applications of fuzzy set theory in manufacturing systems are outlined.

Prerequisite(s): GES 255 OR GES 400 OR GES 500 OR ME 349, or permission of the instructor

ME440 Failure of Engineering Materials
Hours 3

Understand how structural components fail and apply the proper techniques for a failure analysis investigation. Demonstrate the ability to identify and differentiate fractographic features of material failure including overload and progressive failures (ductile, brittle, fatigue, creep, corrosion, wear). Practical failure analysis project experience included.

Prerequisite(s): AEM 250 and AEM 251 and MTE 271 and ME 350 and ME 383

ME442 Multiscale Material Design
Hours 3

This course covers an introduction to materials modeling, terminology, and fundamentals of modeling/simulations in engineering systems, modeling materials at atomic scales using molecular dynamics techniques, statistical methods, mesoscale simulations using phase-field, largescale simulations using continuum mechanics, and finite element method. It also provides basic training on the software tools used in the field – e.g., COMSOL, LAMMPS, VMD, ParaView. Students will learn about different modeling techniques, available software tools, and analysis of the simulation results.

Prerequisite(s): AEM 250, AEM 251, MTE 271, ME 349, and ME 350

ME446 Atomistic Modeling of Materials
Hours 3

This course focuses on the classical molecular dynamics method as a universal tool for calculation of properties of matter in solid, liquid, and gaseous states. The course includes both lectures and a computer practicum that requires elementary programming in C and use of the LAMMPS molecular simulator. An introduction into C programming is provided as a part of the course.

Prerequisite(s): AEM 250 and ME 349

ME448 Biomechanics of Human Movement
Hours 3

An overview of the broad field and major challenges of movement bio mechanics; II. The principles of classical mechanics, anatomy, and physiology to describe, analyze, and assess human motion; and III. The engineering tools and the mathematical approaches applied to perform bio mechanical analysis of moving bodies.

Prerequisite(s): ME 349 Engineering Analysis; MATH 238 Applied Differential Equations 1; AEM 201 Statics; AEM 264 Dynamics

ME450 Dynamic Machine Components
Hours 3

This course covers the selection and application of machine elements in dynamic systems. Specific components covered include transmission elements (gears, belt drives, and chain drives), bearings, and brakes and clutches. Linkage synthesis and dynamic analysis of mechanical systems are also covered.

Prerequisite(s): AEM 264 and ME 350

ME452 Fundamentals of Automotive Systems
Hours 3

Description of a generic vehicle development process. Full vehicle concepts. Performance and fuel efficiency calculations. Fundamentals of internal combustion engines, thermodynamic principles, vibrations. Transmission and drive train design.

Prerequisite(s): MATH 238

ME454 Automotive Electrical and Electronic Systems
Hours 3

Evolution of a classical automotive electrical point#to#point network into a modern electrical/electronic system with bus networking. Influence of E/E systems on the vehicle development process. Analog and digital control systems. Basic electronic components and sensors. Power management of the board network. Principles and behavior of batteries, alternators and starters. Deep dive into ESP#System (Electronic Stability Program) to understand the operating principles of its subsystems: Anti# lock Brake System, Traction Control System and Yaw Control System. Review of sensors and actuators used in ESP control. Principles of bus systems in automobiles. Detailed operation of the CAN, LIN and FlexRay bus system. Special topics including Electro Magnetic Compatibility. Knowledge of MATLAB and SIMULINK.

Prerequisite(s): ECE 225 or ECE 320

ME456 Mechatronics
Hours 3

This is the introductory course to the field of Mechatronics and Robotics. It covers fundamentals of electronics required for mechatronics systems, introduction to microcontroller (Arduino/Beaglebone/Raspberry pi) programming and interfacing, data acquisition, sensing and actuation. The course is a mix of instructional theory and lab, coupled with an independent exploratory project.

Prerequisite(s): ME 360 and ME 372

ME458 Modeling and Simulation of Automotive Systems
Hours 3

Introduction to modeling and simulation of automotive systems with various components including internal combustion engine, transmission, battery, electric motor, and chassis dynamics. Energy efficiency and dynamic performances of conventional, hybrid electric, and full electric vehicles are covered.

Prerequisite(s): ME 349: Engineering Analysis ME 372: Dynamic Systems

ME460 Energy Systems: Analysis and Measurement
W

Hours 4

Techniques of analysis and design of thermal systems including piping networks, heat exchangers, and pumping systems. Hands on experience with these systems through laboratory activities. Statistical design of experiments. Selection and use of basic thermal systems measurement instrumentation. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course.

Prerequisite(s): ME 309 & ME 360 - each must have a minimum grade of C-.

Writing

ME464 Additive Manufacturing of Metals by Design
Hours 3

This course delves into the world of design of components and processes to be built using Additive Manufacturing techniques. Students explore design principles, advanced techniques, and material selection for crafting intricate metal components. The course empowers participants to harness cutting-edge technologies in metal fabrication, fostering creativity and expertise in the field.

Prerequisite(s): AEM 250 and AEM 251 and MTE 271 and ME 349 and ME 350

ME470 Mechanical Vibrations
Hours 3

Formulation and solution of free and forced vibration problems for undamped and damped systems with single and multiple degrees of freedom. An introduction to modeling vibrations in continuous systems is also included. Superposition methods utilizing waveform decomposition, such as Fourier Series, are presented for use in both solution methods and system analysis. Experimental techniques of vibration measurement are also introduced.

Prerequisite(s): ME 372 and AEM 250

ME471 Fundamentals Of Acoustics
Hours 3

Fundamental physical principles underlying wave propagation and resonance in mechanical systems. The course introduces modeling, applications, and provides experience in acoustic and audio measurements and the associated instrumentation. The human auditory transduction mechanism is also studied along with physical parameters that describe how humans hear.

Prerequisite(s): MATH 238, and PH 106 or PH 126, and ECE 225 or ECE 320

ME472 Introduction to Robotic Kinematics
Hours 3

This course covers the fundamental concepts of robotics that will enable students to perform kinematic and static force analyses of robotic systems. Rigid-body motion in three-dimensional space is analyzed using rotation and transformation matrices. Screw theory approach is used for representing and conducting forward kinematics of manipulators (product of exponentials). Inverse kinematics of open-chain manipulators is examined using analytical and numerical techniques. Jacobian-based methods are discussed for conducting velocity and static force analyses.

Prerequisite(s): ME 360 and ME 372

ME475 Control Systems Analysis
Hours 3

Classical feedback control system analysis, Laplace transform, transfer function, time response, proportional-integral-derivative control, root locus, frequency response, and computerized analysis. Also includes a brief introduction to modern control techniques.

Prerequisite(s): ME 349 and ME 372

ME480 Engineering Leadership II
Hours 2

Continues development of organizational leadership fundamentals initiated in ME 380 Engineering Leadership I regarding recruiting, motivating team members, managing resources and time, sponsor outreach, fundraising, scheduling, presentations, and budgeting among leaders working for COE organizations. This is achieved through student led discussion, workshop service and project analysis.

Prerequisite(s): ME 380

ME484 Product Innovation
Hours 3

This is an experiential, team-based learning course that allows students to develop ideas for new uses of patented technologies. Students use NASA technologies as the foundation for a new product idea and then work through the lean product development and customer discovery processes to test their ideas.

ME485 Microfabrication
Hours 3

This course brings together the basic understanding of various microfabrication processes, different Microelectromechanical Systems MEMS devices, and how they can be exploited in a wide range of engineering applications. The physics behind the operation of different fabrication tools will be covered, and the fabrication and operation of real-world examples will be explained.

Prerequisite(s): ME 349

ME489 Mechanical Engineering Design I
Hours 3

Introduction to concepts and techniques of engineering design with supporting mathematical material. Guest lecturers present professional aspects of engineering. The Capstone Design Project is begun and carried on through ME 490 (ME 489 and ME 490 are taken in consecutive semesters).

Prerequisite(s): ME 305 and ME 309 and ME 350 and ME 351 and MATH 238

ME490 Mechanical Engineering Design II
EXP

Hours 3

In this course, student teams serve as consultants to a client. Emphasis is on conducting a professional design study and preparing written and oral presentations of the project.

Prerequisite(s): ME 489

Experiential Learning

ME491 Special Problems
SP

Hours 1-6

This is a special topics lecture class or an assigned problem class. Credit is based on the amount of work undertaken.

Special Topics Course

ME492 Automotive Experience
EXP

Hours 1

This course provides automotive-related experience associated with on campus automotive design competition teams such as EcoCAR, Formula SAE, SAE Baja and Autonomous Indy or suitable industrial internships.

Prerequisite(s): Participation and active member status in one of the automotive design competition teams on campus or an approved automotive-related internship.

Experiential Learning

ME493 Automotive Experience Capstone
EXP

Hours 1

This course documents applications of material covered in coursework a student has chosen to satisfy automotive minor academic requirements within the practical experiences gained during the design-team participation or industrial internships required for the Automotive Minor. Coursework topics should be associated with documented activities which made up the portfolios created in the ME 492 experiences.

Prerequisite(s): ME 492

Experiential Learning

ME497 Mechanical Engineering Project
EXP, SP

Hours 1-3

An individual analytical, experimental or design project. Research on an assigned problem culminates in a required report.

Experiential Learning, Special Topics Course

Manufacturing Systems Engineering Courses

MFE190 Introduction to Manufacturing Systems Engineering
Hours 1

An introduction to the discipline of manufacturing systems engineering and the role of the manufacturing engineering in today's advanced industrial settings. Focus is on learning about the discipline with a series of student hands-on activities.

MFE201 Basics of Robotics
Hours 1

This course introduces students to the world of robotics. Students learn fundamental engineering concepts and how to work with the Vex robot in the classroom safely. Also, this course introduces students to programming with Vex V5. Fundamental programming concepts like loops, statements, variables, constants and assignments are reinforced with activities and worksheets. Students learn how to simplify their code and use their new programming skills to make the BaseBot follow complex paths. Moreover, students learn about a robot's end effectors and how these end effectors affect the robot's design and performance.

Prerequisite(s): MFE 190 with a minimum grade of C- or ME 121 with a minimum grade of C-

MFE202 Basics of PLC
Hours 1

In this course, students learn how to program and use PLCs in industrial applications that require electrical control. The PLC modules feature PLC simulation control software that allows students to program a PLC and simulate industrial applications. Students will learn about programmable logic controllers, input/output relationships, identifying Input/Output addresses for an I/O panel, writing and simulating a basic ladder diagram, different logics and features in programming.

Prerequisite(s): MFE 190 with a minimum grade of C- or ME 121 with a minimum grade of C-

MFE203 Basics of Automation and Materials Handling
Hours 1

Robotics and Materials Handling gives students the fundamental skills needed to operate, maintain, program and test robotic systems. The lab version enables students to gain experience and skill in robotic operation and programming using the SCORBOT-ER4u, an industrial training robot. Using SCORBASE software, an intuitive tool for robot programming and control, students develop and write robot programs and design solutions for industrial robotic applications.

Prerequisite(s): MFE 201 with a minimum grade of C- or MFE 202 with a minimum grade of C-

Prerequisite(s) with concurrency: MFE 201 and MFE 202

MFE204 Basics of Manufacturing and Automation
EXP

Hours 3

Students are introduced to the fundamental skills needed to operate, maintain, program and test robotic systems for handling materials. An industrial training robot and its software will be used to design solutions for industrial robotic applications. This will feature PLC simulation control software for industrial applications.

Prerequisite(s): MATH 126 and ENGR 161

Experiential Learning

MFE222 Robotic Welding
Hours 1

In Robotic Welding, students discover robotic welding fundamentals by first working through the entire welding process in simulation. Only then can they execute actual automated welding applications. Activities challenge students to develop solutions for common welding problems, such as thermal deformation, by adjusting their welding technique. Students also learn to improve weld quality by optimizing important welding parameters such as wire feed rate, robot speed, inert gas shield and voltage.

Prerequisite(s): MFE 203

MFE224 Industrial Automation with Robotics
Hours 1

Robot Expert is a simulation and offline programming software that enables manufacturers to perform complete 3D modeling, visualization and simulation of their automation systems, including robots, tooling and peripheral equipment. In this course, students will learn the basics of how to use this full-featured program and observe how it enables manufacturers to optimize their production processes while eliminating waste and extra costs. In this introductory, students are introduced to some basic manufacturing processes and become familiar with the role of robotics in manufacturing and production.

Prerequisite(s): MFE 203

MFE226 Instrumentation for Automations
Hours 1

This course enables students to gain a solid foundation of knowledge and skill in performing measurements and calculations. More specifically, students learn how to use precision measurement tools, such as steel rule, tape measure, protractor, micrometer, height gauge, various calipers and dial indicators. Students gain proficiency in reading mechanical drawings, in selecting the proper tools for inspecting parts and in preparing quality control/inspection reports. Students learn how to collect data on a sample and calculate the mean, median and standard deviation. They also learn how these concepts relate to statistical sampling, tolerance and quality control. The course includes statistical process control activities that allows students to collect and display measurement data in a spreadsheet.

Prerequisite(s): MFE 203

MFE232 Flexible Manufacturing Systems
Hours 1

The Flexible Manufacturing System (FMS) course exposes students to automation and industrial applications by combining CNC technology with robotics and materials handling. Students develop and edit programs, record precise robotic positions, accurately mill parts, and synchronize mill and robot operation. Students gain "virtual hands-on" experience in CNC and robot programming, especially in I/O commands. Students design solutions for industrial FMS applications with emphasis on real industrial concerns, such as optimized CNC and robotic programming and accurate machine tending.

Prerequisite(s): MFE 203

MFE262 Introduction to the Industrial Internet of Things
Hours 1

Introduction to the Internet of Things and Connectivity focuses on the vast network of smart sensors and devices that is the Internet of Things (IoT) and its impact on Industry 4.0 and the manufacturing world. This course also explores topics related to the interconnection of IoT and industrial devices, such as SCADA systems, cloud computing, edge computing, and machine vision systems.

Prerequisite(s): MFE 203

MFE290 Capstone Experience: Foundations of Programming
Hours 3

This course is a first course in programming for students majoring in manufacturing systems engineering. Language concepts include arrays, matrices, sequences, functions, selection, iteration and recursion. Software engineering concepts include files & I/O , plotting, as well as general programming techniques.

Prerequisite(s): ENGR 103 or ENGR 104 or ENGR 123

MFE302 Advanced PLC
Hours 1

Advanced Programmable Ladder Logic course teaches students how to program and use PLCs in industrial applications that require electrical control. The PLC modules feature software, which allows students to program a PLC and simulate industrial applications. The course includes the testing of input and output responses to ladder diagrams students have programmed. The combination of graphic simulation software with PLC hardware enables students to test and correct control programs both online and offline.

Prerequisite(s): MFE 202

MFE303 Advanced Automation and Materials Handling
Hours 1

Advanced Robotics and Materials Handling explores robotic programming. Using RoboCell, a 3D solid-modeling robotic simulation software, students gain a greater understanding of the robotics concepts, and programming commands learned in Basic Robotics and Materials Handling. This course gives students the advanced skills needed to operate, maintain, program, and test robotic systems. In this course, students work with RoboCell to program and operate the robot. The activities challenge students to design solutions for industrial robotic applications, with emphasis on real industrial concerns, such as recording accurate positions, complicated movements, interfacing with peripherals, working with sensors, optimizing programming, and increasing productivity.

Prerequisite(s): MFE 203

MFE320 Plant Engineering
Hours 3

The course introduces undergraduate engineering students to economic decisions involving engineering alternatives, annual costs, present worth, rate of return, and benefit-to-cost. The course also familiarizes students with the development and management of ergonomics and anthropometric, biomechanical, and human-machine interface models for minimizing occupational injuries and hazards.

Prerequisite(s): AEM 201

MFE326 Process Monitoring and Control
Hours 1

The Pressure Process Control course offers students hands-on training in the measurement and control of pressure processes using open loop, on/off loop and three-element (PID) control methods. The Pressure Process Control training system serves to demonstrate and teach the measurement and control of pressure processes. The system gives students a solid understanding of the fundamentals of instrumentation and industrial process control. The course uses Process Motion simulation control software to control a virtual training panel for the practice the measurement and control of pressure processes using open loop, on/off loop and three-element (PID) control methods. Students raise and lower air pressure to preset levels using manual control and auto-tuning methods. Students learn how the E/P converter with the control valve affects a preset pressure in the air tank. They create variable demand and supply disturbances by manipulating the panel's valves. Students also learn to optimize the parameters for PID control of pressure and to verify controller tuning.

Prerequisite(s): MFE 226

MFE332 Quality Control In Manufacturing Systems
W

Hours 3

The course covers the foundations of modern methods of quality control applied to manufacturing industries. Writing proficiency is required in this course. This course has a W (writing) designation, thus, writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course. Both individual weekly assignments as well as the midterm project will be used to assess the writing proficiency of the student. Writing grading rubrics will be available when the assignment is made. All assignments will be graded and returned to the student within a week of submission.

Prerequisite(s): GES 400 or GES 255 or ME 349

Writing

MFE338 Introduction to Industry 4.0
Hours 1

The world is at the onset of the Fourth Industrial Revolution and this revolution is driven by the smarts in automating decision making and processes. Advancements in IT has resulted in immense improvements in computational power across nearly all electronic devices and enhanced capabilities in connecting the dots in an increasingly networked society. Digital platforms in the Cloud provides a perfect canvas for inventing new business models and for intelligent algorithms to analyze data and derive knowledge for operationalize use by cyber physical systems. This course provides a comprehensive coverage on, among others, the role of data, manufacturing systems, various Industry 4.0 technologies, applications and case studies. In particular, we also draw input from researchers and practitioners on what are the opportunities and challenges brought about by Industry 4.0, and how organizations and knowledge workers can be better prepared to reap the benefits of this latest revolution.

Prerequisite(s): MFE 262

MFE342 Fundamentals of Materials Processing
W

Hours 3

The course covers the scientific and engineering principles relevant to materials production. Methods for production of major materials as well as advanced topics including nanofabrication are also discussed in the course. This course has a W (writing) designation, thus, writing proficiency is required for a passing grade in this course. A student who does not write with the skills normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course.

Prerequisite(s): AEM 250 and AEM 251 and ECE 320

Writing

MFE385 Metrology
Hours 4

The course deals with the use of measuring instruments such as micrometers, Vernier calipers, scales, go & no-go gages, gage blocks, surface plates, comparators, and coordinate measuring machine. It also includes discussion of metrology-related concepts such as precision, accuracy, standards, repeatability, and reproducibility are discussed in the course. This course has a lab component.

Prerequisite(s): AEM 250 and AEM 251 and ENGR 161

MFE390 Capstone Experience: Manufacturing Engineering Design 1
Hours 3

Introduction to application of concepts and techniques of manufacturing systems design. Guest lecturers present professional aspects of engineering. The Capstone Design Project of a manufacturing problem is begun and carried on through MFE 490.

Prerequisite(s): MFE 332 and MFE 385 (Note that MFE 490 must be taken next semester)

MFE442 Advanced Materials Science and Additive Processes
Hours 3

Introduces advanced materials for engineers, emphasizing the production, structure, property and application of advanced materials for manufacturing processes. The course also discusses the principles of additive manufacturing.

Prerequisite(s): MFE 342

MFE473 Discrete Simulation of Manufacturing Systems
C, EXP

Hours 3

This course is designed to introduce engineering student to basic simulation modeling concepts and techniques. The course material emphasizes stochastic and discrete computer simulation. This course has a C (computer) designation, students will have to show proficiency in the use of the Arena software to successfully pass the course.

Prerequisite(s): MFE 290, MFE 385, and (CS 100 or CS 110)

Computer Science, Experiential Learning

MFE483 Computer Aided Manufacturing
C, EXP

Hours 3

The course introduces the concept of Computer Aided Manufacturing which deals with the design of components to manufacturing and also includes planning and controlling the processes. Students will be familiar with its hardware and software and also able to write programs for machining. This course has a C (computer) designation, students will have to show proficiency in the CNC programming (i.e., G-Code and M-Code) to successfully pass the course. This course provides additional instruction related to computing skills and applications.

Prerequisite(s): MFE 290 and (CS 100 or CS 110)

Prerequisite(s) with concurrency: ME 383

Computer Science, Experiential Learning

MFE485 Modern Manufacturing Practices II
Hours 3

The course deals with the investigation of contemporary technologies and approaches for the analysis, design, and development of manufacturing systems.

Prerequisite(s): ME 383

MFE489 Manufacturing Engineering Design I
Hours 3

Introduction to application of concepts and techniques of manufacturing systems design. Guest lecturers present professional aspects of engineering. The Capstone Design Project of a manufacturing problem is begun and carried on through MFE 490.

Prerequisite(s): MFE 332 and MFE 385

MFE490 Capstone Experience: Manufacturing Engineering Design 2
EXP

Hours 3

Semester-long practicum in which three or four-person teams serve as consultants to an industrial client. Emphasis is on conducting a professional design study and preparing written and oral presentations of the project results.

Prerequisite(s): MFE 390 or ME 489

Experiential Learning