MECHANICAL (MECH)

MECH2000 ENGINEERING STATICS
The vector approach of the equilibrium of particle and rigid bodies is presented. Trusses, frames, shear and bending moment diagrams, centroids and moments of inertia are studied. Prerequisites: MATH1850 or MATH1875; and PHYS1250 (4 credits)

MECH2250 ENGINEERING THERMODYNAMICS I
Thermodynamics properties, work and heat interaction are defined. The First and Second laws of thermodynamics are introduced. Conservation of mass and energy and the entropy and the exergy balance relations are applied in analyzing thermodynamic systems. Alternative energy sources and fuel cells are discussed. Psychrometric applications in the air conditioning processes are covered. Laboratory experiences reinforce the classroom theory. Prerequisites: MATH1850 or MATH1875; and PHYS1750 (4 credits)

MECH2300 ENGINEERING GRAPHICS
Basic concepts of engineering graphics, design and sketching, tolerance analysis and ANSI standard drawings are explored using CAD (3 credits)

MECH2500 MECHANICS OF MATERIALS
The concepts of stress and strain and their relation are introduced. Axially loaded members, temperature effect, torsion, bending, combined loading and stress trans-formations are studied. Stability and buckling of columns are discussed. Laboratory experiences reinforce classroom theory. Prerequisite: MECH2000 (4 credits)

MECH2600 MECHANICAL DESIGN & ANALYSIS
This 3-D Computer Aided Design course provides experience in mechanical engineering design and analysis. Assembly component interface tolerance analysis to ensure manufacturability of designs and basic finite element analysis of parts and assemblies are conducted. Prerequisites: MECH2000 and MECH2250 and MECH2500 and ENGR1800 (3 credits)

MECH2750 ENGINEERING THERMODYNAMICS II
Studies vapor power systems including the Rankine cycle and its modifications for use with both fossil and nuclear fuels, vapor compression refrigeration systems, and all-gas cycles including the Brayton cycle and its modifications; the Otto cycle; the Diesel cycle; and supercharging and turbocharging. Introduces the concepts of exergy and second law efficiency. Studies non-reacting mixtures with applications to air/water/vapor mixtures for air conditioning systems and cooling towers. Discusses the elements of optimum power plant design. Laboratory experiences enforce the classroom theory. Prerequisite: MECH2250 (4 credits)

MECH3000 DESIGN OF MACHINE ELEMENTS
This course covers the basic concepts and principles in the design and analysis of machine components. The analysis in design is based on the traditional stress analysis from mechanics of materials and also on the finite element formulation based on theory of elasticity. Plane stress, three-dimensional stress and strain, combined stresses, failure criteria and reliability, fatigue, are considered in the analysis of machine elements: rolling bearings, spur gears, flexible elements, and shafts. Prerequisite: MECH2500 (4 credits)

MECH3025 SCANNING ELECTRON MICROSCOPY: IMAGING, ANALYSIS AND EVALUATION
This course will look at the use of fundamental physics and chemistry principles as a basis for advanced analysis of biological and synthetic objects. An integrated approach of on-line research, lecture, demonstration, and student exploration along with optical and scanning electron microscopy (SEM) will be used to verify findings. Physical and elemental details that cannot normally be seen will be imaged and evaluated to gain an understanding of how naturally occurring and engineered products are developed. Based on student interest, additional analysis techniques will also be presented. Prerequisites: CHEM1100 and PHYS1250 (4 credits)

MECH3050 FUNDAMENTALS OF HVAC SYSTEMS
Moist air properties and air conditioning processes will be covered through theory, Psychrometrics chart and Laboratory experiment. Building maximum heat loss (heating load in winter) and heat gain (cooling load in summer) calculations will be discussed along with different heating and cooling systems and subsystems such as hot air, hydronic, vapor compression, absorption Refrigeration Cycles. Degree-day and bin methods to estimate building energy consumption will be covered. Prerequisite: MECH2250 (4 credits)

MECH3100 ENGINEERING FLUID MECHANICS
Mechanics of fluids with emphasis on control volume analysis are studied. The continuity, energy and momentum principles are applied to real fluids. Additional emphasis is on electromechanical systems and laboratory exercises. Prerequisite: MECH2250 and MECH2250 (4 credits)

MECH3200 NUMERICAL SIMULATION & CFD
This is an advanced new undergraduate and graduate course that explores the fundamentals of different engineering problems with different simulation techniques and CFD. The course will present several important topics such as modeling techniques and CFD. The topics will cover different techniques to solve multidisciplinary engineering problems. The basic knowledge will be applied to typical problems in aerospace and different engineering applications. Prerequisites: MECH3100 and MECH2300 (4 credits)

MECH3250 INTERMEDIATE MATLAB
The goal of this course is to develop the skills and confidence to use MATLAB as an effective tool in solving engineering problems. The basics of MATLAB will first be reviewed and the expanded upon. A variety of topics will be covered, including object-oriented programming, solving ordinary and partial differential equations, creating GUI’s, the use of plot handles, and writing efficient code. Prerequisites: ENGR1800 and MATH2500 (3 credits)

MECH3300 INTRODUCTION TO LabVIEW & DATA ACQUISITION
This course introduces students to the methods and techniques used in LabVIEW and data acquisition. The topics emphasized are basic programming structures and best practices for programming in the LabVIEW environment. Additional topics include the fundamental concepts of data acquisition, techniques to obtain and analyze measurements of physical properties and quantities related to the field of mechanical engineering. Prerequisites: MECH2500, MECH2250 and ELEC2799. (4 credits)
MECH3350  GAS DYNAMICS
This course is an introductory course to the subject of applied Gas Dynamics where the effect of compressibility on fluid flow is introduced. It starts with some basic notions of fluid flow and thermodynamics followed by one dimensional compressible flow. Normal and oblique shock waves. Construction and design of aircraft gas turbine engine. Simulation and CFD analysis of compressible flow and convergent-divergent nozzles. Prerequisite: MECH3200 (4 credits)

MECH3400  RELIABILITY-BASED MECHANICAL DESIGN
Techniques for the quantification of uncertainty and risk inherent in mechanical components and systems; and the implementation of reliability-based design in mechanical components and systems. (4 credits) Prerequisite: MECH3000

MECH3450  ADVANCED DESIGN THEORY FOR MECHANICAL COMPONENTS
Why does a mechanical component with a specified factor of safety as 2.4 still fail? The traditional mechanical component design theory cannot answer this vital design question. The advanced design theory for mechanical components uses reliability to describe the safety of a component and clearly explains that any design component will fail due to the variation of material strength, loading and dimension of the component. This course will address techniques for the quantification of uncertainty and risk inherent in mechanical components and implement reliability as the safety index to design mechanical components. Prerequisite: MECH2500 (3 credits)

MECH3599  ENGINEERING MECHANICS
This course covers static equilibrium and dynamic motion. Major components of this course are force vectors, equilibrium of a particle, resultant and internal forces, centroids, center of gravity, stress and strain, torsion, moments of inertia, shearing, deflection, kinematics of a particle, kinetics of a particle, force, acceleration, work and energy, impulse and momentum. The course includes labs that correspond to the lecture material. Prerequisites: MATH2025 and PHYS1750 (4 credits)

MECH3600  MATERIALS SCIENCE
This is an introductory course into the structure and properties of materials. Subjects include the processing of materials, crystal structure, Miller indices, composition, alloying, electrical properties, phase diagram, corrosion, diffusion, heat treating, inspection, and testing of materials utilized in the electromechanical field. The laboratory activities will reinforce the classroom theory. Prerequisite: Junior status and MECH2500 (4 credits)

MECH3650  AERODYNAMICS
This course is an introductory course to the subject of Aerodynamics. Fundamentals physical quantities and the source of all aerodynamics forces, continuity, momentum and energy equations. Measurement of airspeed: incompressible flow, subsonic compressible flow, supersonic flow. Introduction to viscous flow, laminar and turbulent boundaries, transition, flow separation. Airfoils, wings and other aerodynamic shapes. Elements of airplane performance, equations of motion, thrust, power and maximum velocity. Principles of stability and control (static and dynamic stability, control), moments on the airplane, absolute angle of attack. Astronautics: differential, Lagrange's and orbit equations. Prerequisite: MECH3350 (4 credits)

MECH3800  SPECIAL TOPICS IN MECHANICAL ENGINEERING
Presents topics that are not covered by existing courses and are likely to change from semester to semester. Refer to the Class Schedule for a specific semester for details of offerings for the semester. (1 - 4 credits)

MECH3850  ENGINEERING DYNAMICS
This course covers the kinematics and kinetics of particles and rigid bodies. Kinetic problems are analyzed by utilizing the second law of Newton, work and energy and impulse momentum methods. Dynamics simulation software is used to reinforce the theory. Prerequisites: MECH2000 and MATH2500 (4 credits)

MECH3900  ENGINEERING HEAT TRANSFER
Conduction, convection, and thermal radiation heat transfer mechanisms are described. Steady-state and transient conduction problems are discussed. Convective heat transfer mechanisms and various correlations to evaluate the heat transfer coefficient are discussed. Heat exchanger analysis and thermal radiation heat transfer between surfaces are presented. Prerequisites: MECH2250 and MECH3100 and MATH2500 (4 credits)

MECH4200  SIMULATION BASED DESIGN
This 3-D computer aided design course provides experience in mechanical engineering simulation and design verification analysis. Finite Element Analysis of parts and assemblies are conducted. Prerequisite: MECH3000 (4 credits) spring

MECH4400  ENGINEERING THERMAL DESIGN
Studies vapor power systems including the Rankine cycle and its modifications for use with both fossil and nuclear fuels, vapor compression refrigeration systems, and all-gas cycles including the Brayton cycle and its modifications; the Otto cycle; the Diesel cycle; and supercharging and turbocharging. Introduces the concepts of energy and second law efficiency. Studies non-reacting mixtures with applications to air/water/vapor mixtures for air conditioning systems and cooling towers. Discusses the elements of optimum power plant design. Laboratory experiences enforce the classroom theory. Prerequisites: MECH2250 and MECH3100 and MECH3900 (3 credits)

MECH4425  ADVANCED MECHANICS OF MATERIALS
Stress analysis, the development of strain, stress concentrations, failure theories and fatigue are studied. Shafts, gears, and other elements are also considered. Laboratory problems and appropriate projects are assigned. Prerequisites: MECH2500 and ELEC2850 and MATH2025 and MATH2100 (4 credits)

MECH5000  MECHANICAL ENGINEERING CAPSTONE ANALYSIS
This capstone research-based course is for senior-level mechanical engineering students who will formulate a topic and initiate their capstone project for an innovative technological device or system. Students are encouraged to take an interdisciplinary approach to their design project with research directed by one or more faculty advisors. Prerequisite: Senior status (3 credits)

MECH5500  MECHANICAL ENGINEERING CAPSTONE PROJECT
This capstone project course is for senior-level mechanical engineering students who will formulate a topic and develop a project for an innovative technological device or system. Students are encouraged to take an interdisciplinary approach to their design project, and the work will be performed under the direction of one or more faculty advisors. Course requirements include oral and written progress reports throughout the semester plus a final comprehensive technical report. Prerequisites: Senior status and MECH4200 (4 credits)