

**MEC 251/Strength of Materials**

**1 course unit**

(same as CIV 251)

(spring semester)

*Prerequisites:* ENG 222, CSC 215, or 250

Topics include axial, lateral, and torsional loading of shafts and beams; statically indeterminate structures; temperature and prestrain effects; shear force and bending moment in beams; axial, shear, bearing and bending stresses; deflection of beams; and buckling of columns.

**MEC 263/Mechanical Engineering Laboratory I**

**.5 course unit**

(laboratory)

(spring semester)

*Corequisite:* MEC 251 or CIV 251

Experiments related to strength of materials and basic stress analysis and material science. Computer data acquisition and data analysis.

**MEC 311/Mechanical Design Analysis I**

**1 course unit**

(with design hour)

(fall semester)

*Prerequisite:* MEC 251

Combined stresses, energy methods, Castigliano's theorem, failure theories for static failure of ductile and brittle materials, low- and high-cycle fatigue, bolted connections with symmetric and eccentric loading.

**MEC 321/Numerical Methods for Engineers**

**1 course unit**

(same as CIV 321)

(fall semester)

*Prerequisites:* ENG 272, CSC 215

Numerical solutions to linear and non-linear systems of equations; root finding methods; numerical integration; numerical methods for finding eigenvalues and eigenvectors; numerical integration of ordinary and partial differential equations.

**MEC 343/Biomechanics**

**1 course unit**

(same as BME 343)

(with design hour)

(fall semester)

*Prerequisite:* MEC 251

Comprehensive study of structure, function and mechanical properties of biological soft and hard tissues. Topics include joint and tissue mechanics, analysis of tissue remodeling, fatigue and fracture resistance, and mechanical properties of skeletal tissue.

**MEC 361/Fluid Mechanics**

**1 course unit**

(same as CIV 361)

(spring semester)

*Prerequisites:* ENG 222, ENG 272

Topics include hydrostatics; kinematics of fluid motion; conservation equations in integral and differential form; dimensional analysis; laminar and turbulent viscous incompressible flow; boundary layer theory; and lift and drag.

**MEC 363/Mechanical Engineering Laboratory II**

**.5 course unit**

(laboratory)

(spring semester)

*Prerequisite:* MEC 263

*Corequisites:* MEC 361, MEC 371

Experiments related to fluid mechanics and thermodynamics. Calibration and uncertainty. Performance testing of an internal combustion engine.

**MEC 371/Thermodynamics II**

**1 course unit**

(spring semester)

*Prerequisite:* ENG 322

Topics include availability and irreversibility; power and refrigeration cycles; mixtures and solutions; chemical reactions; Maxwell relations and one-dimensional flow through nozzles and diffusers.

**MEC 381/Introduction to Mechatronics**

**1 course unit**

(with design hour)

(occasionally)

*Prerequisites:* ENG 212, ENG 272

This course is an introduction to the analysis and design of mechatronic systems including actuators, sensors, microcomputer, interfacing, control electronics, signal processing and mechanisms. Course work includes weekly lectures and hands-on labs.

**MEC 391/Independent Study**

**.5-1 course unit**

(occasionally)

*Prerequisites:* Permission of instructor, senior status required

For students wishing to study an advanced area of interest. Topic(s) developed in consultation with a faculty member.

**MEC 411/Heat Transfer**

**1 course unit**

(with design hour)

(fall semester)

*Prerequisites:* ENG 322, ENG 342, MEC 321, MEC 361

Multi-dimensional steady state and transient conduction. Internal and external convection, blackbody and graybody thermal radiation, numerical methods for heat transfer. Design and analysis of heat exchangers.

**MEC 421/Kinematics and Mechanisms**

**1 course unit**

(with design hour)

(occasionally)

*Prerequisites:* ENG 262, CSC 215, junior status required

Analysis of displacement, velocity, and acceleration in mechanical linkages, cams, gears, and mechanisms; synthesis of linkages, analytical, graphical, and computer-generated solutions.

**MEC 423/Introduction to Biomaterials**

**1 course unit**

(same as BME 423)

(with design hour)

(spring semester)

*Prerequisite:* CHE 201

Introduction to metal, polymeric, ceramic, and biological materials used as surgical implants in humans. Topics include acute and chronic biological response to implants, degradation of artificial materials, artificial organs, and medical devices. Consideration of ethical issues.

**MEC 431/Mechanical Design Analysis II**

**1 course unit**

(with design hour)

(occasionally)

*Prerequisites:* MEC 311, senior status

Bolted and welded connections; mechanical springs; rolling and journal bearings; spur, helical, bevel, and worm gears; clutches, brakes, and flexible mechanical elements; safety, economic, reliability, and design considerations.

**MEC 433/Mechanical Engineering Laboratory III**

**.5 course unit**

(laboratory)

(fall semester)

*Prerequisite:* MEC 363

*Corequisite:* MEC 411

Experiments related to heat transfer in forced and natural convection. Computer data acquisition and data analysis.

**MEC 441/Vibration Analysis**

**1 course unit**

(with design hour)

(occasionally)

*Prerequisites:* ENG 262, MEC 321

This course introduces the mathematical models and responses for one and multiple-degree-of-freedom systems. Application and suppression of mechanical vibrations are investigated.

**MEC 451/Heating, Ventilating, and Air Conditioning**

**1 course unit**

(with design hour)

(occasionally)

*Prerequisites:* MEC 361, MEC 371

Heating and cooling loads; principles of psychrometrics; air, electric, hydronic, and steam heating systems; absorption; evaporation and vapor compression air conditioning system. Design and analysis of residential, commercial, and industrial HVAC systems.

**MEC 453/Digital Control Systems**

**1 course unit**

(same as ELC 453)

(with design hour)

(occasionally)

*Prerequisite:* ENG 352

Digital control Systems, dynamic response modeling, design, and compensation techniques.

**MEC 460/Finite Elements in Mechanical Design**

**1 course unit**

(fall semester)

*Prerequisite:* MEC 311

*Coerequisite:* MEC 411 Introduction to finite element analysis. Application of modern engineering tools in the design of mechanical and thermal systems.

**MEC 461/Thermal Systems Design**

**1 course unit**

(with design hour)

(occasionally)

*Prerequisites:* MEC 361, MEC 411

Workable and optimum systems, modeling of thermal systems, system simulation, and optimization.

**MEC 463/Mechanical Engineering Laboratory IV**

**.5 course unit**

(laboratory)

(spring semester)

*Prerequisites:* MEC 263, MEC 311, ENG 262

Experiments related to advanced mechanical engineering topics including free and forced vibrations for first- and multi-degree of freedom systems. Measurements on elements experiencing combined stresses.

**MEC 471/Compressible Fluid Mechanics**

**1 course unit**

(with design hour)

(occasionally)

*Prerequisites:* ENG 322, MEC 361

Study of physical acoustics, one-dimensional compressible flow, normal and oblique shock waves. Design of ducts and nozzles for compressible flow.

**MEC 473/Bioinstrumentation**

**1 course unit**

(same as BME 473, ELC 473)

(with laboratory)

(spring semester)

*Prerequisites:* ENG 212, ENG 214

Theory and design of biomedical instruments used for measurements on humans and animals. Detailed coverage of sensors and transducers that quantify force, pressure, flow, sound, temperature, and displacement. Origin of biopotentials (ECG, EMG, EEG) and biological signal processing. Consideration of noise, interference, and electrical safety issues.

**MEC 481/Advanced Strength of Materials**

**1 course unit**

(with design hour)  
(occasionally)

*Prerequisite:* MEC 311

Beams on elastic foundations, rotating discs, membrane stresses in shells, Castigliano's principles, torsional bucking of beams, and shafts.

**MEC 483/Robotics**

**1 course unit**

(same as ELC 483)  
(with design hour)  
(occasionally)

*Prerequisite:* ENG 272

Introduction to robotics foundations in kinematics, dynamics, control, trajectory generation, actuation, sensing, and design. Laboratory projects involving building mobile robots and operating manipulators are incorporated to reinforce the basic principles introduced in the lecture.

**MEC 495, 496/Senior Project I, II**

**0, 1 course unit**

(every semester)

*Prerequisites:* Senior standing

Senior project focuses students' previous experience upon a specific technical project. Library research, design, cost analysis, construction, testing, and project management. Students work closely with a faculty advisor.