ENGINEERING MECHANICS MINOR

Description

This minor is for engineering majors ONLY.

The College of Engineering enables its students to participate in this approved minor subject to the following conditions:

1. A minor will not reduce or alter the existing course or degree requirements for students electing to pursue a minor.
2. A student's minor program must be organized and approved by an advisor prior to the submission of the senior check to the department chair or head.
3. The minor must be approved by the advisor, the department chair or head, the Dean, and the cognizant program offering the minor.
4. The College of Engineering will follow the "Plan A/B" format of the College of Arts and Sciences in which a student pursuing a single minor must complete the "Plan A" requirements. A student pursuing a double (or greater) minor must fulfill either the "Plan A" or "Plan B" requirements for both minors depending on which plan is offered by the cognizant department.
5. Minors on the Lincoln or Omaha campuses may be added by approval of the College of Engineering Curriculum Committee and faculty.

College Requirements

College Admission

College Entrance Requirements

Students must have high school credit for (one unit is equal to one high school year):

1. Mathematics – 4 units: 2 of algebra, 1 of geometry, and 1 of precalculus and trigonometry
2. English – 4 units
3. Natural sciences – 3 units that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management and computer science)
4. Foreign language – 2 units of a single foreign language
5. Social studies – 3 units
6. Students having a composite ACT score of 28 or greater (or equivalent SAT score) will be admitted to the College of Engineering even if they lack any one of the following: trigonometry, chemistry, or physics.
7. Students having an ACT score of 19 or less in English (or equivalent SAT score) must take ENGL 150 Writing and Inquiry or ENGL 151 Writing and Argument.

A total of 16 units is required for admission.

Students must have an ACT (enhanced) score of 24 or greater (or equivalent SAT). Students who lack entrance requirements may be admitted based on ACT scores, high school rank and credits, or may be admitted to pre-engineering status in the Exploratory and Pre-Professional Advising Center. Pre-engineering students are advised within the Exploratory and Pre-Professional Advising Center.

Students for whom English is not their language of nurture must meet the minimum English proficiency requirements of the University.

Students who lack entrance units may complete precollege training by Independent Study through the University of Nebraska–Lincoln Office of On-line and Distance Education, in summer courses, or as a part of their first or second semester course loads while in the Exploratory and Pre-Professional Advising Center or other Colleges at Nebraska.

Students should consult their advisor, their department chair, or Engineering Student Services if they have questions on current policies.

Other Admission Requirements

Students who transfer to the University of Nebraska–Lincoln from other accredited colleges or universities and wish to be admitted to the College of Engineering (COE) must meet COE freshman entrance requirements and have a minimum cumulative GPA of 2.5 and be calculus-ready. Students not meeting either of these requirements must enroll in the Explore Center or another University college until they meet COE admission requirements. Students transferring from UNO, UNL, or UNK to the College of Engineering must be in good academic standing with their institution.

The COE accepts courses for transfer for which a C or better grade was received. Although the University of Nebraska–Lincoln accepts D grades from the University of Nebraska at Kearney and at Omaha, not all majors in the COE accept such low grades. Students must conform to the requirements of their intended major and, in any case, are strongly encouraged to repeat courses with a grade of C- or less.

All transfer students must adopt the curricular requirements of the undergraduate catalog current at the time of transfer to the COE—not that in use when they entered the University of Nebraska–Lincoln. Upon admission to Nebraska, students wishing to pursue degree programs in the COE will be classified and subject to the policies defined in the subsequent section.

Students who were previously admitted to COE and are returning to the College of Engineering must demonstrate a cumulative GPA of 2.5 in order to be readmitted to COE.

College Degree Requirements

Grade Rules

Grade Appeals

In the event of a dispute involving any college policies or grades, the student should appeal to his/her instructor and appropriate department chair or school director (in that order). If a satisfactory solution is not achieved, the student may appeal his/her case through the College Academic Appeals Committee on his/her campus.

Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted at the University of Nebraska–Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at Nebraska in the College of Engineering. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Requirements for Minor Offered by Department

Plan A Minor

Twelve (12) credit hours beyond the regular undergraduate engineering mechanics sequence (MECH 223 Engineering Statics, MECH 325 Mechanics of Elastic Bodies, and MECH 373 Engineering Dynamics). These may be chosen from the following courses with content in engineering mechanics, excluding any of these courses required in the student's curriculum by the major department:

MECH 416	Engineering Acoustics	3
MECH 448	Advanced Mechanics of Materials	3
MECH 449	Advanced Dynamics	3
MECH 451	Introduction to Finite Element Analysis	3
MECH 452	Experimental Stress Analysis I	3
MECH 454	Introduction to Continuum Modeling	3
MECH 475	Introduction to Mechanical Vibrations	3
MECH 480	Numerical Methods in Engineering	3
MECH 491	Special Topics in Engineering Mechanics	1-6

Grade Rules

Pass/No Pass

No course taken Pass/No Pass will be counted toward the minor.

MECH 100 Introduction to Mechanical Engineering
Description: Overview of mechanical engineering. Introduction to problem layout, and development of basic skills required to solve mechanical engineering problems. Collection, manipulation and presentation of engineering data.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded

MECH 130 Introduction to CAD
Description: Principles and accepted practices of geometric design. Computer generation of 2D and 3D models for mechanical systems. Introduction to engineering design practices such as specifications, dimensioning, and tolerance.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 230; MECH 342; MECH 381
Course and Laboratory Fee: $25

MECH 200 Engineering Thermodynamics
Prerequisites: MECH 223.
Description: First and Second Laws of Thermodynamics, properties of gases and vapors, and cycles. Sources of energy and its conversion to work.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR
Prerequisite for: AGEN 344, BSEN 344; AREN 310; AREN 404; MECH 300; MECH 330; MECH 446; MECH 487

MECH 200H Honors: Engineering Thermodynamics
Prerequisites: Good standing in the University Honors Program or by permission; PHYS 212; MECH 223.
Description: First and Second Laws of Thermodynamics, properties of gases and vapors, and cycles. Sources of energy and its conversion to work. Honors students will be expected to study beyond the students in the normal sections and do a special project.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR
Prerequisite for: AGEN 344, BSEN 344; AREN 310; AREN 404; MECH 300; MECH 330; MECH 446; MECH 487

MECH 220 Statics
Prerequisites: MATH 106.
Description: Fundamental concepts, equilibrium of force systems, analysis of simple frames and trusses. Centroid and moments of inertia and friction.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 324
Course and Laboratory Fee: $10

MECH 223 Engineering Statics
Prerequisites: MATH 107 (grade of C or better), PHYS 211 (grade of C or better)
Description: Action of forces on engineering structures and machines. Force systems, static equilibrium of frames and machines. Friction, center of gravity, moment of inertia, vector algebra.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR
Prerequisite for: AGEN 324, BSEN 324; BSEN 410; CIVE 310; CIVE 310H; CIVE 361; MATL 260; MATL 360; MECH 200; MECH 200H; MECH 324; MECH 325; MECH 325H; MECH 373; MECH 373H

MECH 223H Honors: Engineering Statics
Prerequisites: Good standing in the University Honors Program or by permission; MATH 107 and PHYS 211.
Description: Bodies in equilibrium. Vector algebra, equivalent force systems, distributed loads, and center of gravity. Analysis of trusses, frames, and machines. Friction, wedges, crews, and belts. Area moments of inertia.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: AGEN 324, BSEN 324; CIVE 310; CIVE 310H; CIVE 361; MATL 260; MATL 360; MECH 200; MECH 200H; MECH 324; MECH 325; MECH 325H; MECH 373; MECH 373H

MECH 230 Introduction to Mechanical Engineering Design
Prerequisites: MECH 130, MECH 325
Description: Introduction to formalized engineering design processes and methodology, selection of common mechanical components, and practice of teamwork and problem solving in the context of mechanical engineering.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR
Prerequisite for: MECH 446

MECH 250 Mechanics I
Prerequisites: PHYS 211.
Notes: Parallel: MATH 208. For electrical engineering majors.
Description: Force actions in static coplanar systems with applications to engineering structures and machines. Resultants, moments, couples, equivalent force systems, vector algebra. Static equilibrium conditions and equations.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded
Prerequisite for: MECH 351

MECH 300 Thermal Systems and Design
Prerequisites: MECH 200, CSCE 155N
Description: Applications of control-volume analysis (mass, energy, and momentum), both transient and steady; mixtures of gases and vapors; introduction to combustion; thermodynamic relations and establishment of data banks of thermal properties; applications of computer-aided engineering to processes and cycles; methodologies and case studies for thermal systems design; execution of small-scaled design projects.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR

MECH 310 Fluid Mechanics
Prerequisites: MECH 373; MATH 221
Notes: Parallel: MECH 200, or BSEN 244 or by permission for non-ME students.
Description: Fluid statics, equations of continuity, momentum, and energy dimensional analysis and dynamic similitude. Applications to: flow meters; fluid pumps and turbines; viscous flow and lubrication; flow in closed conduits and open channels. Two-dimensional potential flow.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR
Prerequisite for: AGEN 325, BSEN 325; AGEN 344, BSEN 344; CIVE 319; CIVE 352; MECH 311; MECH 446

MECH 310H Honors: Fluid Mechanics
Prerequisites: MECH 373; MATH 221
Notes: Parallel: MECH 200, or BSEN 244 or by permission for non-ME students.
Description: Fluid statics, equations of continuity, momentum, and energy dimensional analysis and dynamic similitude. Applications to: flow meters; fluid pumps and turbines; viscous flow and lubrication; flow in closed conduits and open channels. Two-dimensional potential flow. Advanced topics/project.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR

MECH 311 Fluid Mechanics Laboratory
Prerequisites: MECH/CIVE 310 or parallel.
Description: Fluid mechanics experiments and demonstrations. Conservation principles; determination of fluid properties, velocity, pressure, and flow measurements; pipe flow; open channel flow; and instrumentation techniques.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded
Course and Laboratory Fee: $20

MECH 318 Applied Linear Algebra and Computational Methods
Prerequisites: MATH 208; MATH 221 or parallel; CSCE 155N or equivalent.
Notes: This course is a substitute for MATH 314 for mechanical engineering students.
Description: Application-based linear algebra concepts and introduction to numerical computations using Matlab. Topics include: linear systems and numerical solvers; eigenvalue and eigenvector computations; methods for root finding and curve fitting; norms and convergence of numerical methods; numerical integration, differentiation, and initial-value ODE problems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR

MECH 321 Engineering Statistics and Data Analysis
Prerequisites: MATH 208
Description: An applications-oriented course for formulating and solving engineering statistical problems. Includes Descriptive statistics, probability distributions, variability, sampling, confidence intervals, tests of significance, basics of statistical process control, and design of experiments.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: ABUS 341, MRKT 341; ACCT 308; BLAW 371; BLAW 371H; BLAW 372; ECEN 850, ECEN 450; ECON 311A; ECON 311B; ECON 312A; ECON 312B; FINA 361; MECH 343; MNGT 301; MRKT 350; SCMA 250; SCMA 331; SCMA 350

MECH 324 Strength of Materials
Prerequisites: MECH 220 or MECH 223.
Notes: For students in architecture and construction management.
Description: Stress and strain analysis in elastic materials. Use of properties of materials in the analysis and design of welded and riveted connections, statically determinate and indeterminate flexure members, columns. Combined stresses, axial, eccentric and torsional loading. Observations of laboratory tests for axially loaded specimens. Introduction to shear and moment diagrams.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 325 Mechanics of Elastic Bodies
Prerequisites: MECH 223 (grade of C or better), MATH 208
Description: Concept of stress and strain considering axial, torsional, and bending forces. Shear and moments. Introduction to combined stresses and column theory.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: AGEN 443; CIVE 334; CIVE 341; CIVE 378; MECH 230; MECH 330; MECH 343; MECH 370; MECH 910

MECH 325H Honors: Mechanics of Elastic Bodies
Prerequisites: Good standing in the University Honors Program or by permission; MECH 223 or 223H; MATH 208.
Description: Introduction to the mechanics of elastic bodies. Concepts of stress and strain. Extension, bending, and torsion. Shear and moment diagrams. Principal stresses. Deflection of statically determinate and indeterminate beams. Buckling of columns. Special advanced topics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: AGEN 443; CIVE 334; CIVE 378; MECH 230; MECH 330; MECH 343; MECH 370

MECH 330 Mechanical Engineering Analysis
Prerequisites: MATH 221; CSCE 155N; MECH 325; MECH 373; MECH 200.
Description: Conceptual modeling of mechanical engineering systems. Analytical exploration of engineering behavior of conceptual models. Case studies drawn from mechanical engineering problems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 350

MECH 342 Kinematics and Dynamics of Machinery
Prerequisites: MECH 130 and MECH 373
Description: Analysis of the motions of linkage and cam mechanisms. Methods of design of linkage and cam mechanisms. Gear theory. Analysis and design of ordinary and planetary gear trains. Determination of static and dynamic forces in machines. Balancing of machines. Flywheel design. Dynamics of cam mechanisms. Vibration of machines.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 343; MECH 488
Course and Laboratory Fee: $5

MECH 343 Elements of Machine Design
Prerequisites: MECH 325; MECH 342 or parallel; MATL 360; MECH 321 or STAT 380 or parallel.
Description: Design of machine elements under different conditions of loading. Design work includes a project of broader scope (done primarily out of class) requiring a breadth of knowledge. Failure theories for static and dynamic loading of bolts, springs, bearings, and shafts.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR

MECH 350 Introduction to Dynamics and Control of Engineering Systems
Prerequisites: MECH 373; ECEN 211; CSCE 155N or AGEN/BSEN 212A; MATH 314 or parallel.
Description: Unified treatment of the dynamics and control of engineering systems. Emphasis on physical aspects, formulation of mathematical models, application of various mathematical methods, and interpretation of results in terms of the synthesis and analysis of real systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR
Prerequisite for: MECH 446

MECH 351 Mechanics II
Prerequisites: MECH 250.
Notes: For electrical engineering majors.
Description: Application of Newton's laws to engineering problems involving coplanar kinematics and kinetics of particles. Work, energy, impulse, and momentum. Conservative systems. Periodic motion.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded

MECH 370 Manufacturing Methods and Processes
Prerequisites: MATL 360; and MECH 325.
Description: Introduction to traditional and modern manufacturing processes and methods to include: foundry; forming processes; welding; metal removal theory and practices; modern manufacturing systems and automation; and economics of process selection.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 373 Engineering Dynamics
Prerequisites: MECH 223 (grade of C or better), MATH 208.
Description: Force action related to displacement, velocity, and acceleration of rigid bodies. Kinematics of plane motion, kinetics of translation and rotation. Mass moment of inertia, vibration, work, energy and power, impulse and momentum.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: BSEN 410; MECH 310; MECH 310H; MECH 330; MECH 342; MECH 350

MECH 373H Honors: Engineering Dynamics
Prerequisites: Good standing in the University Honors Program or by permission; MECH 223 or 223H; MATH 208.
Description: Motion of particles and rigid bodies under the action of forces and moments. Kinematics of plane motion: displacement, velocity, and acceleration. Kinetics of translation and rotation; work, energy and power; impulse, momentum and impact. Introduction to vibration analysis.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 310; MECH 310H; MECH 330; MECH 342; MECH 350

MECH 380 Mechanical Engineering Measurements
Prerequisites: ECEN 231; JGEN 200 or JGEN 300; MECH 321 or STAT 380 or parallel; MECH 350 and MECH 310, or parallel.
Description: Theory, statistics, applications and design of mechanical engineering experiments.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR
Prerequisite for: MECH 487; MECH 488
Course and Laboratory Fee: $20

MECH 381 Elements of Computer-Aided Design
Prerequisites: MATH 221; MECH 130 or CSCE 155N
Description: Principles and techniques currently used for the computer-aided design (CAD). Applications of interactive graphics devices for drafting, design, and analysis. Modelling and analogy of engineering systems. Elementary finite element, Bode, and numerical analyses. CAD case studies and term project.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Course and Laboratory Fee: $25

MECH 399 Undergraduate Research and Thesis
Prerequisites: Permission.
Description: Engineering design or laboratory investigation that an undergraduate is qualified to undertake.
Credit Hours: 1-5
Min credits per semester: 1
Max credits per semester: 5
Max credits per degree: 6
Grading Option: Graded
Course and Laboratory Fee: $25

MECH 403 Internal Combustion Engines
Crosslisted with: MECH 803
Prerequisites: MECH 300 or equivalent.
Description: Basic cycle analysis and engine types, fundamental thermodynamics and operating characteristics of various engines are analyzed, combustion processes for spark and compression-ignition engines, fuels, testing procedures, and lubrication systems are evaluated. Emphasis on the thermodynamic evaluation of the performance and understanding the basic operation of various engine types.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 404 Theory of Combustion
Crosslisted with: MECH 804
Prerequisites: MECH 300 and MECH 420/MECH 820.
Description: Stoichiometric analysis of combustion processes. Energy transfer, flame propagation, and transformation velocities during combustion. Combustor applications and design considerations. Emission formation and methods of control.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 904

MECH 405 Turbomachinery
Crosslisted with: MECH 805
Prerequisites: MECH 300 and MECH 310/CIVE 310
Description: Thermodynamic analysis and design of axial and radial flow turbines, compressors, and pumps. Fundamentals of the operating characteristics and performance parameters of turbomachines will be evaluated. Cavitation and blade element theory.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 406 Air Conditioning Systems Design
Crosslisted with: MECH 806
Prerequisites: MECH 300 or equivalent.
Description: Application of thermodynamic and fluid dynamic principles to the design of air conditioning systems. Comprehensive design project is an integral part of the course.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 407 Power Plant Systems Design
Crosslisted with: MECH 807
Prerequisites: MECH 300 or equivalent.
Description: Application of thermodynamic and fluid dynamic principles to the design of Power Plants. Comprehensive design project is an integral part of the course.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 408 Heat Exchanger Design
Crosslisted with: MECH 808
Prerequisites: MECH 300 or equivalent.
Description: Design methodology for various heat exchangers employed in mechanical engineering. Introduction to computer-aided design as applied to heat exchangers. Practical exercises in actual design tasks.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 413 Aerodynamics
Crosslisted with: MECH 813
Prerequisites: MECH 200 and MECH 310/CIVE 310.
Description: Subsonic and supersonic air flow theory, dynamics of flight, performance parameters, rotoranalysis, and special topics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 414 Compressible Flow
Crosslisted with: MECH 814
Prerequisites: MECH 300 and MECH 310/CIVE 310.
Description: Analysis of the flow of compressible fluids by means of the momentum equation, continuity equation, and the laws of thermodynamics and some application of thermodynamic laws to incompressible fluids.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 415 Two-Phase Flow
Crosslisted with: MECH 815
Prerequisites: MECH/CIVE 310; MECH 380 or parallel.
Description: Transport phenomena of homogeneous and heterogeneous types of mixtures such as solid-liquid, liquid-liquid, and liquid-gas. Properties of components and mixtures. Flow induced vibrations and parameter distributions. Optimization and design problems in multiphase systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 416 Engineering Acoustics
Crosslisted with: MECH 816
Prerequisites: MECH 310 and MATH 221/MATH 821.
Description: Transverse and longitudinal traveling waves. Acoustic wave equation of fluids. The reflection, transmission, radiation, reception, absorption, and attenuation of sound. Acoustic cavities and waveguides. Sound propagation in pipes, resonators and filters.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 420 Heat Transfer
Crosslisted with: MECH 820
Prerequisites: MECH 310
Description: Heat transfer by conduction, convection, and radiation. Correlation of theory with experimental data and engineering design.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: AREN 810; MECH 404, MECH 804; MECH 487; MECH 922; MECH 923; MECH 924

MECH 421 Elements of Nuclear Engineering
Crosslisted with: MECH 821, ENGR 421
Prerequisites: ENGR 300 or ENGR 301 or ENGR 310; MATH 208/MATH 208H; and PHYS 212/PHYS 212H
Description: Survey of nuclear engineering concepts and applications. Nuclear reactions, radioactivity, radiation interaction with matter, reactor physics, risk and dose assessment, applications in medicine, industry, agriculture, and research.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: ENGR 410; ENGR 420

MECH 422 Industrial Quality Control
Crosslisted with: MECH 822
Prerequisites: MECH 321 or STAT 380
Description: Statistical process control and quality assurance techniques in manufacturing. Control charts, acceptance sampling, and analyses and design of quality control systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR

MECH 424 Laser Material Processing with Compressible Flow Perspective
Crosslisted with: MECH 824
Prerequisites: Permission.
Description: Fundamentals of laser material processing. Laser material interactions from the compressible flow perspective. Analytical, semi-analytical, and numerical approaches.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 425 Solar Energy Engineering
Crosslisted with: MECH 825
Prerequisites: MECH 420 or permission.
Description: Conversion of solar energy into more useful forms with emphasis on environmental heating and cooling applications. Includes solar energy availability, solar collectors and design, solar systems and their simulation and solar economics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 426 Heat Transfer at Nanoscales and in Ultrashort Time Domains
Crosslisted with: MECH 826
Prerequisites: MECH 420.
Description: Heat transfer in nanoscale and nanostructured materials. Heat transfer in ultrafast laser materials processing.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 428 Analysis of Thermal Data
Crosslisted with: MECH 828
Prerequisites: MECH 420 or parallel.
Description: Indirect measurement of thermal properties and heat flux are explored with various methods, and optimization, with examples drawn from engineering practice.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL/SPR

MECH 431 Computational Heat Transfer and Fluid Flow
Crosslisted with: MECH 831
Prerequisites: MECH 310; MATH 314; MECH 420 or parallel.
Description: Finite difference methods for steady and transient diffusion and convection-diffusion problems. Finite volume technique for the solution of multi-dimensional fluid flow, and heat and mass transfer problems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 932

MECH 433 Microscale Transport Phenomena in Biosystems
Crosslisted with: MECH 833
Prerequisites: MECH 310
Notes: Knowledge of engineering mathematics to describe physical systems, especially transport phenomena
Description: An introduction to transport phenomena with an emphasis on applying the principles of mass transfer and fluid dynamics to microscale biosystems including microorganisms. Topics include Brownian motion, diffusion-based mass transfer, cellular receptors, Taylor dispersion, bacterial diffusion, chemotaxis, low Reynolds number fluid dynamics, hydrodynamics of swimming microorganisms, surface tension and microfluidics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 434 Facility Planning and Design
Notes: introductory knowledge of ergonomics
Description: Design, analysis and layout of facilities: queuing, material handling systems, material flow analysis, systematic layout planning and design of warehouse facilities.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 435 Introduction to Cell Mechanics
Crosslisted with: MECH 835
Notes: Knowledge of calculus and basic physics to describe physical systems
Description: An introduction to cell mechanics with an emphasis on application of fundamental mechanics and various experimental methods to understanding cell mechanics. Topics include cell structure, basic solid/fluid/statistical mechanics, biopolymer mechanics, cytoskeletal network mechanics, cellular adhesion and motility, and mechanobiology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 436 Introduction to Continuum Biomechanics
Crosslisted with: MECH 836
Prerequisites: Senior or graduate student standing
Notes: Linear Algebra (MATH 314) and Mechanics of Elastic Bodies (MECH 325) are recommended.
Description: An introduction to continuum biomechanics with an emphasis on soft tissues. Case studies covering diverse applications of biomechanics in biology and medicine, including in the areas of mechanobiology, medical devices, and tissue engineering. Continuum mechanics concepts include kinematics, kinetics, balance laws, and constitutive relations. Includes some programming in MATLAB.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 437 Biomedical Device Design
Crosslisted with: MECH 837
Prerequisites: MECH 223, MECH 373
Notes: basic understanding of solid mechanics
Description: Design of devices intended for use in biomedical environments. Introduction to modeling of the bio-environment, bio-materials, and material selection. Overview of design methodologies and strategies used in biomedical device design from a material properties perspective. Introduction to federal regulation and other pertinent issues.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: SPRING

MECH 438 Mechanics of Biomaterials
Crosslisted with: MECH 838
Prerequisites: MECH 325 or AGEN/BSEN 324 or parallel
Description: Theory, application, simulation, and design of biomaterials that apply mechanical principles for solving medical problems (case studies in artery, brain, bone, etc.). Tentative Topics include Mechanical characterization of biomaterials; Bio-manufacturing a tissue; Function-structure relationship; Design and analysis of medical implants; Active response of biomaterials: growth and remodeling mechanism; Cellular behavior and measurements, etc.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

MECH 439 Biomaterial Surface Patterning
Crosslisted with: MECH 839
Description: Biomaterials, biocompatibility, and biomaterial surface characteristics (chemistry, surface energy, topography, wettability, etc.). Protein adsorption on biomaterials. Microscale and nanoscale chemical patterning; anisotropic and isotropic micro/nanotopography; cell sensing and response to patterned substrates.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 442 Intermediate Kinematics
Crosslisted with: MECH 842
Prerequisites: MECH 342.
Description: Analytical cam design. Geometry of constrained plane motion and application to the design of mechanisms. Analysis and synthesis of pin-jointed linkage mechanisms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 943

MECH 444 Intermediate Dynamics of Machinery
Crosslisted with: MECH 844
Prerequisites: MECH 342 and MECH 350.
Description: Fundamentals of vibration, vibration and impact in machines, balance of rotors, flexible rotor dynamics and instabilities, parametric vibration, advanced dynamics and design of cam mechanisms, and dynamics of flywheel.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 445 Mechanical Engineering Design Concepts
Crosslisted with: MECH 845
Prerequisites: MECH 200, MECH 342, MECH 350, and MECH 310/CIVE 310.
Description: Development of design concepts. Introduction to synthesis techniques and mathematical analysis methods. Applications of these techniques to mechanical engineering design projects.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 945
Course and Laboratory Fee: $20

MECH 446 Mechanical Engineering Design I
Prerequisites: BSEN 206, MECH 200, MECH 230, MECH 310, MECH 350, professional admission to Mechanical Engineering BS program
Notes: This course should be taken in the fall semester of the final full academic year, followed immediately by MECH 447 in the spring semester.
Description: The first of two courses in the capstone sequence. Practical application of the engineering design process in a team project focused on a mechanical engineering problem, including design reviews and reports.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded
Offered: FALL
Prerequisite for: MECH 447
ACE: ACE 10 Integrated Product
Course and Laboratory Fee: $15

MECH 447 Mechanical Engineering Design II
Prerequisites: MECH 446, professional admission to Mechanical Engineering BS program
Description: Definition, scope, analysis, synthesis, and the design for the solution of a comprehensive engineering problem in any major area of mechanical engineering.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded
ACE: ACE 10 Integrated Product
Course and Laboratory Fee: $15

MECH 448 Advanced Mechanics of Materials
Crosslisted with: MECH 848
Prerequisites: MECH 373, MECH 325.
Description: Stresses and strains at a point. Theories of failure. Thick-walled pressure vessels and spinning discs. Torsion of noncircular sections. Torsion of thin-walled sections, open, closed, and multicelled. Bending of unsymmetrical sections. Cross shear and shear center. Curved beams. Introduction to elastic energy methods.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 915; MECH 930; MECH 933; MECH 935; MECH 937; MECH 938; MECH 939; MECH 940; MECH 941; MECH 952

MECH 449 Advanced Dynamics
Crosslisted with: MECH 849
Prerequisites: MECH 373 and MATH 221/821.
Description: Particle Dynamics usung Newton's laws, energy principles, momentum principles. Rigid body dynamics using Euler's equations and Lagrange's equations. Variable mass systems. Gyroscopic motion.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 915; MECH 935

MECH 450 Mechanical Engineering Control Systems Design
Crosslisted with: MECH 850
Prerequisites: MECH 350.
Description: Applications of control systems analysis and synthesis for mechanical engineering equipment. Control systems for pneumatic, hydraulic, kinematic, electromechanical, and thermal systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Course and Laboratory Fee: $20

MECH 451 Introduction to Finite Element Analysis
Prerequisites: Open to College of Engineering Students only.
Description: Matrix methods of analysis. Finite element stiffness method. Computer programs. Applications to structures and soils. Introduction to finite element analysis of fluid flow.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Course and Laboratory Fee: $25

MECH 452 Experimental Stress Analysis I
Crosslisted with: MECH 852
Prerequisites: MECH 325.
Description: Investigation of the basic theories and techniques associated with the analysis of stress using mechanical strain gages, electric strain gages, brittle lacquer, photoelasticity, and membrane analogy.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 952
Course and Laboratory Fee: $25

MECH 453 Robotics: Kinematics and Design
Crosslisted with: MECH 853
Prerequisites: MECH 350.
Description: Robotics synthesize some aspects of human function by the use of mechanisms, sensors, actuators, and computers.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 454 Introduction to Continuum Modeling
Crosslisted with: MECH 854
Prerequisites: MATH 221/821, MECH 325 and MECH 373
Description: Basic concepts of continuum modeling. Development of models and solutions to various mechanical, thermal and electrical systems. Thermo-mechanical and electro-mechanical coupling effects. Differential equations, dimensional methods and similarity.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 455 Vehicle Dynamics
Crosslisted with: MECH 855
Prerequisites: MECH 343 and MECH 350.
Description: Introduction to basic mechanics governing automotive vehicle dynamic acceleration, braking, ride, handling and stability. Analytical methods, including computer simulation, in vehicle dynamics. The different components and subsystems of a vehicle that influence vehicle dynamic performance.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Course and Laboratory Fee: $20

MECH 456 Dynamics of Internal Combustion Engines
Crosslisted with: MECH 856
Prerequisites: MECH 342 and MECH 343.
Description: Basics of design of the internal combustion engines. Design of various engine parts such as pistons, connecting rods, valve trains, crankshafts, and the vibration dampers. Dynamics of the engine. The vibration of the crankshaft assembly and the valve train. Balancing of the engines.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 457 Mechatronic Systems Design
Crosslisted with: MECH 857
Prerequisites: ECEN 231; MECH 350 or parallel.
Notes: Lab sessions allow for constructing mechatronic systems. Lab time arranged. A comprehensive design project included.
Description: Theory, application, simulation, and design of systems that integrate mechanical, computer, and electronic components.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 958

MECH 458 Digital Control of Mechanical Systems
Crosslisted with: MECH 858
Prerequisites: MECH 450
Description: Introduction to digital measurement and control of mechanical systems. Applications of analysis and synthesis of discrete time systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Course and Laboratory Fee: $20

MECH 470 Theory and Practice of Materials Processing
Crosslisted with: MECH 870
Prerequisites: MECH 370
Description: Theory, practice and application of conventional machining, forming and non-traditional machining processes with emphasis on tool life, dynamics of machine tools and adaptive control.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: MECH 970

MECH 472 Additive Manufacturing
Crosslisted with: MECH 872
Prerequisites: MECH 370 or parallel
Description: Hands-on exposure to several aspects of Additive Manufacturing (AM): (1) design and experimentation; (2) process optimization; and (3) materials testing. Coverage of a variety of AM technologies, their advantages and limitations, and how to design for AM. Discussion of both polymer and metal technologies, and exploration of recent applications of AM across multiple industries.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 474 Manufacturing Systems I
Crosslisted with: MECH 874
Prerequisites: Open to College of Engineering Students only.
Description: Principles of automated production lines; analysis of transfer lines; group technology; flexible manufacturing systems; and just-in-time; and optimization strategies for discrete parts manufacturing.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 475 Introduction to Mechanical Vibrations
Crosslisted with: MECH 875
Prerequisites: MECH 373 and MATH 221
Description: Review of rigid body dynamics; equations of motion, free vibration, damping; linear response of one, two, and multi-degree of freedom systems; forced vibrations, harmonic, periodic, impulse, and general responses; resonance and vibration isolation; rotating imbalance; Fourier transforms, digitization and analysis of experimental data.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: MECH 975

MECH 476 Manufacturing Information Systems
Crosslisted with: MECH 876
Prerequisites: Senior standing; CSCE 155A, CSCE 155E, CSCE 155H, CSCE 155N, or CSCE 155T or equivalent
Description: An exploration of information systems and their impact in a manufacturing environment. Software, hardware, database systems, enterprise resource planning, networking, and the Internet.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

MECH 480 Numerical Methods in Engineering
Crosslisted with: MECH 880
Prerequisites: MATH 221/MATH 821; CSCE 155N.
Notes: Linear Algebra recommended. Credit towards the degree cannot be earned in both CSCE/MATH 440/840 and MECH 480/880.
Description: Numerical algorithms and their convergence properties in: solving nonlinear equations; direct and iterative schemes for linear systems of equations; eigenvalue problems; polynomial and spline interpolation; curve fitting; numerical integration and differentiation; initial and boundary values problems for Ordinary Differential Equations (ODEs) and systems of ODEs with applications to engineering; finite difference methods for partial differential equations (potential problems, heat-equation, wave-equation).
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: CHME 496, CHME 896; MECH 851; MECH 888
Course and Laboratory Fee: $25

MECH 483 Engineering Analysis with Finite Elements
Crosslisted with: MECH 883
Prerequisites: MECH 310; MECH 343; MECH 350; MECH 420 or parallel
Description: Analysis of engineering systems using finite elements; a critical and challenging task performed during the design process for many engineering systems. Four very distinct domains are studied: Structural stress analysis, heat transfer, fluid flow, and modal analysis.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

MECH 487 Thermal Fluids Laboratory
Prerequisites: MECH 200 and MECH 380; MECH 420/820 or parallel.
Description: Design, execution, and evaluation of physical experiments in the areas of thermodynamics, fluid mechanics, and heat transfer.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded with Option
Course and Laboratory Fee: $30

MECH 488 Kinematics and Machine Design Laboratory
Prerequisites: MECH 342; MECH 380 or parallel.
Description: Design projects and physical experiments in the area of machine design and kinematics.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded
Course and Laboratory Fee: $30

MECH 491 Special Topics in Engineering Mechanics
Crosslisted with: MECH 891
Prerequisites: Permission.
Description: Treatment of special topics in engineering mechanics by experimental, computational and/or theoretical methods. Topics vary from term to term.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Graded
Course and Laboratory Fee: $25

MECH 492 Special Topics
Crosslisted with: MECH 892
Description: Special topics in mechanical engineering and related areas.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 24
Grading Option: Graded

MECH 494 Independent Study
Crosslisted with: MECH 894
Prerequisites: Permission
Description: Faculty-supervised independent study.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 24
Grading Option: Graded

MECH 498 Research
Crosslisted with: MECH 898
Description: Faculty-supervised research.
Credit Hours: 0-6
Min credits per semester:
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Graded

MECH 499H Honors Thesis
Prerequisites: Senior standing in mechanical engineering; admission to the University Honors Program.
Description: Honors thesis research project meeting the requirements of the University Honors Program. Independent research project executed under the guidance of a member of the faculty of the Department of Mechanical Engineering which contributes to the advancement of knowledge in the field. Culminates in the presentation of an honors thesis to the department and college.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded