ENGINEERING MECHANICS AND AEROSPACE ENGINEERING (E M A)

E M A 1 – COOPERATIVE EDUCATION PROGRAM
1 credit.

Work experience which combines classroom theory with practical knowledge of operations to provide students with a background upon which to base a professional career in industry.
Requisites: Sophomore standing only
Course Designation: Workplace - Workplace Experience Course
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

E M A 103 – PRINCIPLES OF ENGINEERING FROM THE RENAISSANCE TO MODERN TIMES
3 credits.

Engineering achievements of the Renaissance period and their relation to modern engineering practice, key principles developed, and errors in understanding of that time. Innovative work of notable figures such as Galileo Galilei and Leonardo da Vinci and their contributions to fundamental mechanics principles of engineering, traced through modern engineering practice and current engineering applications. Introduction to concepts of stress, strain, tension, compression, deflection of beams, flaws, and fracture. Not for engineering majors.
Requisites: Satisfied Quantitative Reasoning (QR) A requirement
Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

E M A 105 – INTRODUCTION TO UNMANNED AIRCRAFT SYSTEMS
3 credits.

Prepares students to operate Unmanned Aircraft Systems (UAS) for commercial purposes. Focuses on remote sensing, automation / artificial intelligence, data analytics and business applications / opportunities for UAS. Teaches all applicable subjects and provides hands-on experience necessary to 1) safely, legally and ethically operate UAS for commercial purposes; 2) effectively apply UAS to solve business problems and 3) manage, process and analyze data collected via UAS. Optional Federal Aviation Administration exam for a remote pilot-in-command (RPIC) certification. Group projects involving real-world drone flights to collect data and produce commercially viable products.
Requisites: None
Repeatable for Credit: No

E M A 201 – STATICS
3 credits.

Principles of mechanics, force systems, equilibrium, structures, distributed forces, moments of inertia of areas, and friction.
Requisites: (MATH 222, 276, or concurrent enrollment), or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 202 – DYNAMICS
3 credits.

Kinematics, force-mass-acceleration relations, work and energy, impulse and momentum, moments of inertia and mass.
Requisites: E M A 201 or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 291 – PROJECTS IN ENGINEERING MECHANICS & ASTRONAUTICS
1-3 credits.

Individual engineering projects under staff supervision.
Requisites: Consent of instructor
Repeatable for Credit: No
Last Taught: Spring 2016

E M A 303 – MECHANICS OF MATERIALS
3 credits.

Stress and strain, torsion, bending of beams, shearing stresses in beams, compound stresses, principal stresses, deflections of beams, statically indeterminate members, columns. For civil engineers.
Requisites: E M A 201 and (MATH 222 or 276), or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

E M A/M E 307 – MECHANICS OF MATERIALS LAB
1 credit.

Data processing, tension/compression tests, creep stress concentrations, fatigue, fracture, composite materials, combined stress, beam flexure, dynamic loads, buckling.
Requisites: (M E 306, E M A 303 or concurrent enrollment) or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

E M A/CIV ENGR 395 – MATERIALS FOR CONSTRUCTED FACILITIES
3 credits.

Properties and tests of materials used in the initial construction or repair of facilities (including buildings, transportation systems, utility systems, and reinforced earth). Introduction to laboratory and field measurement techniques to assess material performance capabilities. Technical report preparation.
Requisites: (E M A 303 or M E 306), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 405 – PRACTICUM IN FINITE ELEMENTS
3 credits.

Use of finite elements (FE) for solving practical problems in mechanics. Elementary theory of FE is discussed. A commercial computer program is used for applications. Major emphasis is on behavior of FE, modeling, and evaluation of results for correctness.
Requisites: (E M A 303 or M E 306), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 469 – DESIGN PROBLEMS IN ENGINEERING
3 credits.

The design philosophy is presented. Students will be required to apply their knowledge of elementary mechanics, engineering and basic science to arrive at acceptable solutions to a variety of design problems.
Requisites: Declared in Engineering Mechanics and (E M A 303 or M E 306)
Repeatable for Credit: No
Last Taught: Fall 2023

E M A/E P 471 – INTERMEDIATE PROBLEM SOLVING FOR ENGINEERS
3 credits.

Use of computational tools for the solution of problems encountered in engineering physics applications. Topics covered include orbital mechanics, structural vibrations, beam and plate deformations, heat transfer, neutron diffusion, and criticality. Emphasis will be on modeling, choice of appropriate algorithms, and model validation.
Requisites: (MATH 319, 320 or 375) and (E P 271 or COMP SCI 310), or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

E M A/E P 476 – INTRODUCTION TO SCIENTIFIC COMPUTING FOR ENGINEERING PHYSICS
3 credits.

Background for professional numerical computation in Linux environments begins with shell scripting and software archiving. Programming skills in a compiled language are then developed through scientific and engineering examples. Engineering problem-solving skills are reinforced through applications that require numerical solutions to systems of differential and/or integral equations, while motivating progressively more advanced computational methods.
Requisites: (E P 271, COMP SCI 300, or 310) and (MATH 319, 320, or 375), or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2022

E M A 489 – HONORS IN RESEARCH
1-3 credits.

Undergraduate research and senior honors thesis in engineering mechanics and astronautics.
Requisites: Declared in Engineering Mechanics Honors in Research
Course Designation: Honors - Honors Only Courses (H)
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

E M A 506 – ADVANCED MECHANICS OF MATERIALS I
3 credits.

Analysis and design of load-carrying members, shear center, unsymmetrical bending, curved beams, beams on elastic foundations, energy methods, theories of failure, thick-walled cylinders, stress concentrations, design to prevent failure by excessive elastic deformation, plastic deformation and fracture.
Requisites: (E M A 303 or M E 306), graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Fall 2023

E M A/CIV ENGR/M E 508 – COMPOSITE MATERIALS
3 credits.

Physical properties and mechanical behavior of polymer, metal, ceramic, cementitious, cellulosic and biological composite systems; micro- and macro-mechanics; lamination and strength analyses; static and transient loading; fabrication; recycling; design; analytical-experimental correlation; applications.
Requisites: (E M A 303 or M E 306), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 519 – FRACTURE MECHANICS
3 credits.

Introduction to the mechanics of fracture of linear and nonlinear materials. Crack stress and deformation fields; stress intensity factors; crack tip plastic zone; fracture toughness testing; energy release rate; J-integral. Criteria for crack growth initiation/stability; application to design.
Requisites: (E M A 303 or M E 306), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

E M A 521 – AERODYNAMICS
3 credits.

Potential flow theory; stream functions; vortex filaments and sheets. Two- and three-dimensional wing theory. Doublet and panels methods. Propeller theory.
Requisites: (E M A 202, M E 240, or PHYSICS 311) and (CIV ENGR 310 or M E 363), or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2023

E M A 522 – AERODYNAMICS LAB
3 credits.

Experimental methods for aerodynamic measurements: wind tunnel tests with 6-component sting balance, pitot probe, hot wire anemometer; flow visualization with smoke generator and laser sheet; digital data acquisition; practical considerations for experimental design. Methods for comparing theoretical predictions to experimental measurements and computational simulations.
Requisites: E M A 521, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 523 – FLIGHT DYNAMICS AND CONTROL
3 credits.

Aircraft longitudinal and lateral static stability. Aircraft equations of motion. Stability derivatives. Longitudinal and lateral dynamic stability of uncontrolled motion. Open-loop aircraft control. Closed-loop aircraft control.
Requisites: E M A 521 and 542, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 524 – ROCKET PROPULSION
3 credits.

Rocket performance. One dimensional gasdynamics. Thrust chambers, nozzle design criteria. Fundamentals of combustion. Rocket configurations.
Requisites: M E 363, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

E M A/M E 540 – EXPERIMENTAL VIBRATION AND DYNAMIC SYSTEM ANALYSIS
3 credits.

Application of digital data acquisition to the investigation of mechanical components, structures and systems using time histories, transforms and response functions to characterize free, forced and transient inputs. Introduction to sensors, instrumentation and methods appropriate for dynamic system response.
Requisites: (M E 440, E M A 545, or concurrent enrollment) or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

E M A/M S & E 541 – HETEROGENEOUS AND MULTIPHASE MATERIALS
3 credits.

Principles of the mechanics of solid multiphase systems. Role of heterogeneity and anisotropy in determining physical properties including elastic, dielectric and piezoelectric properties. Applications in lightweight structures, ultrastrong materials, materials for protection of the body, and materials for the replacement of human tissues. Materials with fibrous, lamellar, particular, and cellular structures. Heterogeneous materials of biological origin. Biomimetic and bio-inspired materials.
Requisites: E M A 303, M E 306, or M S & E 441, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

E M A 542 – ADVANCED DYNAMICS
3 credits.

Kinematics and kinetics of plane and three-dimensional motion, Coriolis acceleration, general methods of linear and angular momentum, central force motion, gyrodynamics, generalized coordinates. Lagrange's equations.
Requisites: (E M A 202, M E 240, or PHYSICS 311), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2023

E M A 545 – MECHANICAL VIBRATIONS
3 credits.

General theory of free, forced, and transient vibrations; vibration transmission, isolation, and measurement; normal modes and generalized coordinates; method of matrix equation formulation and solution. The application of theory and methods to the analysis, measurement and design of dynamic systems.
Requisites: (E M A 202, M E 240, or PHYSICS 311), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

E M A/E P 547 – ENGINEERING ANALYSIS I
3 credits.

Methods of higher mathematics; stress on problem solving rather than rigorous proofs; linear algebra, calculus of variations, Green's function.
Requisites: MATH 321, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

E M A/E P 548 – ENGINEERING ANALYSIS II
3 credits.

Function of complex variable, series solution of differential equations, partial differential equations. A year of math beyond calculus
Requisites: (MATH 322 and 320), (MATH 322 and E P/E M A 547), or (MATH 322, 319, and 340), or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

E M A/ASTRON 550 – ASTRODYNAMICS
3 credits.

Coordinate system transformations, central force motion, two body problem, three and n-body problem, theory of orbital perturbations, artificial satellites, elementary transfer orbits, and elementary rocket dynamics.
Requisites: (E M A 202, M E 240, or PHYSICS 311, or concurrent enrollment), or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 569 – SENIOR DESIGN PROJECT
3 credits.

Students will select specific engineering design projects. These projects will be student team efforts supervised by individual faculty members.
Requisites: E M A 469 and (have completed or be concurrently enrolled in two of E M A 506, 519, 521, 542, 545)
Repeatable for Credit: No
Last Taught: Spring 2024

E M A/M E 570 – EXPERIMENTAL MECHANICS
3 credits.

Experimental methods for design and analysis of mechanical components, structures and materials. Electrically and optically recorded stress, strain and deformation data; computer acquisition/reduction/presentation techniques; applications to static and transient events, sensors, transducer design, NDT, fracture and residual stresses.
Requisites: Senior standing and (M E 306, E M A 303 or 304) or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

E M A 599 – INDEPENDENT STUDY
1-3 credits.

Directed study projects as arranged with instructor.
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

E M A 601 – SPECIAL TOPICS IN ENGINEERING MECHANICS
1-3 credits.

Selected topics in such areas as structural mechanics, dynamics, experimental mechanics, vibrations, engineering materials, soil mechanics, engineering analysis, rheology, etc.
Requisites: Graduate/professional standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

E M A 605 – INTRODUCTION TO FINITE ELEMENTS
3 credits.

A first course in finite elements, with theory and applications in stress analysis and in areas related to structural mechanics. Practice in the use and/or development of computer programs.
Requisites: (E M A 303 or M E 306), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

E M A 610 – STRUCTURAL FINITE ELEMENT MODEL VALIDATION
3 credits.

An introduction to test-based validation of finite element models for the design and analysis of dynamic structures.
Requisites: E M A 545 or M E 440, or graduate/professional standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2022

E M A 611 – ADVANCED MECHANICAL TESTING OF MATERIALS
3 credits.

Theory and use of servo-controlled, electro-hydraulic equipment for research of mechanical properties of engineering materials. Measurement of stress, strain, hysteresis energy, and material properties during deformation and at fracture. Analysis of four significant components of total strain.
Requisites: (E M A/M E 307 or M E/E M A 307) and (E M A 506 or concurrent enrollment), or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

E M A/E P 615 – MICRO- AND NANOSCALE MECHANICS
3 credits.

An introduction to micro- and nanoscale science and engineering with a focus on the role of mechanics. A variety of micro- and nanoscale phenomena and applications covered, drawing connections to both established and new mechanics approaches.
Requisites: Graduate/professional standing or E M A 303 or M E 306
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2021

E M A 622 – MECHANICS OF CONTINUA
3 credits.

Tensor analysis; analysis of stress, strain and rate of strain; application of Newtonian mechanics to deformable media; mechanical constitutive equations; field equations of fluid mechanics and elasticity.
Requisites: MATH 340 or (MATH 320 and 321), or graduate/professional standing
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 630 – VISCOELASTIC SOLIDS
3 credits.

Linear theory of viscoelasticity; non-aging materials; Boltzmann superposition principle; time-temperature superposition boundary value problems. Applications: vibration damping, relaxation of stress, creep, droop, and sag in structural members, sound absorption, creep buckling, settlement of foundations, tire mechanics, and shock attenuation.
Requisites: M E 306 or E M A 303, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2021

E M A 642 – SATELLITE DYNAMICS
3 credits.

Review of Euler's equations, torque-free motion, stability of rotation, energy dissipation effects, gyroscopic instruments, gyrodynamics of the Earth, gravity gradient stabilized satellites, spin stabilized satellites, dual spin satellites, tethered satellites, mass movement techniques, space vehicle motion and rocket dynamics.
Requisites: E M A 542 or PHYSICS 311, or graduate/professional standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

E M A 690 – MASTER'S RESEARCH
1-9 credits.

Directed study projects as arranged with instructor.
Requisites: Declared in Engineering Mechanics, M.S., Ph.D., or Doctoral Minor
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2019

E M A 700 – THEORY OF ELASTICITY
3 credits.

Equations of elasticity in curvilinear and rectangular coordinates; two dimensional problems; problems of prismatic bars; variational methods and energy principles; complex variable and numerical methods; thermal stress problems. Knowledge of advanced mechanics of materials [such as E M A 506] and vector calculus [such as MATH 321] strongly encouraged.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

E M A 702 – GRADUATE COOPERATIVE EDUCATION PROGRAM
1-2 credits.

Work experience that combines classroom theory with practical knowledge of operations to provide students with a background on which to develop and enhance a professional career. The work experience is tailored for MS students from within the U.S. as well as eligible international students.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2020

E M A/M E 703 – PLASTICITY THEORY AND PHYSICS
3 credits.

Physical foundations of plasticity as a basis for choices made in the formulation of theories representing plastic deformation and their limitation. Motion of dislocations and formation and growth of deformation twins. Experimental results in the context of plasticity models. Traditional and research topics of plasticity and theories for rate-independent, rate-dependent, single and polycrystal descriptions. Numerical solution of equations and computational plasticity. Knowledge of mechanics of materials [such as E M A 303 or M E 306] and continuum mechanics [such as E M A 622] required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

E M A 705 – ADVANCED TOPICS IN FINITE ELEMENTS
3 credits.

Finite element methods for problems with linear and nonlinear media. Stress analysis, heat transfer, and fluid dynamics. Vibration and transient analysis. Weighted residual methods. Material and geometric nonlinearity. Nonlinear iteration methods. Instructor may also select additional material. Knowledge of finite element theory [such as E M A 605] strongly encouraged.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

E M A/M E 706 – PLATES, SHELLS AND PRESSURE VESSELS
3 credits.

Stress and deflection analysis of structural plates and membranes under mechanical and thermal loads; variational and numerical methods; instability and vibrations; membrane shell theory; cylindrical shells; pressure vessel and piping design applications; ASME Pressure Vessel Code. Knowledge of mechanics of materials [such as M E 444 or E M A 506] strongly encouraged.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

E M A/M E 708 – ADVANCED COMPOSITE MATERIALS
3 credits.

Contemporary topics such as new materials; smart materials/structures/systems; fatigue; fracture; experimental techniques; nondestructive evaluation; transient, micro, three-dimensional, nonlinear, inelastic and environmental effects; manufacturing methods: repair and applications. Knowledge of composite materials [such as E M A/CIV ENGR/M E 508] strongly encouraged.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

E M A/M E 722 – INTRODUCTION TO POLYMER RHEOLOGY
3 credits.

Formulation of constitutive equations using embedded base vectors. Viscosity, normal stress differences, stress relaxation, elastic recoil. Polymer rheology; homogeneous strain history. Knowledge of differential equations [such as MATH 320] strongly encouraged.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2023

E M A 742 – THEORY AND APPLICATIONS IN ADVANCED DYNAMICS
3 credits.

Dynamical systems theory, advanced rigid body attitude dynamics, Lagrange's equations of motion, conservation laws, quasi-coordinates, Routh's method for ignorable coordinates, Hamilton's equations of motion, dynamic stability, Liapunov stability methods, angular momentum methods for systems of rigid bodies, modeling of rotating elastic systems, Kane's equations of motion, deterministic chaos. Knowledge of advanced three-dimensional dynamics [such as E M A 542 or PHYSICS 311] strongly encouraged.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2015

E M A 745 – ADVANCED METHODS IN STRUCTURAL DYNAMICS
3 credits.

Emphasis is placed on techniques used to analyze aerospace structures. Variational principles, Hamilton's extended principle, Lagrange's equations, mathematical models for continuous systems, natural modes of vibrations, dynamic response using mode superposition, mode acceleration, residual flexibility, vibration analysis using finite element methods, advanced substructure representations, component mode synthesis, systems with rigid body modes for aeronautical and astronautical systems. Knowledge of vibrations [such as E M A 545 or M E 440] strongly encouraged.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2022

E M A 747 – NONLINEAR AND RANDOM MECHANICAL VIBRATIONS
3 credits.

Exact solutions and sectorial linearization; free and forced vibration of mechanical systems with nonlinear restoring force; self-excited mechanical vibrations and relaxation vibrations; subharmonic responses; nonlinear vibration of mechanical systems with more than one degree of freedom; nonlinear vibration of bounded continuous media; random excitation and random response, random vibrations of mechanical systems and structures; random vibrations of nonlinear mechanical systems; failure of materials under random vibrations.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2019

E M A/COMP SCI/E C E/E P/M E 759 – HIGH PERFORMANCE COMPUTING FOR APPLICATIONS IN ENGINEERING
3 credits.

An overview of hardware and software solutions that enable the use of advanced computing in tackling computationally intensive Engineering problems. Hands-on learning promoted through programming assignments that leverage emerging hardware architectures and use parallel computing programming languages. Students are strongly encourage to have completed COMP SCI 367 or COMP SCI 400 or to have equivalent experience.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

E M A/CIV ENGR/M E 775 – TURBULENT HEAT AND MOMENTUM TRANSFER
3 credits.

Stochastic methods in turbulent heat and momentum transfer; fully developed turbulence; numerical methods including model applications to boundary layers, reacting flows, mass transfer, and unsteady flows; linear and non-linear stability and transition; emphasis on applications of interest to Mechanical, Aerospace, and Environmental Engineers. Knowledge of fluid mechanics [such as M E 363 or CBE 320] strongly encouraged.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

E M A 790 – MASTER'S RESEARCH AND THESIS
1-9 credits.

Directed study projects as arranged with instructor.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

E M A 890 – PRE-DISSERTATOR RESEARCH
1-9 credits.

Directed study projects as arranged with instructor.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

E M A 990 – RESEARCH AND THESIS
1-12 credits.

Directed study projects as arranged with instructor.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024