

Aerospace Engineering

IN THE COLLEGE OF ENGINEERING

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Faculty

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Courses Acceptable for Master's Degree Program in Aerospace Engineering (A E)

Refer to Courses and Curricula and Regulations of the Division of Graduate Affairs sections of this bulletin for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

UPPER DIVISION COURSES

A E 510. Finite Element Methods in Aerospace Structures (3)

Prerequisite: Aerospace Engineering 410.
Static and dynamic analysis of aerospace structures utilizing finite element methods.

A E 515. Methods of Analysis (3)

Prerequisite: Aerospace Engineering 280 with minimum grade of C.
Selected topics from vector calculus, partial differential equations, and complex analysis, with engineering applications.

A E 520. Spacecraft Attitude Dynamics and Control (3)

Prerequisite: Aerospace Engineering 320 or graduate standing.
Spacecraft rigid-body attitude dynamics and feedback control.

A E 530. Rocket and Space Propulsion (3)

Prerequisite: Aerospace Engineering 430.
Equilibrium combustion thermodynamics. Performance of rocket propelled vehicles. Rocket propulsion fundamentals. Topics in chemical (solid and liquid) and electrical propulsion systems.

A E 535. Mechanics of Composite Structures (3)

(Same course as Mechanical Engineering 535)

Prerequisites: Aerospace Engineering 280 and Aerospace Engineering 310 or Mechanical Engineering 314.
Micro- and macro-mechanics of composite materials, classical lamination theory, initial failure prediction and progressive failure analysis of laminates, analysis of beam and plate structures, stiffness and strength based design of composites. Not open to students with credit in Mechanical Engineering 540.

A E 540. Aircraft Stability and Control II (3)

Prerequisite: Aerospace Engineering 440.
Dynamic stability and control of rigid aircraft; general equations of unsteady motion, stability derivatives, perturbed state thrust forces and moment, special problems in dynamic stability and response.

A E 546. Aerospace Guidance and Navigation (3)

Prerequisite: Aerospace Engineering 320 with a grade of C (2.0) or better or graduate standing.
Principles and theories of navigation for aerospace vehicles. Aerospace guidance for entry vehicles, launch vehicles, missiles, and spacecraft. Classical and advanced guidance designs.

A E 550. Viscous Flow (3)

Prerequisites: Aerospace Engineering 340 and credit or concurrent registration in Aerospace Engineering 515.
Kinematics of fluid motion. Conservation of mass, momentum, and energy. Navier-Stokes equations; exact solutions. Boundary layer approximations, turbulent flow.

A E 596. Advanced Aerospace Engineering Topics (3)

Prerequisite: Consent of instructor.
Modern developments in aerospace engineering. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit of six units for any combination of Aerospace Engineering 496, 499, and 596 applicable to a bachelor's degree. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

GRADUATE COURSES

A E 600. Seminar (1-3)

Prerequisites: Consent of the graduate adviser and instructor.
Intensive study of one of the following topics: Nonlinear vibrations, random vibrations, continuum mechanics, anisotropic elasticity, energy methods, plasticity, and other areas of engineering mechanics. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit six units applicable to a master's degree. (Formerly numbered Engineering Mechanics 600.)

A E 601. Computational Fluid Mechanics (3)

Prerequisites: Credit or concurrent registration in Aerospace Engineering 302 and Aerospace Engineering 515.
Finite difference method of solving general fluid mechanics problems. Study of stability, convergence, compatibility, dissipation, and dispersion. A project is required.

A E 611. Vibration of Elastic Solids (3)

Prerequisites: Aerospace Engineering 410 or Mechanical Engineering 520, and Aerospace Engineering 515.
Vibrational characteristics of elastic media. Vibration of plates. Longitudinal and transverse wave motion in infinite, semi-infinite and finite thickness media. (Formerly numbered Engineering Mechanics 611.)

A E 612. Compressible Fluid Flow (3)

Prerequisites: Aerospace Engineering 302 and credit or concurrent registration in Aerospace Engineering 515.
Theory of flow at supersonic speeds. Linearized theory, three-dimensional wings in steady flight, slender-body theory, methods of characteristics.

A E 620. Incompressible Aerodynamics (3)

Prerequisites: Aerospace Engineering 301 and Aerospace Engineering 515.
Theory of incompressible aerodynamics; airfoil and wing theory; computational methods.

A E 621. Theory of Elasticity (3)

Prerequisites: Civil Engineering 301 (or Mechanical Engineering 304) and credit or concurrent registration in Aerospace Engineering 515.
Analysis of stress and strain: stress-strain relations; the equations of elasticity; uniqueness theorem; compatibility conditions; flexure and torsion. (Formerly numbered Engineering Mechanics 621.)

A E 631. Analysis of Elastic Plates (3)

Prerequisites: Aerospace Engineering 310 and 515.
Elasticity, energy principles, variational methods, classical theory, bending, and vibration of rectangular plates with various boundary conditions, shear deformation plate theories.

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A E 641. Structural Optimization (3)

Prerequisites: Aerospace Engineering 310 and 510.

Analytical and numerical methods for structural optimization. Optimization problem formulation; optimization using calculus of variations; linear programming; nonlinear optimization; global optimization; generalized optimality criteria and dual methods; sensitivity analysis; multilevel and decomposition techniques; shape and topology optimization. (Formerly numbered Engineering Mechanics 641.)

A E 644. Turbulent Flow (3)

Prerequisites: Aerospace Engineering 515 and 550.

Nature of turbulence based on simple flow observations and a theoretical basis for interpreting and predicting the behaviors of specialized turbulent flow problems.

A E 651. Theory of Elastic Stability (3)

Prerequisites: Aerospace Engineering 310 and graduate standing in aerospace engineering.

Stability of elastic systems. Differential equations of stability by summation of forces and moments, and by the variational method. Applications. (Formerly numbered Aerospace Engineering 727 and Engineering Mechanics 727.)

A E 670. Optimal Control (3)

Prerequisite: Aerospace Engineering 320, Electrical Engineering 420, or Mechanical Engineering 330.

Applications in aerospace engineering to include Hamilton-Jacobi-Bellman equation, maximum principle, optimal control of dynamic systems, and parameter optimization. Fuel-optimal, linear quadratic optimal control, and time-optimal problems.

A E 696. Advanced Topics in Aerospace Engineering (1-3)

Advanced topics in aerospace structural mechanics and design to include non-linear elasticity, plasticity, analysis of plates and shells, fracture mechanics, thermal stress analysis, fatigue analysis, non-linear aeroelasticity, advanced topics in finite element methods, structural optimization and reliability analysis. May be repeated with new content. See *Class Schedule* for specific content. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

A E 731. Aeroelasticity (3)

Prerequisites: Aerospace Engineering 611 and 620.

Fluid-structure interaction and its static and dynamic effects on airplanes. Unsteady aerodynamics, static aeroelastic instability (divergence), aileron reversal, sweep effects, doublet lattice method, dynamic aeroelastic instability (flutter), computational dynamic aeroelasticity using NASTRAN. (Formerly numbered Engineering Mechanics 731.)

A E 797. Research (1-3) Cr/NC/RP

Prerequisite: Consent of graduate adviser.

Research in engineering. Maximum credit six units applicable to a master's degree.

A E 798. Special Study (1-3) Cr/NC/RP

Prerequisite: Consent of staff; to be arranged with department chair and instructor.

Individual study. Maximum credit three units applicable to a master's degree.

A E 799A. Thesis or Project (3) Cr/NC/RP

Prerequisites: An officially appointed thesis committee and advancement to candidacy.

Preparation of a project or thesis for the master's degree.

A E 799B. Thesis or Project Extension (0) Cr/NC

Prerequisite: Prior registration in Thesis or Project 799A with an assigned grade symbol of RP.

Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis is granted final approval.

A E 799C. Comprehensive Examination Extension (0) Cr/NC

Prerequisite: Completion or concurrent enrollment in degree program courses.

Registration required of students whose only requirement is completion of the comprehensive examination for the master's degree. Registration in 799C limited to two semesters.
