2011-13 Cal Poly Catalog

Aerospace Engineering Department

AERO–AEROSPACE ENGINEERING

AERO 102 General Aviation (4)
Fundamentals of flight aerodynamics and principles. Introduction to power systems, instrumentation, flight planning, modern air navigation, weather data interpretation, flight computer uses, meteorology. Hands-on cockpit/taxi familiarization. Private pilot's examination preparation. Not a technical elective for engineering students. Field trip may be required. 4 lectures.

AERO 103 Instrument Aviation (4)
Introduction to advanced aircraft instrumentation, flight planning, interpretation of weather data, and meteorology. Instrument navigation, uses of flight computer, subjects covered in instrument pilot's examination. Not acceptable as technical elective to engineering students. 4 lectures. Prerequisite: Private pilot certification.

AERO 121 Aerospace Fundamentals (2)
Introduction to the engineering profession including the aeronautical and aerospace fields. Engineering approach to problem-solving and analysis of data obtained from experiments. Basic nomenclature and design criteria used in the aerospace industry. Applications to basic problems in the field. 1 lecture, 1 laboratory.

AERO 200 Special Problems for Undergraduates (1–4)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units. Prerequisite: Consent of department head.

AERO 215 Introduction to Aerospace Design (2)
Introduction to problem solving techniques and team-centered design projects in aerospace engineering. Primary emphasis on the solution of design problems in aerospace engineering using computers. 2 laboratories. Prerequisite: AERO 121, MATH 143. Recommended: CSC 111, IME 144.

AERO 240 Additional Engineering Laboratory (1–4) (CR/NC)
Total credit limited to four units. Credit/No Credit grading. 1-4 laboratories.

AERO 270 Selected Topics (1–4)
Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Open to undergraduate students and consent of instructor.

AERO 300 Aerospace Engineering Analysis (5)

Analytical methods for aerospace engineering problems. Topics include vector calculus, linear algebra, differential equations, Laplace transforms and Fourier series. Computer tools and numerical methods as applied to problems in aerodynamics, structures, stability and control and astronautics. 4 lectures, 1 laboratory. Prerequisite: PHYS 133, ME 211. Corequisite: MATH 244.

AERO 301, 302, 303 Aerothermodynamics I, II, III (4) (4) (4) Properties and characteristics of fluids, fluid statics and dynamics, the thermodynamic relations, laminar and turbulent flows, subsonic and supersonic flows as applied to flight vehicles. Introduction to heat transfer. 4 lectures, fall, winter and spring. AERO 301 prerequisite: ME 211 and AERO 300. AERO 302 prerequisite: AERO 301. AERO 303 prerequisite: AERO 302.

AERO 304 Experimental Aerothermodynamics (2)
Laboratory experiments verify the momentum and energy equations. Mass flow rate, fan performance, boundary layer measurements, diffuser performance, and induction pump performance experiments are evaluated. 1 lecture, 1 laboratory. Prerequisite: ENGL 149.

AERO 306 Aerodynamics and Flight Performance (4)
Introduction to theoretical aerodynamics. Primary emphasis in the subsonic region, including compressibility effects. Basic aerodynamic theory: Airfoil theory, wing theory, lift and drag. Team-centered aerodynamic design. Flight performance. 4 lectures. Prerequisite: AERO 215, AERO 301. Concurrent: AERO 302.

AERO 307 Experimental Aerodynamics (2)
Wind tunnel testing of basic aerodynamic properties of airfoils, finite wings, aircraft or spacecraft models, and vehicle flight performance. Emphasis on both static and dynamic responses of aircraft. Various measurement techniques, data reduction schemes, and analysis methods. 2 laboratories. Prerequisite: AERO 302, AERO 306, ENGL 149.

AERO 310 Air and Space (4) **GE Area F**
Technological innovations that have led to modern aircraft and spacecraft as viewed from an historical perspective. Development of aerodynamics, propulsion systems, light-weight structures, and control systems. How aviation has affected, and been affected by, history. Impact of aviation on society, including civil and military aircraft/spacecraft. Federal regulation of aviation, including air traffic control and airlines. Future developments in air and space technology. 4 lectures. Prerequisite: Junior standing and completion of GE Area B. *Crosslisted as AERO/HNRS 310*. Fulfills GE Area F.

AERO 320 Fundamentals of Guidance and Control (4)
Introduction to state-space and transfer function models for aircraft, spacecraft, missiles, and helicopters. Elementary classical and modern analysis techniques using computers. 4 lectures. Prerequisite: AERO 215, AERO 300. Concurrent: ME 212.

AERO 331 Aerospace Structural Analysis I (4)

Deflection analysis. Principles of fictitious displacement, virtual work, and unit load method. Energy methods: Castigliano's theorem, Maxwell-Betti reciprocal theorem, minimum principles, Rayleigh-Ritz's method and Galerkin's method. Stress analysis of aircraft and spacecraft components. 4 lectures. Prerequisite: AERO 300, CE 207, and ME 212.

AERO 360 Creative Problem Solving in Engineering Design (2)
The creative problem solving process for an engineering design team. How to explore context and causes as part of defining a design problem; the principles of brainstorming, synthesis, and judgment. Role of iteration, implementation, and communication. Importance of a diverse view, including: customers, products, processes, systems, ethics, and professional responsibility. Team-based applications to case studies and real-world engineering design problems. 2 laboratories. Prerequisite: PSY 350.

AERO 400 Special Problems for Advanced Undergraduates (1–4)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units. Prerequisite: Consent of instructor.

AERO 401 Propulsion Systems (4)
Power plant types, components, characteristics, and requirements. Principles of thrust and energy utilization. Thermodynamic processes and performance of turboprop, turboshaft, turbofan, turbojet, ramjet, and rocket engines. 3 lectures, 1 laboratory. Prerequisite: AERO 303, CHEM 124.

AERO 405 Supersonic and Hypersonic Aerodynamics (4)
Review of gas dynamics, shock-wave and boundary-layer interaction, aerodynamic design. 2-dimensional supersonic flows around thin airfoil; finite wing in supersonic flow. Local surface inclination methods for high-speed flight, boundary-layer and aerodynamic heating, viscous interactions. 4 lectures. Prerequisite: AERO 303, AERO 306.

AERO 407 Reentry Aerodynamics (4)
Near planet environments. Transition from orbital to aero-dynamic motion. Aerodynamic heating and effects on design. 4 lectures. Prerequisite: AERO 405. Concurrent: AERO 451.

AERO 409 Flight Test (4)
Overview of flight tests, test equations, and supporting facilities. Principles of team-centered flight testing with applications to performance, stability and control, and avionics systems testing. Test planning, instrumentation, data analysis and reports. 2 lectures, 2 laboratories. Prerequisite: AERO 306. Concurrent: AERO 320.

AERO 416 Principles of Rotary Wing Flight (4)
Introduction to analysis of rotary wing aircraft. Overview of avionics systems. Performance figures of merit. Stability and control of helicopters. Equations of motion for forward flight. 4 lectures. Prerequisite: AERO 306, AERO 300.

AERO 419 Simulation of Aerospace Vehicles and Systems (4)
Overview of flight simulators, aerospace avionics systems, and supporting facilities including simulation equations for flight mechanics and land navigation. Team-centered projects, reports, and presentations are emphasized with a strong focus on computer simulation of piloted flight. 2 lectures, 2 laboratories. Prerequisite: AERO 420.

AERO 420 Stability and Control of Aerospace Vehicles (4)
Stability and control derivatives, reference frames, steady-state static analysis and perturbed dynamic analysis for aircraft and spacecraft. Transfer function, state-space, and modal representations of system dynamics in response to control inputs. Design guidelines and introduction to augmentation systems. 4 lectures. Prerequisite: AERO 306, AERO 320, and ME 212.

AERO 421 Experimental Integrated Control System Analysis (1)
Implementation of elementary control analysis techniques to design and build control systems for integrated aerospace vehicles, structures and thermal systems. Analysis of sensors and actuators as applied to control problems and data acquisition. Extended use of modern computational controller design tools and data analysis. 1 laboratory. Prerequisite: AERO 420.

AERO 425 Aircraft Performance (4)
Fundamentals of propeller and jet aircraft performance. Steady and accelerated flight. Equations of motion. Level flight, gliding, climbing, driftdown. Takeoff and landing. Federal Aviation Regulations (FARs). Range and endurance. Payload-range diagram. Maneuvering. V-n diagram. Turning and pull-ups. Stall and spin behavior. Energy methods. 4 lectures. Prerequisite: ME 212, AERO 306, AERO 300.

AERO 431 Aerospace Structural Analysis II (4)

Basic equations of elasticity with applications to typical aerospace structures. Concepts studied include analysis of aircraft and aerospace structures; airworthiness and airframe loads; structural constraints; elementary aeroelasticity; structural instability; introduction to modern fatigue; fracture mechanics; and composite structures analysis. 4 lectures. Prerequisite: AERO 331.

AERO 432 Advanced Composite Structures Analysis (4)
Review of isotropic material behavior. Behavior of unidirectional fiber composites. Properties of short-fiber composites and orthotropic lamina. Analysis of laminated composites. Stresses and strains of composites. Strength and hygrothermal behavior of composite materials. 3 lectures, 1 laboratory. Prerequisite: AERO 331.

AERO 433 Experimental Stress Analysis (1)

Employing the knowledge of stress analysis and aerospace structural analysis in an individual and group design project dealing with aerospace structures. 1 laboratory. Prerequisite: AERO 331, AERO 431.

AERO 435 Aerospace Numerical Analysis (4)
Taylor series. Finite difference calculus. Interpolation and extrapolation. Finite difference method. Basic equations of elasticity. Global stiffness matrix. Rayleigh-Ritz method. Galerkin method. Bernoulli-Euler beam element. Finite element formulation. Dynamic analysis. 3 lectures, 1 laboratory. Prerequisite: AERO 300, AERO 331.

AERO 443, 444, 445 Aircraft Design I, II, III (4) (3) (3)
Preliminary layout of a typical aircraft vehicle using design and calculation techniques developed in previous aerospace engineering courses. Design of a flight vehicle, including its structures and systems. Preparation of necessary drawings and a report. AERO 443: 2 lectures, 2 laboratories. AERO 444 and AERO 445: 3 laboratories. Prerequisite: Senior standing, IME 144, AERO 215, AERO 303, AERO 306, AERO 331, AERO 405, AERO 420, AERO 431. Concurrent: AERO 401. Open to students enrolled in the multidisciplinary design minor.

AERO 446 Introduction to Space Systems (4)
Basic satellite types and their applications. Major subsystems of a satellite system. Space environment, propulsion system, power system, structural design, spacecraft dynamics and attitude control, orbit mechanics, thermal control, communications, and ground segments. Spacecraft integration and testing. May also be available to offsite locations (Distance Education). 4 lectures. Prerequisite: ME 212, AERO 320.

AERO 447, 448, 449 Spacecraft Design I, II, III (4) (3) (3) Preliminary layout of typical space vehicle using design and calculation techniques developed in previous aerospace engineering courses. Design of selected components and preparation of necessary drawings. AERO 447: 2 lectures, 2 laboratories. AERO 448 and AERO 449: 3 laboratories. Prerequisite: IME 144, AERO 215, AERO 303, AERO 331, AERO 420, AERO 431, AERO 446, AERO 451, senior standing. Concurrent: AERO 401. Open to students enrolled in the multidisciplinary design minor.

AERO 450 Introduction to Aerospace Systems Engineering (4)

Aerospace systems and subsystems. Systems integration. Development of system requirements. Analysis, modeling and simulation of complex systems. Project management. Cost analysis. Optimization and trade studies. 4 lectures. Prerequisite: Senior standing or consent of instructor.

AERO 451 Spaceflight Dynamics I (4)
Motion of a body in a central force field. Keplerian orbits. Orbital maneuvers. Launch vehicle trajectories. Rigid spacecraft attitude dynamics. Kinematic variables: Euler angles and quaternions. 4 lectures. Prerequisite: ME 212, AERO 215, AERO 300, AERO 320.

AERO 452 Spaceflight Dynamics II (4)
Orbital motion, perturbing forces. Aspherocity of the Earth, aerodynamic drag, third-body tidal forces, etc. Enke and Cowell solution techniques. Restricted 3-body problem. Satellite attitude dynamics, rigid body-symmetric and asymmetric semirigid bodies. Attitude control, spinning/fixed gravity gradient. 4 lectures. Prerequisite: AERO 451.

AERO 461, 462 Senior Project I, II (2) (3)
Selection and completion of a project which is typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 150 hours total time. Prerequisite: Senior standing.

AERO 463, 464 Senior Project Laboratory I, II (2) (3)
Selection and completion of a project by individuals or team which is typical of problems which graduates must solve in their fields of employment. Project involves, but is not limited to, physical modeling and testing of integrated design and may include students from other disciplines. Formulation of outline, literature review, and project schedule. AERO 463: 2 laboratories. AERO 464: 3 laboratories. Prerequisite: Senior standing. Note: although AERO 463, 464 substitute for AERO 461, 462, students may not use repeat credit for the purpose of increasing GPA.

AERO 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Consent of instructor.

AERO 471 Selected Advanced Laboratory (1–4)
Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories. Prerequisite: Consent of instructor.

AERO 493 Cooperative Education Experience (2) (CR/NC)
Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units. Prerequisite: Sophomore standing and consent of instructor.

AERO 494 Cooperative Education Experience (6) (CR/NC)
Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units. Prerequisite: Sophomore standing and consent of instructor.

AERO 495 Cooperative Education Experience (12) (CR/NC)
Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units. Prerequisite: Sophomore standing and consent of instructor.

AERO 500 Individual Study (1–4)
Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Total credit limited to 12 units. Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

AERO 510 Systems Engineering I (4)
Project management. Scheduling and budgeting. Queuing theory. Process control and life-cycle cost analysis. Contracts and negotiation. 4 lectures. Prerequisite: Graduate standing or consent of instructor. *Crosslisted as AERO/IME 510.*

AERO 511 Systems Engineering II (4)
Risk management. Design strategies to meet system/mission requirements. Design for supportability, manufacturability, reliability, etc. Quality function development and quality control concepts. 4 lectures. Prerequisite: AERO 510 or IME 510, graduate standing or consent of instructor. *Crosslisted as AERO/IME 511.*

AERO 512 Aerospace Vehicle Software Applications (4)
Computer system requirements for aerospace vehicles. Typical aerospace vehicle computer architectures. Software testing, verification and validation. Vehicle automatic systems. Risks and benefits of vehicle autonomous operations. Integration of software with vehicle subsystems. Software development cost/schedule estimation. 4 lectures. Prerequisite: AERO 450, AERO 446. Graduate standing or consent of instructor.

AERO 515 Continuum Mechanics (4)
Vectors and tensors stress analysis. Analysis of deformation. Velocity fields and compatibility conditions. Constitutive equations. Isotropy. Mechanical properties of real fluids and solids. Field equations and boundary conditions in fluid mechanics problems and applications in elasticity. Active remodeling of structures. 4 seminars. Prerequisite: Graduate standing or consent of instructor.

AERO 517 Multidisciplinary Design and Optimization (4)
Numerical optimization applied to the design of complex systems. Multi-criteria decision making, unconstrained and constrained optimization methods, system sensitivity analysis, system decomposition techniques, and multidisciplinary design optimization. 4 lectures. Prerequisite: Familiarity with programming in Matlab. Graduate standing or consent of instructor.

AERO 519 Fundamentals of Vehicle Dynamics and Control (4)
Fundamentals of particle and rigid body dynamics as they apply to aerospace vehicles. Kinematic variables and coordinate transformations. Attitude dynamics. Fundamentals of feedback control and its application to aerospace systems. Stability analysis. Numerical simulation. 4 lectures. Prerequisite: Graduate standing or consent of instructor. Not open to students with credit in AERO 451 and AERO 452.

AERO 520 Applied Airplane Aerodynamics (4)
Fundamentals of analytic aerodynamics; potential flow, Kutta-Joukowski theorem. Schwarz-Christoffel transformation, lifting line theory, thin wing theory, three-dimensional lift and drag of wings, slender body theory. Panel methods. Boundary-layer effects on aerodynamics. Viscous flow. 4 seminars. Prerequisite: AERO 306, MATH 502, graduate standing or consent of instructor.

AERO 521 Missile and Launch Vehicle Aerodynamics (4)
The aerodynamics of missile configurations in subsonic, transonic, supersonic, and hypersonic flows. Slender bodies and wings at high angles of attack. Asymmetric flow separation and vortex shedding. Wing-body interactions. Control effectiveness. Drag prediction methods and aerodynamic heating. The impact of low observability on aerodynamic design. Missile configuration design. 4 lectures. Prerequisite: AERO 405, graduate standing, or consent of instructor.

AERO 522 Boundary-Layer Theory (4)
Concept of boundary-layer. Boundary-layer equations, similarity transformation, integral and differential methods for steady, two-dimensional laminar and turbulent boundary layers. 4 lectures. Prerequisite: AERO 302, graduate standing or consent of instructor.

AERO 523 Turbulence (4)
Flow physics of turbulence. Turbulence scales and structures. Reynolds equations. Vorticity dynamics. Energy production, convection, and dissipation. Similarity rules and turbulence modeling for jets, wakes, mixing and boundary layers. Effect of turbulence on noise, combustion, heat transfer, and flow control. 4 lectures. Prerequisite: AERO 302, graduate standing or consent of instructor.

AERO 524 Low Gravity Fluid Dynamics and Heat Transfer (4)
Low gravity environment. Mass, momentum and energy transport equations. Free and forced convections. Materials processing. Two-phase flows. Combustion and flame propagation. Turbulence. Fluid management in space. Students are expected to do self-study and make a presentation for the seminar. 3 lectures, 1 seminar. Prerequisite: AERO 301, AERO 302, and AERO 303, graduate standing or consent of instructor.

AERO 525 Computational Fluid Dynamics (4)
Classification of partial differential equations. Numerical methods applicable to the solution of elliptic, parabolic, and hyperbolic partial differential equations. Consideration of accuracy and stability of numerical methods. Application to the fundamental equations of fluid dynamics, grid generation, turbulence modeling. 4 lectures. Prerequisite: AERO 3O3, graduate standing or consent of instructor.

AERO 526 Spacecraft Thermal/Fluid Control (4)
Satellite thermal/fluid control hardware. Governing equations for flow and heat transfer. Surface tension and liquid/vapor interface. Heat transfer by free convection, forced convection and radiation in low-gravity environment. Heat pipes. Capillary-pumped loops. Cryogenic systems. Fluid management in space. 4 lectures. Prerequisite: AERO 301, AERO 302, and AERO 303, or graduate standing.

AERO 530 Inelastic Structural Analysis (4)
Inelastic stress analysis. Yield criteria. Strain hardening. Plastic straining and bending. Elastic-plastic problems. Plastic instability. Slip-line fields for plains. Plastic strain problems and analysis and introduction to viscoplasticity. 3 lectures, 1 laboratory. Prerequisite: Graduate standing or consent of instructor.

AERO 532 Advanced Aerospace Composite Design (4)
Behavior of composite materials. Bending, buckling, and vibration of laminated plates. Fatigue and fracture mechanics analysis of composite structures. Optimum design of composite pressure vessels. 2 seminars, 2 laboratories. Prerequisite: Graduate standing or consent of instructor.

AERO 533 Finite Elements for Aerospace Structural Analysis (4) Overview of theoretical and applied methods of finite element analysis for aerospace structures including composite and light weight structures. Topics include basic equations of elasticity, solutions of linear systems of equations transformation, global stiffness matrix, Bernoulli-Euler element, plane stress triangles, finite element formulation, isoparametric elements, alternative formulation, eigenvalue problems and dynamic analysis. 3 lectures, 1 laboratory. Prerequisite: AERO 431.

AERO 534 Aerospace Structural Dynamics Analysis (4) Fundamentals of structural dynamics and aeroelasticity of flight vehicles. Undamped and damped, free and forced vibration of a single and multi degree- of-freedom linear systems. Finite elements and vibrational analysis. 3 lectures, 1 laboratory. Prerequisite: Graduate standing or consent of instructor.

AERO 535 Advanced Aerospace Structural Analysis (4)
Types of failure. Theories of failure. Stability of structures. Advanced flight vehicle and fracture mechanics analysis and design. Fundamentals and applications of modern fatigue analysis in the aerospace industry. 3 lectures, 1 laboratory. Prerequisite: Graduate standing or consent of instructor.

AERO 540 Elements of Rocket Propulsion (4)
Thrust and impulse equations, propellant composition and mixture ratios, nozzle expansion ratios, solid and liquid propellant combustion, internal ballistics, thermo-chemical computations, chemical kinetics, and combustion instability, nozzle design and exhaust plumes. 4 seminars. Prerequisite: AERO 303, AERO 401, graduate standing or consent of instructor.

AERO 541 Air Breathing Propulsion (4)
Aerothermodynamics of propulsion systems, power plant selection and design, on-off design performance, component characterization, component design, component matching, optimization, and introduction to power plant and airframe integration systems for aircraft. 4 seminars. Prerequisite: AERO 401, graduate standing or consent of instructor.

AERO 550 Analysis and Design of Flight Control Systems (4) Fundamental principles of flight control design and the application of the Cooper-Harper test and evaluation tool to modern aerospace vehicles. Human factors, issues, and automation, case study of the space shuttle. 3 lectures, 1 laboratory. Prerequisite: AERO 420, graduate standing or consent of instructor.

AERO 551 Global Positioning Satellite Navigation Systems (4) Principles of Global Positioning Satellite navigation systems. Kalman filter design and application to integrated navigation and guidance systems. Statistical evaluation and test methods in aerospace. Interactive computer simulations. 3 lectures, 1 laboratory. Prerequisite: AERO 420, graduate standing or consent of instructor.

AERO 552 Advanced Control of Spacecraft and Aircraft (4)
Model following and digital control of aerospace craft, including dynamic estimation of vehicle states using Kalman filters and adaptive compensation. Team-centered projects involving optimal attitude control in deep space, hovering vehicles, and aeroelastic systems. Survey of non-linear, fuzzy, and neural net controllers for aerospace applications. 2 lectures, 2 laboratories. Prerequisite: AERO 420, graduate standing or consent of instructor.

AERO 553 Advanced Linear Control Theory (4)
Advanced linear control theory techniques and analytic and computational analysis. State space system representation, solutions to linear dynamic systems, stability analysis, full-state and output feedback, controllability and observability and advanced control topics. Computational methods applied to problems in stability and control of dynamic systems. 4 lectures. Prerequisite: AERO 320, graduate standing or consent of instructor.

AERO 555 Piloted Flying Qualities of Aerospace Vehicles (4)

Flying qualities prediction from flight test data and reduced-order analytical models of vehicles, systems, and human pilots. Application of the Cooper-Harper flight test scale to fly-by-wire aircraft, the space shuttle, and remotely controlled vehicles include rotorcraft. Team-centered projects, reports, and presentations are required. 2 lectures, 2 laboratories. Prerequisite: AERO 420.

AERO 557 Advanced Orbital Mechanics (4)

N-body orbit interactions, computer simulations, orbit determination, orbit and transfer optimization, libration points, halo orbits, and orbit perturbations. 4 lectures. Prerequisite: AERO 451, graduate standing, or consent of instructor.

AERO 560 Spacecraft Dynamics and Control (4)

Orbit determination and control. Orbit maneuvering and rendezvous. Attitude control of rigid spacecraft via reaction wheels, control moment gyros and thrusters. Modeling, analysis and control of flexible spacecraft. 4 lectures. Prerequisite: AERO 420, AERO 452, AERO 553, graduate standing or consent of instructor.

AERO 561 Vehicle Integration and Testing (2)

Space vehicle integration requirements and procedures. Clean room requirements and operations. Quality control and inspection. Qualification and acceptance testing requirements. Test equipment. Vibration and shock testing. Space environment and thermal-vac testing. Development of test procedures. 1 lecture, 1 laboratory. Prerequisite: AERO 446. AERO 450 recommended. Graduate standing or consent of instructor.

AERO 562 Space Operations (2)

Launch operations and vehicle integration with launch vehicle. In-orbit operations and maneuvers. Spacecraft tracking. Telemetry and command. Ground systems. Failure detection and identification. Emergency operations. 1 lecture, 1 laboratory. Prerequisite: AERO 446. AERO 450 recommended. Graduate standing or consent of instructor.

AERO 565 Advanced Topics in Aircraft Design (4)

Application of advanced analytic engineering methods to aircraft design problems. Analysis and synthesis of advanced topics related to design of aircraft. 4 lectures. Prerequisite: AERO 522, AERO 530 and AERO 550, graduate standing or consent of instructor. Concurrent: AERO 520.

AERO 566 Advanced Topics in Spacecraft Design (4)

Application of advanced engineering tools to the design of space vehicles. System architecture and mission design. Concept of operations. Requirements development and flow down. System and subsystems trade studies and preliminary design. 4 lectures. Prerequisite: AERO 450, AERO 446, graduate standing or consent of instructor.

AERO 567 Launch Vehicle and Missile Design (4)

Basic launch vehicle/missile types. Launch vehicle subsystems and their interactions. Vehicle requirements development and flow down. Payload accommodations. System and subsystems trade studies and preliminary design. 4 lectures. Prerequisite: AERO 401, AERO 450, AERO 446, graduate standing or consent of instructor.

AERO 570 Selected Advanced Topics (4)

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 4 lectures. Prerequisite: Graduate standing or consent of instructor.

AERO 571 Selected Advanced Laboratory (1–4)

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories. Prerequisite: Graduate standing or consent of instructor.

AERO 572 Topics in Aircraft Manufacturing and Fabrication (1) Selected topics for assembling aircraft and aircraft components, including empennage, wing fuselage, engine, flight controls, avionics, finishing work, and flight testing. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

AERO 593 Cooperative Education Experience (2) (CR/NC)

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

AERO 594 Cooperative Education Experience (6) (CR/NC)

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

AERO 595 Cooperative Education Experience (12) (CR/NC)

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

AERO 599 Thesis (Design Project) (1-9)

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis. Prerequisite: Graduate standing.