### AEROSPACE ENGINEERING (AERSP)

**AERSP 504: Aerodynamics of V/STOL Aircraft**  
3 Credits  
Jet wings, high lift devices, propellers and ducted propellers, circulation and boundary layer control, unsteady airfoil theory.  
**Prerequisite:** AERSP 407

**AERSP 505: Aero- and Hydroelasticity**  
3 Credits  
Interaction of elastic systems having several degrees of freedom with fluid flows in various configurations.  
**AERSP 506: Rotorcraft Dynamics**  
3 Credits  
**Prerequisite:** AERSP 504, E MCH 571

**AERSP 507: Theory and Design of Turbomachinery**  
3 Credits  
Theory and principles of machinery design: compressors, turbines, pumps, and rotating propulsors; opportunity to work out design examples.  
**AERSP 508: Foundations of Fluid Mechanics**  
3 Credits  
Mathematical review, fluid properties, kinematics, conservation laws, constitutive relations, similarity principles, the boundary layer, inviscid flow, vorticity dynamics, wave motion.  
**AERSP 509: Dynamics of Ideal Fluids**  
3 Credits  
Irrotational flow theory, two-dimensional and axisymmetric flows, airfoil theory, complex variables, unsteady phenomena; flow with vorticity, finite wing theory.  
**Prerequisite:** AERSP 508

**AERSP 511: Aerodynamically Induced Noise**  
3 Credits  
**AERSP 514: Stability of Laminar Flows**  
3 Credits  
The stability of laminar motions in various geometries as influenced by boundary conditions and body forces of various kinds.  
**AERSP 518: Dynamics and Control of Aerospace Vehicles**  
3 Credits  
Dynamical problems of aircraft and missiles, including launch, trajectory, optimization, orbiting, reentry, stability and control, and automatic control.  
**Prerequisite:** AERSP 413 or AERSP 450

**AERSP 524: Turbulence and Applications to CFD: DNS and LES**  
3 Credits  
First of two courses: Scalings, decompositions, turbulence equations; scale representations, Direct and Large-Eddy Simulation modeling; pseudo-spectral methods; 3 computer projects.  
**Prerequisite:** AERSP 508 or M E 521  
Cross-listed with: ME 524

**AERSP 525: Turbulence and Applications to CFD: RANS**  
3 Credits  
Second in two courses: Scalings, decomposition, turbulence equations; Reynolds Averaged Navier Stokes (RANS) modeling; phenomenological models; 3 computer projects.  
**Prerequisite:** AERSP 508 or M E 521  
Cross-listed with: ME 525

**AERSP 530: Aerothermochemistry of Advanced Propulsion Systems**  
3 Credits  
Physics and chemistry needed to analyze high performance rocket propulsion systems including reacting high temperature radiating gas and plasma flows.  
**Prerequisite:** AERSP 312 or M E 420

**AERSP 535: Physics of Gases**  
3 Credits  
An introduction to kinetic theory, statistical mechanics, quantum mechanics, atomic and molecular structure, chemical thermodynamics, and chemical kinetics of gases.  
Cross-listed with: ME 535

**AERSP 540: Theory of Plasma Waves**  
3 Credits  
Solutions of the Boltzmann equation; waves in bounded and unbounded plasmas; radiation and scattering from plasmas.  
**Prerequisite:** E E 471  
Cross-listed with: NUCE 540
AERSP 550: Astrodynamics
3 Credits

Applications of classical celestial mechanics to space flight planning. Determination and construction of orbital parameters by approximation methods. Perturbation techniques. AERSP 550 Astrodynamics (3) This course covers the mathematics and practices in orbital mechanics as applied to space mission analysis, design and operation. The major topics are: the n-body problem, the two-body problem, Keplerian orbits, the Kepler problem (position as a function of time), three-dimensional specifications of Keplerian orbits (orbital elements), Lambert’s problem (determining the trajectory between two specified points with a given time of flight), impulsive transfers, the Hohmann transfer and its extension to other problems, the sphere of influence, the patched-conic approximation, the restricted three-body problem, linear orbit theory (relative motion between vehicles in neighboring orbits), gravitational modeling, perturbation methods (Encke’s method and variation of elements), orbit determination, tracking kinematics, and time systems.

Prerequisite: AERSP450 or E MCH409 or PHYS 419

AERSP 552: Interplanetary Astrodynamics
3 Credits

This course focuses on mathematics and practices in interplanetary astrodynamics. Major topics include: astrodynamics applied to interplanetary space missions, the N-body problem, orbit transfers, Lambert’s problem, gravity assists, planetary entry, descent and landing, planetary ephemerides, tracking sources and measurements, and spacecraft navigation. Other topics may be covered as time permits.

Recommended Preparations: AERSP 450 Sufficient proficiency in computer programming to code and debug a complex computer program. Fundamental knowledge in astrodynamics, as would be found in an junior or senior astrodynamics course.

AERSP 554: Statistical Orbit Determination
3 Credits

When tracking satellites in orbit, large amounts of tracking data (range, range-rate, azimuth, elevation) is collected. To convert this data to physical orbital elements of the satellite’s orbit, this data must be filtered, and this filtering is done using methods of statistical orbit determination. This course focuses on the mathematics and practices in statistical orbit determination for analyzing large amounts of satellite tracking data. Major topics include: classical orbit determination techniques, probability and statistics, least-squares solution, weighted least squares, statistical interpretation of the least-squares problem, Cholesky decomposition, Gauss-Markoff theorem, sequential estimation algorithms, extended sequential estimation algorithms, square root filters, state noise compensation algorithm, state noise compensation algorithms, smoothing algorithms, minimum variance, maximum likelihood, Bayesian estimation. Other topics may be covered as time permits.

AERSP 560: Finite Element Method in Fluid Mechanics and Heat Transfer
3 Credits

Application of finite element techniques to viscous/unsteady fluid flow/heat transfer problems.
AERSP 611: Ph.D. Dissertation Part-Time
0 Credits/Maximum of 999
No description.

AERSP 880: Wind Turbine Systems
3 Credits
Wind turbine technology and the critical elements of turbine systems design.

AERSP 886: Engineering of Wind Project Development
3 Credits
An overview of the wind project development process and technical considerations for onshore and offshore applications.