REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING/MASTER OF SCIENCE

Accredited by ABET, Inc., (formerly the Accrediting Board for Engineering and Technology)

COLLEGE OF ENGINEERING

THE UNIVERSITY OF OKLAHOMA

For Students Entering the Oklahoma State System for Higher Education **Summer 2009 through Spring 2010**

GENERAL REQUIREMENTS

Total Credit Hours . . . . . **152-158•**

Minimum Retention/Graduation Grade Point Averages:

Overall - Combined and OU **3.25**

Major - Combined and OU **3.25**

Curriculum - Combined and OU **3.25**

A minimum grade of C is required for each course in the curriculum.

Aerospace Engineering
F010
Bachelor of Science in Aerospace Engineering/ Master of Science

OU encourages students to complete at least 31-32 hours of applicable coursework each year to have the opportunity to graduate in five years.

Year	FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
FRESHMAN	**ENGL 1113**, Prin. of English Composition (Core I)	3	**ENGL 1213**, Prin. of English Composition (Core I), **or**	3
	CHEM 1315, General Chemistry (Core II)	5	**EXPO 1213**, Expository Writing (Core I)	
	MATH 1823, Calculus & Analytic Geometry I (Core I)	3	**MATH 2423**, Calculus & Analytic Geometry II (Core I)	3
	HIST 1483, U.S. 1492-1865, **or**	3	**PHYS 2514**, General Physics for Engineering & Science Majors (Core II)	4
	1493, U.S. 1865-Present (Core IV)			
	ENGR 1411, Freshman Engineering Experience	1	**P SC 1113**, American Federal Government (Core III)	3
	†Approved Elective: Artistic Forms (Core IV)	3	***C S 1313,** Programming for Non-Majors	3
	TOTAL CREDIT HOURS	**18**	**TOTAL CREDIT HOURS**	**16**
SOPHOMORE	**MATH 2433**, Calculus & Analytic Geometry III	3	**MATH 2443**, Calculus & Analytic Geometry IV	3
	PHYS 2524, General Physics for Engr. & Science Majors	4	**MATH 3413**, Physical Mathematics I	3
	AME 2113, Statics	3	**MATH 3401**, Numerical Methods with MATLAB	1
	AME 2213, Thermodynamics	3	**AME 2303,** Design & Manufacturing Processes	3
	✤AME 2223, Intro. to Aerospace Engineering	3	**AME 2533**, Dynamics	3
			AME 2623, Circuits and Sensors	3
	TOTAL CREDIT HOURS	**16**	**TOTAL CREDIT HOURS**	**16**
	‡ In order to be admitted to upper-division AME classes, students must submit an application to the AME office. At the time of the application, students shall have completed a set of requisite courses and should have a 2.80 OU retention and 2.80 combined retention grade point average.			
JUNIOR	**AME 3112**, Solid Mechanics Lab	2	**AME 3103**, Interactive Engineering Design Graphics	3
	AME 3143, Solid Mechanics	3	**AME 3333**, Flight Mechanics	3
	AME 3253, Aerodynamics	3	**AME 3523**, Aerospace Structural Analysis	3
	AME 3272, Wind Tunnel Lab	2	**AME 3623**, Embedded Real-Time Systems	3
	AME 4383, Control Systems	3	**ENGL 3153**, Technical Writing	3
	ENGR 2002, Professional Development	2		
			§Approved Experimental Elective	2
	TOTAL CREDIT HOURS	**15**	**TOTAL CREDIT HOURS**	**17**
	✯ Approval for admission to the accelerated BS/MS program must be initiated at the beginning of the second semester of the junior year.			
SENIOR	**AME 4243**, Aerospace Propulsion Systems	3	**AME 4373**, Aerospace Systems Design II (Capstone)	3
	AME 4273, Aerospace Systems Design I	3	**†COMM 3513**, Intercultural Communication (or an advisor-approved substitution) Western Civ. & Culture (Core IV)	3
	AME 5493, Space Sciences and Astrodynamics	3		
	AME 4513, Flight Controls	3	**†ANTH 4623**, Approaches to Cross-Cultural Human Problems (or an advisor-approved substitution) Non-Western Culture (Core IV)	3
	AME Graduate Elective	3		
			† Approved Elective: Social Science (Core III)	3
			AME Graduate Elective	3
	TOTAL CREDIT HOURS	**15**	**TOTAL CREDIT HOURS**	**15**
	Students are eligible for graduate status upon graduation with the Bachelor of Science in Aerospace Engineering.			
FIFTH YEAR	**AME 5573**, Adv. Engineering Analysis I, **or** MATH Elective	3	**§AME 5980**, Thesis Research **or** Graduate-level Elective	3-4
	§AME 5980, Thesis Research **or** Graduate-level Elective	2-3		
			§AME Graduate Elective	3
	AME Graduate Elective	3		
			AME Graduate Elective	3
	AME Graduate Elective	3		
			AME Graduate Elective	3
	TOTAL CREDIT HOURS	**11-12**	**TOTAL CREDIT HOURS**	**12-13**

✯ Students may enter the accelerated program based on the undergraduate degree pattern offered in the year they first enrolled in the Oklahoma State System of Higher Education or later.
NOTE: Engineering transfer students may take ENGR 3511 in place of ENGR 1411.

§ Dependent upon whether a student chooses the thesis or non-thesis option. Non-thesis option additionally requires: **AME 5990 Special Project** (3 hrs.) to be taken in the Summer between the Senior and the Fifth Year, and **Comprehensive Exam** to be taken in the last semester of study.

Courses designated as Core I, II, III, IV or Capstone are part of the General Education curriculum. Students must complete a minimum of 40 hours of General Education courses, chosen from the approved list.

† To be chosen from the **University-Wide General Education Approved Course List**. Three of these 12 hours must be upper-division (3000-4000). See list online.

In the College of Engineering, in order to progress in your curriculum, and as a specific graduation requirement, a grade of C or better is required in each course in the curriculum. Please refer to the General Catalog for additional enrollment limitations.

Students must successfully complete prerequisite courses (with a minimum C grade) before proceeding to the next course.

• Two college-level courses in a single foreign language are required; this may be satisfied by successful completion of 2 years in a single foreign language in high school. Students who must take foreign language at the University will have an additional 6-10 hours of coursework.

§ It is recommended that a student take either AME 4802 "Robotics Laboratory" or 4812 "Dynamics and Controls Laboratory" for the experimental elective.

Fourth and fifth year graduate electives must satisfy MS in aerospace engineering requirements.

✤ AME courses are sequential and usually offered only in the semester shown. Note prerequisites on the back of this page.

*This course fulfills the Computer Literacy Requirement for graduation as required by the Oklahoma State Regents for Higher Education. If CS 1323 is taken, students must have a working knowledge of C language before enrolling in AME 3623.

COURSES IN AEROSPACE AND MECHANICAL ENGINEERING (AME)

2113 Statics. Prerequisite: Physics 2514 and Mathematics 2433 or concurrent enrollment in Mathematics 2433. Vector representation of forces and moments: general three-dimensional theorems of statics; centroids and moments of area and inertia. Free-body diagrams, equilibrium of a particle and of rigid bodies, distributed loads, friction and internal shear and moment loads. Analysis of trusses, frames, and machines. (F)

2213 Thermodynamics. Prerequisite: Mathematics 2433 and Physics 2524, or concurrent enrollment (in both). First and second law of thermodynamics are developed and applied to the solutions of problems from a variety of engineering fields. Extensive use is made of differential calculus to interrelate thermodynamics functions. (F)

2223 Introduction to Aerospace Engineering. Prerequisite: Physics 2514. Nature of atmospheric and space flight and of associated vehicles, conceptual design of flight and space vehicles, and current problems in aerospace engineering. (F)

2303 Materials, Design and Manufacturing Processes (Crosslisted with Industrial Engineering 2303). Prerequisite: 2113 or Civil Engineering 2113 or Engineering 2113. Mechanical and physical properties of engineering materials. Introduction to design concepts, manufacturing processes and equipment used in engineering. (Sp)

2533 Dynamics. Prerequisite: 2113, Mathematics 2433. Dynamics (kinematics and kinetics) of particles and rigid bodies for rectilinear, curvilinear and angular motion; work and energy methods; conservations of impulse and momentum; introduction to mechanical vibrations. (Sp)

2623 Circuits and Sensors. Prerequisite: Mathematics 3413 and 3401, or concurrent enrollment; Physics 2524 or concurrent enrollment. Formulation and solution of circuit equations, network theorems, sinusoidal steady-state analysis, simple transients. Introduction to digital logic circuits. Physical principles of sensing and actuation. Applications to engineered systems of computer programming, embedded systems, and controls. (Sp)

3103 Interactive Engineering Design Graphics. Prerequisite: Mathematics 1823. Visualization and modeling techniques for product design and development. Design methodology, graphic standards, projection theory, freehand sketching, spatial geometry, CAD systems, geometric modeling, and tolerancing. Solving open-ended design and visualization problems. **Laboratory** (Sp)

3112 Solid Mechanics Lab. Prerequisite: 2113 or Engineering 2113; 3143 or concurrent enrollment. Measurement of displacement; velocity, acceleration, force, torque, strain, stress, data acquisition and processing; data analysis. **Laboratory** (F)

3143 Solid Mechanics. Prerequisite: 2113 or Engineering 2113, Mathematics 3113, or 3413 and 3401. Concepts of stress and strain; mechanical behavior of engineering materials; analysis of uniform stress states; analysis of members in torsion; stresses and deflections in beams; modes and theories of failure; design criteria. (F)

3253 Aerodynamics. Prerequisite: 2223, 2533, Mathematics 3413 and 3401. Fluid properties, fluid statics, flow description, conservation equation; incompressible inviscid flow dynamics; characteristic airfoil parameters; two-dimensional flow around thin airfoils; flow around wings of finite span; boundary layer development; compressibility; governing equations for inviscid compressible flow normal and oblique shock relations; Prandtl-Meyer expansion waves; quasi-one dimensional flow through nozzles and diffusers. (F)

3272 Windtunnel Laboratory. Prerequisite: 3253 or concurrent enrollment. Operation and calibration of subsonic and supersonic wind tunnels, power and measurement. Experimental testing of model airplanes and aerodynamic shapes; determination of drag of flight vehicle components. **Lecture and Laboratory** (F)

3333 Flight Mechanics. Prerequisite: 2223, 2533. Performance of aerospace vehicles, weight and balance, equations of motion for rigid aircraft, introduction to static stability and control (open loop) as related to aircraft analysis and design. (Sp)

3523 Aerospace Structural Analysis. Prerequisite: 3143, Mathematics 3413 and 3401. Advanced concepts of stress and strain; introduction to the analysis of aerospace engineering structures: complex bending and torsion, shear flows in thin-walled and stringer-skin sections; buckling; introduction to the finite element method; introduction to composite materials. (Sp)

3623 Embedded Real-Time Systems. Prerequisite: 2623 or equivalent, Computer Science 1313 or 1323 or equivalent. The fundamentals of real-time embedded systems are covered including processes, scheduling, frequency requirements, and watchdog timers. Includes work with actual real-time systems. (Sp)

G4243 Aerospace Propulsion Systems. Prerequisite: 2213 or Engineering 2213, and 3153 or 3253. Propulsion systems, thermodynamic cycles, combustion and thermochemical analysis, reciprocating engines, gas turbine and jet engines, current developments in propulsion systems. (F)

4273 Aerospace Systems Design I (Slashlisted with 5273). Prerequisite: 3253 and 3333, or permission of instructor. Analysis and design of an aerospace system such as a complete flight vehicle, a propulsion system, a structural system, or a control system; market analysis, operating studies, mission specification, certification requirements; configuration selection; multidisciplinary character of design, classical design and analysis methods. No student may earn credit for both 4273 and 5273. **Laboratory** (F)

4373 Aerospace Systems Design II (Slashlisted with 5373). Prerequisite: 4273 or permission of instructor. Analysis and design of an aerospace systems such as a complete flight vehicle, a propulsion system, a structural system, or a control system; handling qualities, propulsion system integration design case studies; consideration of operational aspects, reliability, and maintainability; ground and flight testing; advanced design and analysis methods. No student may earn credit for both 4373 and 5373. **Laboratory** (Sp) [V]

G4383 Control Systems. Prerequisite: 2533, Mathematics 3413 and 3401. Introduction to the concepts and theory of feedback control systems. Representation of electromechanical systems and aerospace vehicles by transfer and state variable methods. Stability and performance analysis, design techniques and synthesis methods for linear control systems. (F)

4493 Space Sciences and Astrodynamics (Slashlisted with 5493). Prerequisites: Physics 2524, Mathematics 2443. Selected topics in astrophysics which may include astrodynamics, stellar structure and evolution, stellar pulsation, supernovae black holes, interstellar medium, galactic structure and clusters and superclusters, active galaxies, quasars, and cosmology. No student may earn credit for both 4493 and 5493. (F)

G4513 Flight Controls (Slashlisted with 5513). Prerequisite: 3333, 4383. Classical control theory with applications to aircraft flight control system design. No student may earn credit for both 4513 and 5513. (F)

4593 Space Systems and Mission Design (Slashlisted with 5593). Prerequisite: 4493 or permission from instructor. Topics include basic orbital mechanics, orbit determination, perturbations, numerical techniques, interplanetary transfer, influence of space environment, atmospheric re-entry. Space vehicles subsystems design; propulsion, attitude determination and control, structural design, thermal control, power and telecommunications. Investigation into mission design concepts and consideration. No student may earn credit for both 4593 and 5593. (Sp)

G5573 Advanced Engineering Analysis I. Prerequisite: Mathematics 3413 or equivalent. Vector and tensor analysis. Calculus of variations followed by variational methods and/or the method of weighted residuals. (Irreg.)

G5980 Research for Master's Thesis. Variable enrollment, two to nine hours; maximum credit applicable toward degree, six hours. (F, Sp, Su)

COURSES IN ANTHROPOLOGY (ANTH)

4623 Approaches to Cross-Cultural Human Problems. Prerequisite: 1113 or junior standing. Introduces students to the complex problems of contemporary global-scale cultures and helps them better understand their place on this global arena. This course will look at specific international issues or problems, and relate them to processes occurring in many parts of the world. (Irreg.) [IV-NW]

COURSES IN CHEMISTRY AND BIOCHEMISTRY (CHEM)

1315 General Chemistry. Prerequisite: Mathematics 1503 or 1643, or math ACT equal to or greater than 23. First of a two-semester sequence in general chemistry. Topics covered: basic measurement, gas laws and changes in state, stoichiometry, atomic theory, electron configuration, periodicity, bonding, molecular structure and thermochemistry. **Laboratory** (F, Sp, Su) [II-LAB]

COURSES IN COMMUNICATION (COMM)

3513 Intercultural Communication. Prerequisite: 1113 and junior standing. Introduction to intercultural communication theory, research and selected applications. Topics include conceptualizing intercultural communication theoretically, trends in research, diffusion of innovation, nationality barriers and training for foreign assignments. (F, Sp) [IV-WC]

COURSES IN COMPUTER SCIENCE (C S)

1313 Programming for Nonmajors. Prerequisite: Mathematics 1523 or equivalent. Introduction to the design and implementation of computer programs. Emphasis on problem solving. (F, Sp)

COURSES IN ENGINEERING (ENGR)

1411 Freshman Engineering Experience. Prerequisite: declared major in Engineering or permission of instructor. Required of all entering freshmen with a declared Engineering major. Lecture hours cover a variety of topics including: majors and minors; career planning; advising; and extra-curricular activities. Students also work on multi-disciplinary engineering projects in smaller groups during the lab hour. (F)

1411 Freshman Engineering Experience. Prerequisite: declared major in Engineering or permission of instructor. Required of all entering freshmen with a declared Engineering major. Lecture hours cover a variety of topics including: majors and minors; career planning; advising; and extra-curricular activities. Students also work on multi-disciplinary engineering projects in smaller groups during the lab hour. (F)

COURSES IN MATHEMATICS (MATH)

1823 Calculus and Analytic Geometry I. Prerequisite: 1523 at OU, or satisfactory score on the placement test, or, for incoming freshmen direct from high school, satisfactory score on the ACT/SAT. Topics covered include equations of straight lines; conic sections; functions, limits and continuity; differentiation; maximum-minimum theory and curve sketching. A student may not receive credit for this course and 1743. (F, Sp, Su) [I-M]

2423 Calculus and Analytic Geometry II. Prerequisite: 1823. Integration and its applications; the calculus of transcendental functions; techniques of integration; and the introduction to differential equations. A student may not receive credit for this course and 2123. (F, Sp, Su) [I-M]

2433 Calculus and Analytic Geometry III. Prerequisite: 2423. Polar coordinates, parametric equations, sequences, infinite series, vector analysis. (F, Sp, Su)

2443 Calculus and Analytic Geometry IV. Prerequisite: 2433. Vector calculus; functions of several variables; partial derivatives; gradients, extreme values and differentials of multivariate functions; multiple integrals; line and surface integrals. (F, Sp, Su)

3401 Numerical Methods with MATLAB. Prerequisite: 3413 or concurrent enrollment. Programming with MATLAB. Numerical solution of nonlinear equations. Matrices and linear algebraic equations, regression, interpolation, splines. Numerical integration. Numerical solution of systems of ordinary differential equations. Numerical solution of partial differential equation. **Laboratory** (F, Sp)

†G3413 Physical Mathematics I. Prerequisite: 2443 or concurrent enrollment. Complex numbers and functions. Fourier series, solution methods for ordinary differential equations and partial differential equations, Laplace transforms, series solutions, Legendre's equation. Duplicates two hours of 3113. (F)

COURSES IN PHYSICS (PHYS)

2514 General Physics for Engineering and Science Majors. Prerequisite: Mathematics 1823. Not open to students with credit in 1205. Vectors, kinematics and dynamics of particles, work and energy systems of particles, rotational kinematics and dynamics, oscillations, gravitation, fluid mechanics, waves. (F, Sp, Su) [II-NL]

2524 General Physics for Engineering and Science Majors. Prerequisite: 2514 and Mathematics 2423. Not open to students with credit in 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)