### Requirements for the Bachelor of Science in Aerospace Engineering/Master of Science in Aerospace Engineering

#### College of Engineering

**The University of Oklahoma**

**General Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Minimum Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Credit Hours</td>
<td>152-158+</td>
</tr>
</tbody>
</table>

**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.

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**University-Wide General Education Approved Course List**

<table>
<thead>
<tr>
<th>Department</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH</td>
<td>1914, Differential and Integral Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>ENGR</td>
<td>1113, Prin. of English Composition (Core I)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM</td>
<td>1315, General Chemistry (Core II)</td>
<td>5</td>
</tr>
<tr>
<td>HIST</td>
<td>1483, U.S. 1492-1865, or 1493, U.S. 1865-Present (Core IV) 1411,</td>
<td>3</td>
</tr>
<tr>
<td>ENGR</td>
<td>Freshman Engineering Experience</td>
<td>1</td>
</tr>
<tr>
<td>PHYS</td>
<td>2524, General Physics for Engr. &amp; Science Majors</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>2113, Statics</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>2223, Intro. to Aerospace Engineering</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>3112, Solid Mechanics Lab</td>
<td>2</td>
</tr>
<tr>
<td>AME</td>
<td>3143, Solid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>3253, Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>3272, Wind Tunnel Lab</td>
<td>2</td>
</tr>
<tr>
<td>AME</td>
<td>4383, Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>ENGR</td>
<td>4002, Professional Development</td>
<td>2</td>
</tr>
<tr>
<td>AME</td>
<td>4243, Aerospace Propulsion Systems</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>4273, Aerospace Systems Design I</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>5493, Space Sciences and Astronautics</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>4513, Flight Controls</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>Graduate Elective</td>
<td>3</td>
</tr>
<tr>
<td>AME</td>
<td>5573, Adv. Engineering Analysis I, or MATH Elective</td>
<td>3</td>
</tr>
<tr>
<td>$AME$</td>
<td>5980, Thesis Research or Graduate-level Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

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**Fourth and Fifth Year Graduate Electives**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AME Graduate Elective</td>
<td>3</td>
</tr>
<tr>
<td>$AME$ Graduate Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

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**Total Credit Hours**

- Freshman: 16
- Sophomore: 17
- Junior: 15
- Senior: 15
- Fifth Year: 11-12

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**College of Engineering**

**Aerospace Engineering**

**A010** Bachelor of Science in Aerospace Engineering/Master of Science (Aerospace Engineering) F010

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**Oklahoma State System for Higher Education**

**Summer 2015 through Spring 2016**

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**NOTE:** Engineering transfer students may take ENGR 3511 in place of ENGR 1411.

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

**AP credit is acceptable for any of these required courses.**

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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.

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

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.

- 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.

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Courses not specifically designated as core courses in the curriculum are open electives. Students must choose a minimum of 31-32 hours of applicable coursework each year to have the opportunity to graduate in five years.

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**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.

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

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Students who must take foreign language at the University will have an additional 6-10 hours of coursework.

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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.

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**Total Credit Hours**

- Freshman: 16
- Sophomore: 17
- Junior: 15
- Senior: 15
- Fifth Year: 11-12

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**Students are eligible for graduate status upon graduation with the Bachelor of Science in Aerospace Engineering.**

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**†** Approval for admission to the accelerated BS/MS program must be initiated at the beginning of the second semester of the junior year.

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**‡** In order to progress into 2nd year courses in AME, students must successfully complete (grade C or better) MATH 1914; MATH 2924; PHYS 2514 and CHEM 1315 with 3.0 Combined Retention GPA, and possess a minimum 3.0 Combined Retention GPA in 24 or more credit hours.

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Students who must take foreign language at the University will have an additional 6-10 hours of coursework.

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Aerospace Engineering Accelerated BS/MS — A010/F010 — Page 2

COURSES IN AEROSPACE AND MECHANICAL ENGINEERING (AME)

2113 Statics. Prerequisite: Physics 2514 and Mathematics 2433 or 2934 or concurrent enrollment in Mathematics 2433 or 2934. 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, Sp)

2213 Thermodynamics. Prerequisite: Mathematics 2433 or 2934; 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 equations to relate thermodynamic 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. Prerequisite: Concurrent 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 or 2934. 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 or 1914. Visualization and modeling techniques for product design and development. Design methodology, graphical standards, projection theory, freehand sketching, spatial geometry, CAD systems, geometric modeling, and tolerancing. Solving open-ended design and visualization problems. (Lab) (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 and oblique shock relations; Prandtl-Meyer expansion waves, quasi-one-dimensional flow through nozzles and diffusers. (F, Sp)

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 slender 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. Embedded systems and real-time 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 3253. Propulsion systems, review of compressible flow, combustion and thermochritional analysis, reciprocating engines, gas turbine and jet engines, current developments in propulsion systems. (F)

4273 Aerospace Systems Design I (Slashed 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 (Slashed 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 (Slashed with 5493). Prerequisite: Physics 2524, Mathematics 2443 or 2934. Selected topics in astrophysics which may include astrodynamics, stellar structure and evolution, stellar pulsation, supernova black holes, intergalactic structure and clusters and superclusters, active galaxies, quasars, and cosmology. No student may earn credit for both 4493 and 5493. (F)

G4513 Flight Controls (Slashed 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)

G5573 Advanced Aerospace 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.)

G5900 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 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, law of gases and changes in state, stoichiometry, atomic theory, electron configuration, periodicity, bonding, molecular structure and biochemistry. Laboratory (F, Sp, Su) [II-LAB]

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 laboratory hours. (F)

2002 Professional Development. Prerequisite: sophomore standing. Develop an understanding of engineering ethics, teamwork, leadership, and professional responsibility through the concepts of contemporary, social, and global issues. (F, Sp)

COURSES IN MATHEMATICS (MATH)

1914 Differential and Integral Calculus I. Prerequisite: satisfactory score on the placement test or, for incoming freshmen, an ACT score of 28 or higher and a high school GPA of 3.75 or higher. Duplicates three hours of 1823 and one hour of 2423. Limits and continuity, differentiation, applications of differentiation to optimization and curve sketching, integration, the fundamental theorem of calculus, the substitution rule, applications of integration to computation of areas. (F)

2924 Differential and Integral Calculus II. Prerequisite: 1914 with a grade of C or better. Duplicates two hours of 2423 and two hours of 2433. Further applications of integration, the natural logarithmic and exponential functions, indeterminate forms, techniques of integration, improper integrals, parametric curves and polar coordinates, infinite sequences and series. (F)

2934 Differential and Integral Calculus III. Prerequisite: 2924 with a grade of C or better. Duplicates one hour of 2433 and three hours of 2443. Vectors and vector functions, functions of several variables, partial differentiation and gradients, multiple integration, line and surface integrals, Green-Stokes-Gauss theorems. (F)


G3413 Physical Mathematics I. Prerequisite: 2443 or 2934 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 or Mathematics 1914 with grade of C or better. 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 or 2624 with a grade of C or better. Not open to students with credit in 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)