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

B.S. Portion of the Program Accredited by the Engineering Accreditation Commission of ABET, **http://www.abet.org**

GALLOGLY COLLEGE OF ENGINEERING

THE UNIVERSITY OF OKLAHOMA

For Students Entering the Oklahoma State System for Higher Education **Summer 2018 through Spring 2019**

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

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 **1914**, Differential and Integral Calculus I (Core I)	4	+MATH **2924**, Differential and Integral Calculus II	4
	HIST 1483, U.S. 1492-1865, **or** **1493**, U.S. 1865-Present (Core IV)	3	**PHYS 2514**, General Physics for Engineering & Science Majors (Core II)	4
	ENGR 1411, Freshman Engineering Experience	1	**P SC 1113**, American Federal Government (Core III)	3
			C S 1313, Programming for Non-Majors with C	3
	TOTAL CREDIT HOURS	**16**	**TOTAL CREDIT HOURS**	**17**
‡ 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.				
SOPHOMORE	+MATH **2934**, Differential and Integral Calculus III	4	**MATH 3413**, Physical Mathematics I	3
	PHYS 2524, General Physics for Engr. & Science Majors	4	**MATH 3401**, Numerical Methods with MATLAB	1
	AME 2113, Statics	3	**AME 2303,** Design & Manufacturing Processes	3
	AME 2213, Thermodynamics	3	**AME 2533**, Dynamics	3
	❖**AME 2223**, Intro. to Aerospace Engineering	3	**AME 2623**, Circuits and Sensors	3
			†Approved Elective: Artistic Forms (Core IV)	3
	TOTAL CREDIT HOURS	**17**	**TOTAL CREDIT HOURS**	**16**
JUNIOR	**AME 3112**, Solid Mechanics Lab	2	**AME 3103**, Interactive Engineering Design Simulation	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.

*CHEM 1315 can be substituted with CHEM 1335 (Fall only).

† 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.

+MATH 1823, 2423, 2433, and 2443 sequence can be substituted for MATH 1914, 2924, and 2934.

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

COURSES IN AEROSPACE AND MECHANICAL ENGINEERING (AME)

2113 Statics. Prerequisite: Physics 2514; MATH 1823 or 1914; MATH 2423 or 2924; and CHEM 1315 all with a minimum grade of C or better with an overall average of 3.0 in these four courses. (AP credit accepted and weighted based upon score.) 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)

2213 Thermodynamics. Prerequisite: Physics 2514; MATH 1823 or 1914; MATH 2423 or 2924; and CHEM 1315 all with a minimum grade of C or better with an overall average of 3.0 in these four courses. (AP credit accepted and weighted based upon score.) Mathematics 2433 or 2934; and Physics 2524, or concurrent enrollment in MATH 2433 or 2934 and PHYS 2524. 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: PHYS 2514; MATH 1823 or 1914; MATH 2423 or 2924; and CHEM 1315 all with a minimum grade of C or better with an overall average of 3.0 in these four courses. (AP credit accepted and weighted based upon score.) Introduction to the foundational dynamics of aerospace vehicles, propulsion system performance, and basic aerodynamic forces and conventions. (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 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: Physics 2514; MATH 1823 or 1914; MATH 2423 or 2924; and CHEM 1315 all with a minimum grade of C or better with an overall average of 3.0 in these four courses. (AP credit accepted and weighted based upon score.) 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 Simulation. Prerequisite: AME 3143, Solid Mechanics; and AME 3153, Fluid Mechanics or AME 3253, Aerodynamics. Visualization and introductory finite element modeling techniques for product design and development. Three-dimensional CAD modeling, components and assemblies, graphic standards, dimensions and tolerances, engineering drawings. Introduction to finite element methods for structural and fluid mechanics problems, with verification. (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: AME 2113 or ENGR 2113; MATH 3113, or MATH 3413 and MATH 3401; AME 2303; AME 2533. 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: AME 2213, AME 2223, AME 2533, MATH 3413 and MATH 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: AME 3253 or concurrent enrollment. Operation and calibration of a subsonic wind tunnel. Experimental testing of airfoils, model airplanes, and aerodynamic shapes. Calibration and use of balance and associated test equipment. **Laboratory** (F)

3333 Flight Mechanics. Prerequisites: AME 2223, AME 2533, and AME 3253. Classical linear stability analysis and equations of motion in the body frame for rigid body aircraft. Static and dynamic analysis of aircraft open loop stability. Aircraft design topics including weight and balance, trim, and control sizing. (Sp)

3523 Aerospace Structural Analysis. Prerequisites: AME 3143, MATH 3401 and MATH 3413. 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. Prerequisites: AME 2213 and AME 3253. Propulsion systems, review of compressible flow, combustion and thermochemical analysis, gas turbine and jet engines, rocket vehicles, chemical rockets. This course is approved for graduate credit. (F)

4273 Aerospace Systems Design I (Slashlisted with 5273). Prerequisites: AME 3103, AME 3253, AME 3333, and AME 3523 or permission of the instructor. Analysis, design, and optimization of an aerospace system. Performance analysis, mission simulation, and multi-disciplinary optimization of flight vehicles using both classical and modern 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: AME 4273 or permission of the instructor. Synthesis course that emulates a team aircraft design program from conceptual design to flight test and mission evaluation. Conceptual design, preliminary analysis, detailed CAD, FEA, and CFD analysis; optimization of aircraft configuration. Advanced design, analysis, and fabrication methods based on a complete flight vehicle, a propulsion system, a structural system, or a control system. **Laboratory.** No student may earn credit for both 4373 and 5373. (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 or 2934. 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). Prerequisites: AME 3333 and AME 4383. Classical and modern control theory with applications to aircraft flight control system design. No student may earn credit for both 4513 and 5513. (F)

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. General Chemistry is an overview of the chemical basis of natural phenomena. First of a two-semester sequence in general chemistry. Topics covered: basic measurement, atomic theory, electron configuration, periodicity, chemical reactivity and energetics, stoichiometry, gas laws and changes in state, bonding and molecular structure. A student may not receive credit for this course and CHEM 1335. **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 Non-Majors with C. Prerequisite: MATH 1523 or concurrent enrollment. Introduction to the design and implementation of computer programs. Emphasis on problem solving. Topics include: variables and constants, arithmetic and Boolean expressions, conditional statements, loops, procedures and functions, arrays, standard libraries, input and output, structures, and program documentation. (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)

2002 Professional Development. Prerequisite: ENGR 1410 or ENGR 1411, or ENGR 3511 or ENGR 3410 or concurrent enrollment; ENGL 1213 or EXPO 1213, and 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. (Sp)

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 variable, partial differentiation and gradients, multiple integration, line and surface integrals, Green-Stokes-Gauss theorems. (F)

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 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 2924 with a grade of C or better. Not open to students with credit in 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)