SCHOOL OF AEROSPACE AND MECHANICAL ENGINEERING

Ramkumar Parthasarathy, Ph.D., Director
Yingtao Liu, Ph.D., Graduate Liaison
Room 212 Felgar Hall
865 Asp Avenue
Norman, OK 73019-1052
Phone: (405) 325-5011
www.ou.edu/coe/ame

General Information

Aerospace Engineering

Aerospace engineering is one of the most rewarding and challenging branches of engineering. There is a fulfilling excitement in designing and building flying craft ranging from general aviation to high-performance military aircraft and commercial airliners to drones. There are also opportunities in the design and flight of spacecraft and unmanned vehicles. Challenging space projects are awaiting the next generation of engineers. Aerospace technology has also expanded to include ground effect machines, helicopters, hydrofoil ships, high-power lasers, wind turbines, and high-speed rail vehicles, opening up even more career opportunities for aerospace engineers.

Careers

Aerospace engineers work in industries or government agencies whose mission is to design, test, manufacture, or operate aircraft or spacecraft. Opportunities are available in companies that build large commercial aircraft and companies that specialize in the smaller general aviation aircraft and drones. Careers in private industry and government include work on commercial and military aircraft, UAVs, missiles, spacecraft and satellites.

Engineers employed by the National Aeronautics and Space Administration (NASA) are involved in research, design, development and operation of the U.S. space program and in many aspects of aeronautics. Also, some aerospace engineers find satisfying careers in applying their broad engineering knowledge to other areas of technological development.

Mechanical Engineering

Mechanical engineering is one of the most versatile of all engineering programs. Most branches of industry employ mechanical engineers. The profession encompasses breadth, flexibility and the opportunity for great individuality. Mechanical engineers apply knowledge of material and thermal sciences, fluid and solid mechanics, and mathematics to design, develop, and build mechanical and electromechanical devices and systems.

Since most physical devices and systems have one or more mechanical aspects, mechanical engineering is almost always required in the design, manufacture and utilization of any technical product or system.

Careers

The career opportunities available to mechanical engineers are truly unlimited. Mechanical engineering plays a central role in all major industries including the aerospace, automotive, chemical, computer, construction, electrical, machinery, metals, petroleum and nuclear industries. Mechanical engineers are employed in most technological field including industrial machinery, oil and gas, energy farm equipment, textiles, transportation, pharmaceutical, medical instrumentation, apparel manufacturing, electronics, soap and cosmetics, paper and wood products, education, utilities, and office machinery.

In these and other fields, mechanical engineers are involved in research, development, design, production and testing, construction, operations, sales, management, consulting, and teaching. Mechanical engineers are also employed in defense laboratories and in government where they hold positions of responsibility in state and federal government, in big and small corporations, and in private practice.

Programs & Facilities

Research Facilities

The school's laboratories are primarily located in Felgar Hall and the Engineering Research Center on North Campus and the South Campus. Specialized laboratories have been developed for additive manufacturing, combustion and propulsion, composite materials and structures, robotics, stress analysis and mechanical behavior of materials, fatigue, fluid flow and heat transfer, aerodynamics, hypersonics, material characterization and development, structural health monitoring and biomedical applications.

These laboratories are equipped with modern instrumentation and dedicated data acquisition systems.

Within AME, a departmental computer laboratory is available for use in courses and research. Several other computer laboratories are also available on campus.

The **L.A. Comp Subsonic Wind Tunnel** is located on the Norman campus at the foot of the OU water tower. It is a closed circuit, 4 ft. x 6 ft. test section tunnel, capable of producing wind speeds over 175 miles per hour.

The AME Machine Shop, located in the basement of Felgar Hall, supports the academic and research programs of the school.

See About AME Research for more information concerning Instructional labs and research labs.

Undergraduate Study

Aerospace and Mechanical Engineering Program Educational Objectives (PEOs)

Program Educational Objectives are broad statements that describe what graduates are expected to attain within a few years of graduation.

a. Our graduates will have successful professional careers in industry, government, academia or non-profit organizations.

b. Our graduates will be successful in solving the engineering problems associated with the lifecycle of complex systems.

c. Our graduates will continue to learn and advance their careers through activities such as participation in professional organizations, attainment of professional certification and post-graduate study.

Aerospace Engineering Student

Student outcomes are statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge and behaviors that students acquire as they progress through the program.

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. An ability to communicate effectively with a range of audiences

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

8. Knowledge of the major aeronautical topics and some astronautical topics

Mechanical Engineering Student

Student outcomes are statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge and behaviors that students acquire as they progress through the program.

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. An ability to communicate effectively with a range of audiences

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

8. Knowledge of thermal and mechanical systems

Curriculum in Aerospace Engineering

For detailed semester by semester curriculum requirements, please see Aerospace Engineering, Bachelor of Science. (Bachelor of Science in Aerospace Engineering accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the General Criteria and the Aerospace and Similarly Named Program Criteria.)

Curriculum in Mechanical Engineering

Standard Option

For detailed semester by semester curriculum requirements for the Standard Option, please see Mechanical Engineering (Standard), Bachelor of Science. (Bachelor of Science in Mechanical Engineering accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the General Criteria and the Mechanical and Similarly Named Engineering Programs Program Criteria.)

Premedical Option

The understanding of many physical phenomena associated with the human body is enhanced by the knowledge gained in the study of mechanical engineering. The fluid mechanics of the cardiovascular system, the kinetics and stress analysis of orthopedics, the dynamics of the auditory system are but a few examples of the interaction of mechanical engineering and medicine. Research and development of many diagnostic and treatment techniques are intimately interwoven with principles studied in mechanical engineering.

Students enrolled in the Mechanical Engineering B.S. curriculum and interested in studying medicine or dentistry may choose a premedical elective pattern. This elective pattern allows the student to earn a B.S. degree in Mechanical Engineering and satisfy the prerequisite course requirements for the University of Oklahoma's medical or dental schools.

For detailed semester by semester curriculum requirements or the Premedical Option, please Mechanical Engineering (Premedical Option), Bachelor of Science.

Pre-med students should consult their Pre-Health and Pre-Medical Professions advisor *as well as their Mechanical Engineering advisor for necessary medical school information.*

Accelerated Bachelor of Science/Master of Science

The School of Aerospace and Mechanical Engineering also offers an accelerated combined BS/MS program to qualified students. This program provides the opportunity for students to complete both the undergraduate and master's degrees in five years.

- Aerospace Engineering, Bachelor of Science/Master of Science
- Mechanical Engineering (Standard), Bachelor of Science/Master of Science

More detailed information on the M.S. degree program and its requirements may be obtained from the Student Services Coordinator of the School of Aerospace and Mechanical Engineering.

Graduate Study

The School of Aerospace and Mechanical Engineering offers a broad range of opportunities for advanced academic study and research in the fields of aerospace and mechanical engineering and in the underlying engineering sciences.

The following paragraphs present only the standard minimum requirements and are no more than guidelines, not intended to exclude

consideration of any valid academic objectives. The admission evaluation, the academic plan, and the research studies of each student should represent a unique synthesis of program strengths and resources with that student's background and aspirations.

Questions about the programs or about any specific requirement or consideration may be addressed to the Student Services Coordinator in the School of Aerospace and Mechanical Engineering, 865 Asp Avenue, 212 Felgar Hall, University of Oklahoma, Norman, OK 73019-1052.

Areas of Specialization

There is an overlap of the graduate programs in these closely allied fields of the School, and several areas of specialization have evolved within and across these primary disciplines.

Mechanical Engineering

These programs can be categorized into the focus areas of materials, design and manufacturing; intelligent systems; bioengineering, and energy systems and propulsion. These include solid mechanics, fluid mechanics, thermal sciences and heat transfer, controls, robotics, engineering design, and bioengineering.

- Current studies in **solid mechanics** include: experimental mechanics; structural dynamics; mechanical behavior of materials; analysis and processing of composite materials and structures; structural optimization; fatigue and fracture mechanics characterization, additive manufacturing of metals and composite materials; and smart structures.
- Current studies in **fluid mechanics** include: computational fluid dynamics; compressible and hypersonic flows; viscous flows; non-Newtonian fluids; rheology; transport phenomena; turbulent jets and boundary layers; and multiphase flows.
- Current studies in **thermal sciences** include: theoretical and applied studies of radiative, conductive, and convective heat transfer; thermal properties of materials; combustion and flame dynamics; propulsion; renewable and alternate energy systems including battery-based and hydrogen-based systems; mass transfer and handling of alternate fuels for automobile applications; biological heat transfer; heat transfer in porous media and EHD enhanced heat transfer.
- Current **control studies** include: structural control; and non-linear, robust, autonomous, optimal, and real-time control of systems and vehicles.
- Current **engineering design** studies include: energy system design; materials in design applications; product and product family design; development and applications of computer-aided design and engineering; internet based design; tool integration for concurrent engineering; computer-integrated manufacturing; and rapid prototyping.
- Current studies in **bioengineering** include: biomechanics, biomaterials; implantable devices

Aerospace Engineering

These graduate programs offer opportunities for specialization in aeroservoelasticity; aerospace structures; structural and multidisciplinary design optimization (MDO); flight controls; aerodynamics; propulsion; hypersonics; combustion and flame dynamics; multiphase flows; non-equilibrium flows; computational methods; aeroelasticity; robotics; intelligent systems; astrodynamics; space vehicle/mission design; computational fluid dynamics; and flight vehicle design and synthesis.

Engineering Analysis

Coordinated graduate programs share techniques of advanced engineering analysis, with current emphasis on finite element methods, nonlinear analysis, variational calculus, perturbation methods, computational fluid mechanics, and optimization methodologies.

Prerequisites for Full Graduate Standing

In addition to meeting the general requirements of the Graduate College, prospective students are expected to have previously earned a B.S. degree or its equivalent in the respective fields of aerospace or mechanical engineering. Students with baccalaureate degrees in other engineering disciplines, physical sciences or mathematics who meet the Graduate College requirements may be conditionally admitted to the AME graduate programs with the stipulation that they must complete specified undergraduate courses to correct identified deficiencies in their background.

Evidence of successful academic potential is considered for admission to the graduate program. This is most commonly indicated by the achievement of a grade point average of 3.2 or better on a 4.0 scale (or an equivalent achievement as reflected in the grading system of the applicant's previous education program) for the most recent two years of academic work. GRE scores (optional), letters of reference, and the statement of purpose are also considered in the admission process. Applicants who have a strong research commitment and an intention to pursue graduate studies through the doctoral level are particularly encouraged. Details concerning the admission criteria and the required background courses may be obtained from the School of Aerospace and Mechanical Engineering.

Master of Science

General Information

The degree of Master of Science in Aerospace or Mechanical Engineering usually requires the completion of an original research thesis in addition to coursework beyond the baccalaureate level.

Thesis Program (Standard)

The traditional research-oriented M.S. program with thesis emphasizes an advanced study and research experience that is particularly suited to prepare students for research and development careers in the industry or the government and for further graduate studies. To be eligible for the research option, a student must have identified an appropriate research area and be accepted as an M.S. thesis student by a member of the AME graduate faculty.

Non-Thesis Program

The coursework-emphasis plan is designed to meet the professional needs of part-time students and other students whose background and educational goals may be best served by additional instructed study in lieu of the research investigation involved in an M.S. thesis. To pursue this plan-of-study, students must indicate interest in the coursework-emphasis program on the application for admission. After admission, these students are encouraged to identify faculty members who will serve as their academic M.S. program advisors or they may complete the program under the overall guidance of the Graduate Liaison. The non-thesis M.S. program culminates in a comprehensive examination.

Students pursuing the thesis option are given preference in graduate assistantship consideration.

Students wishing to change from the thesis to non-thesis option must petition the AME graduate liaison. If the petition is approved, no more than 24 hours of credit will be transferred towards the fulfillment of the course requirements in the non-thesis option. Such a transfer cannot take place during a semester.

Accelerated BS/MS Program

The School of Aerospace and Mechanical Engineering also offers an accelerated combined BS/MS program to qualified students. This program provides an opportunity for students to complete both the undergraduate and master's degrees in five years.

More detailed information on the M.S. degree program and its requirements may be obtained from the Student Services Coordinator of the School of Aerospace and Mechanical Engineering.

Doctor of Philosophy

The degree of Doctor of Philosophy (Ph.D.) in aerospace engineering or mechanical engineering requires the completion of an original research dissertation in addition to coursework beyond the bachelor's/master's degree.

Our Ph.D. program emphasizes an advanced study and research experience that is particularly suited to prepare students for research careers in industry or government and for positions in academia. To be eligible for the program, a student must have been admitted into the Ph.D. program. The student must then identify an appropriate research area and must be accepted as a Ph.D. student by a member of the AME graduate faculty. A general exam and a dissertation defense at the end of the research program assures that the student meets the high standards of this terminal degree.

Students must complete at least 42 hours of coursework and at least 42 hours of dissertation work for a minimum of 90 hours beyond the undergraduate degree.

Courses

AME 2102 Engineering Design Graphics 2 Credit Hours
Prerequisite: Sophomore standing and majors only; ENGR 1413, and MATH 1914 or MATH 2423. Visualization and modeling techniques for product design and development. Design methodology, graphic standards, projection theory, freehand sketching, and spatial geometry. Three-dimensional Computer-Aided-Design modeling, components and assemblies, graphic standards, geometric dimensioning and tolerancing, engineering drawings. Solving open-ended design and visualization problems. (Sp)

AME 2113 Statics 3 Credit Hours
Prerequisite: (PHYS 2514; MATH 1823 or 1914; MATH 2423 or 2924; and CHEM 1315 all with a minimum grade of C; MATH 2433 or 2934 or concurrent enrollment. 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)

AME 2213 Thermodynamics 3 Credit Hours
Prerequisite: Majors only; (Physics 2514; MATH 1823 or 1914; MATH 2423 or 2924; and CHEM 1315) all with a minimum grade of C. First and second laws 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)

AME 2223 Introduction to Aerospace Engineering 3 Credit Hours
Prerequisite: AE majors (A010 & B010) only; PHYS 2514; MATH 1823 or 1914; MATH 2423 or 2924; and CHEM 1315 all with a minimum grade of C. Introduction to the foundational dynamics of aerospace vehicles, propulsion system performance, and basic aerodynamic forces and conventions. (F)

AME 2303 Materials, Design and Manufacturing Processes 3 Credit Hours
(Crosslisted with I E 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)

AME 2402 Engineering Computing 2 Credit Hours
Prerequisite: MATH 1823 or 1914 or concurrent enrollment; Majors only. Introduction to computer programming and university computing facilities. Program design and development: computer application exercises in engineering. (F)

AME 2533 Dynamics 3 Credit Hours
Prerequisite: AME 2113, MATH 2433 or 2934; Majors only. 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)

AME 2623 Circuits and Sensors 3 Credit Hours
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; MATH 3413 and 3401 or concurrent enrollment; PHYS 2524 or concurrent enrollment; Majors only. 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)

AME 3103 Interactive Engineering Design Simulation 3 Credit Hours
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)

AME 3112 Solid Mechanics Lab 2 Credit Hours
Prerequisite: 3143 or concurrent enrollment. Measurement of displacement; velocity, acceleration, force, torque, strain, stress, data acquisition and processing; data and uncertainty analysis; report writing. (F)

AME 3122 Heat Transfer and Fluid Mechanics Lab 2 Credit Hours
Prerequisite: AME 3112; AME 3173 or concurrent enrollment. Basic measurement concepts in fluid mechanics and thermal science. Concepts and methods of measuring pressure, temperature, flow, thermal and transport properties. Laboratory. (Sp)

AME 3143 Solid Mechanics 3 Credit Hours
Prerequisite: 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)

AME 3153 Fluid Mechanics 3 Credit Hours
Prerequisite: AME 2113, AME 2213, AME 2533, and MATH 3113; majors only. Principles of fluid mechanics: fluid statics, flow descriptions, conservation equations, dimensional analysis, potential flow, viscous flow and internal flow. (F)

AME 3173 Heat Transfer 3 Credit Hours
Prerequisite: AME 2213 and AME 3153 or CEES 2223. Heat transfer by conduction, convection, and radiation; mass transfer and combined modes of heat transfer. (Sp)

AME 3253 Aerodynamics 3 Credit Hours
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)

AME 3272 Windtunnel Laboratory 2 Credit Hours
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)

AME 3333 Flight Mechanics 3 Credit Hours
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)

AME 3353 Design of Mechanical Components 3 Credit Hours
Prerequisite: 2303 and 3143. Analysis and design of mechanical subsystems and selection of elements such as gears, shafts, clutches, brakes and modern mechanical components. (Sp)

AME 3363 Design of Thermal-Fluid Systems 3 Credit Hours
Prerequisite: AME 2402 or C S 1313, AME 3153 or AME 3253, and AME 3173. Design of fluid flow, heat transfer and energy systems including analysis, synthesis and optimization. Topics include but are not limited to: ducts and piping systems, fluid machinery, heat exchangers, thermal storage devices, furnaces, combustors, refrigeration and air conditioning systems. (F)

AME 3413 Vibrating Systems 3 Credit Hours
Prerequisite: 2533 and Mathematics 3113. Free and forced vibrations in lumped-parameter linear systems of one, two or more degrees of freedom. Resonance phenomena, dynamic absorbers; vibration-measuring equipment. Introduction to Laplace transforms and transient vibrations, distributed systems. (Irreg.)

AME 3440 Mentored Research Experience 3 Credit Hours
0 to 3 hours. Prerequisites: ENGL 1113 or equivalent, and permission of instructor. May be repeated; maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it the with the URCP office. Not for honors credit. (F, Sp, Su)

AME 3523 Aerospace Structural Analysis 3 Credit Hours
Prerequisite: 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)

AME 3623 Embedded Real-Time Systems 3 Credit Hours
Prerequisite: AME 2623 or equivalent, C S 1313 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)

AME 3723 Numerical Methods For Engineering Computation 3 Credit Hours
Prerequisite: AME 2402 or C S 1313, and MATH 3113 or MATH 3413. Course uses specific software applications tailored toward aerospace and mechanical engineering. Basic methods for obtaining numerical solutions with a digital computer. Included are methods for the solutions of algebraic and transcendental equations, simultaneous linear equations, ordinary and partial differential equations, and curve fitting techniques. The methods are compared with respect to computational efficiency and accuracy. (F)

AME 3960 Honors Reading 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Consists of topics designated by the instructor in keeping with the student's major program. Coverage includes materials not usually presented in the regular courses. (F, Sp, Su)

AME 3970 Honors Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. The projects covered will vary. Deals with concepts not usually presented in regular coursework. (F, Sp, Su)

AME 3980 Honors Research 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Provides an opportunity for the gifted Honors candidate to work on a special project in the student's field. (F, Sp, Su)

AME 3990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: permission of instructor and junior standing. May be repeated once with change of content. Independent study may be arranged to study a subject not available through regular course offerings. (F, Sp, Su)

AME 4003 Introduction to Structural Health Monitoring 3 Credit Hours
(Slashlisted with AME 5003) Prerequisite: AME 3112 and AME 3143. Comprehensive instruction of structural dynamics, signal processing, passive and active sensing, feature extraction, statistical pattern recognition, nondestructive evaluation methods. No student may earn credit for both 4003 and 5003. (F)

AME 4013 Introduction to Medical Device Design 3 Credit Hours
(Slashlisted with AME 5013; Crosslisted with BME 4013) Prerequisite: Junior standing or permission of instructor. Introduction to medical device design with emphasis on the entire procedure of developing a medical device from identifying the unmet medical need to product launching. Topics include marketing and technology survey, concept development, the biocompatible material, device prototype, bench test, in vitro/in vivo test, clinical trial and FDA regulation. No student may earn credit for both 4013 and 5013. (Sp)

AME 4043 Analysis of Heat Pumping Systems 3 Credit Hours
(Slashlisted with AME 5043) Prerequisite: AME 2213 and AME 3173. A systematic introduction of thermodynamic analysis methods for heat pumping systems, including vapor-compression, absorption and other common heat pumping technologies. A specific focus is on the applications to air-conditioning, heat pump and refrigeration equipment. No student may earn credit for both 4043 and 5043. (F)

AME 4093 Applied Biomechanics - Ear Mechanics 3 Credit Hours
(Slashlisted with AME 5093; Crosslisted with BME 4093) Prerequisite: Junior standing; PHYS 2514; MATH 1823 or 1914; MATH 2423 or 2924; and CHEM 1315 all with a minimum grade of C or better. The course curriculum starts with a review of some basic solid mechanics and fluid mechanics. Then the course will review the applications of mechanics in different biosystems or organs. Finally, this course will cover how to apply mechanics on ear tissue mechanical measurements, ear modeling and ear implant design. No student may earn credit for both 4093 and 5093. (F)

AME 4133 Heat Transfer in Multiphase Systems 3 Credit Hours
(Slashlisted with AME 5133) Prerequisite: MATH 2433, PHYS 2524, AME 2213, AME 3153 and AME 3173; senior standing or permission of instructor. Basic principles for analysis of transport phenomena in multi-phase systems are developed and their application to a wide variety of engineering systems including phase change is presented. The scope is limited to thermodynamics and heat and mass transfer fundamentals in solid-liquid, liquid-vapor and solid- vapor phase change processes with emphasis on condensation, evaporation, sublimation, vapor deposition, boiling, melting and solidification. No student may earn credit for both 4133 and 5133. (Sp)

AME 4143 Nanocomposites 3 Credit Hours
(Slashlisted with 5143) Prerequisite: 3143 or permission from instructor. Nanostructured materials and their interactions with polymer matrices; dispersion of nanoparticles and nanotubes; surface and interfaces; structure and characterization of nanophases; synthesis and processing of structural nanocomposites; characterization of properties of nanocomposites; nanomechanics of elastic modulii; potential applications and design. No student may earn credit for both 4143 and 5143. (Irreg.)

AME 4163 Principles of Engineering Design 3 Credit Hours
Prerequisites: AME 3103, AME 2533, AME 3353. Design process and methodology from concept through analysis, layout and prototyping. Types of design problems, human element in design, computer aid in design, specification development, concept generation, concept evaluation, product generation, function and performance evaluation, prototyping, design for manufacturing, design for assembly, design for life-cycle, sustainability, final product documentation, inclusive intergroup communication, ethics, safety and economics. (F)

AME 4183 Design Theory and Methods 3 Credit Hours
(Slashlisted with AME 5183) Prerequisite: AME 3103 and AME 3723, or permission of instructor. A general understanding of modern design theory and mainstream design methods for support of engineering design. Topics include: game and utility theories, decision-based design, single-objective design optimization, multi-objective design optimization, gradient calculation, multi-disciplinary design optimization, and practical engineering applications. Software tools installed on students' laptops for use in lectures, to work on homework, take tests, and collaborate on class project. No student may earn credit for both 4183 and 5183. (Irreg.)

AME 4193 Introduction to Computer-Aided Design 3 Credit Hours
(Slashlisted with AME 5193) Prerequisite: AME 3103 and MATH 2443/2934, or permission of instructor. A general understanding of computer-aided design and underline theory of commercial CAD systems for support of engineering design. Topics include: e-Design paradigm, geometric modeling, solid modeling (CSG, B-Rep, parametric modeling, direct modeling), assembly modeling, design parametrization, and product data exchange and management. Offered as a laptop course with hands-on lab sessions. No student may earn credit for both 4193 and 5193. (Irreg.)

AME 4213 Biomechanics I 3 Credit Hours
(Slashlisted with AME 5213) Prerequisite: 3143 and 3153 or permission of instructor. Introduction to physiological systems with emphasis on structure and function of tissues and organs; application of continuum mechanics to understanding of tissue and organ behavior at microscopic and macroscopic levels; viscoelastic and solid biomaterials. No student may earn credit for both 4213 and 5213. (F)

AME G4243 Aerospace Propulsion Systems 3 Credit Hours
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)

AME 4263 Computer Integrated Manufacturing 3 Credit Hours
(Slashlisted with AME 5263) Prerequisites: AME 2303 or permission of instructor. A general understanding of computer-based methods for manufacturing and assembly of mechanical products. The concept and methods for product manufacturing and assembly will be introduced from design viewpoint. No student may earn credit for both 4263 and 5263. (Irreg.)

AME 4273 Aerospace Systems Design I 3 Credit Hours
(Slashlisted with AME 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)

AME 4281 Engineering Co-Op Program 1 Credit Hour
(Crosslisted with BME, C S, CEES, CH E, ECE, EPHY and ISE 4281) Prerequisite: Departmental permission and junior standing. May be repeated; maximum credit 6 hours. The Co-Op program provides students an opportunity to enhance their education via career exploration in related professional work experiences. Course assignments help students articulate their experiences by completing journals; mid-term paper; final paper and/or final presentation. Faculty receive an evaluation from the student's Co-Op supervisor who monitors performance. Faculty collaborate with the Co-Op supervisor to ensure student success. (F, Sp, Su)

AME 4283 Concurrent Design and Manufacturing 3 Credit Hours
Prerequisite: 2303, 2533, and 3143. The general concepts and methods in performing concurrent design and manufacturing for product development. Fundamental design theories and methods such as utility theory, state transition matrix method, game theory, and system life-cycle modeling and optimization will be introduced. No student may earn credit for both 4283 and 5283. (F)

AME 4303 Designing for Open Innovation 3 Credit Hours
(Slashlisted with AME 5303) Prerequisite: All seniors in engineering, business, and the sciences or permission of the instructor. Open innovation; designing for sustainability; realizing new complex engineered systems; system definition, verification and validation; identifying and managing dilemmas; Blooms Taxonomy; white space competencies, energy systems. No student may earn credit for both 4303 and 5303. (Irreg.)

AME 4373 Aerospace Systems Design II 3 Credit Hours
(Slashlisted with AME 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].

AME G4383 Control Systems 3 Credit Hours
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)

AME 4393 Renewable Energy Systems and Control 3 Credit Hours
(Slashlisted with AME 5393) Prerequisite: Senior Standing; MATH 2934 or MATH 2443; AME 2402 or CS 1313; AME 3723 or equivalent; MATH 3333 and AME 4383 or ECE G441 are preferred but not required. This course introduces students to the fundamentals of data science methods for the design and operation of energy systems. The course is oriented towards students pursuing a technical career in cleantech, or a graduate study in the energy sciences and engineering. Course contents include: mathematical modeling & analysis, state estimation, optimization, machine learning, and optimal control. No student may earn credit for both 4393 and 5393. (Sp)

AME G4442 Internal Combustion Engines Laboratory 2 Credit Hours
Prerequisite: 3122 or graduate standing. Test equipment and instrumentation, propulsion systems, reciprocating engines, supercharger fuel systems, tests and evaluation. Lecture and Laboratory (Sp)

AME 4493 Space Sciences and Astrodynamics 3 Credit Hours
(Slashlisted with AME 5493) Prerequisites: PHYS 2524, MATH 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)

AME 4503 Nonlinear Dynamical Systems and Control 3 Credit Hours
(Slashlisted with AME 5503) Prerequisite: AME 4383 or Instructor's permission. Students will learn to analyze and control nonlinear dynamical systems and apply that knowledge to real engineering problems. No student may earn credit for both 4503 and 5503. (Sp)

AME 4513 Flight Controls 3 Credit Hours
(Slashlisted with AME 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)

AME 4553 Design Practicum 3 Credit Hours
Prerequisite: senior standing, 3363 and 4163. Design study of actual problems in industry. Lecture and Laboratory (Sp) [V].

AME 4593 Space Systems and Mission Design 3 Credit Hours
(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)

AME G4653 Air Conditioning Systems 3 Credit Hours
Prerequisite: 3173. Theory and design of systems for controlling properties such as temperature, humidity, air purity, air distribution and noise in enclosures. (Sp)

AME 4802 Robotics Laboratory 2 Credit Hours
Prerequisite: AME major only (A010 or B010); AME 3112, C S 1313 or equivalent. Hands-on studies of robot systems with emphasis on semi-autonomous mobile robots. Mechanical, electrical and computational features of robots will be investigated. Lecture and Laboratory (F)

AME G4822 Fluid and Thermal Laboratory 2 Credit Hours
Prerequisite: 3173; 3122 or equivalent or graduate standing. May be repeated with change of content; maximum credit six hours. Experimental studies in heat transfer or fluid mechanics. Lecture and Laboratory (F)

AME G4832 Micro and Nanomaterials Lab 2 Credit Hours
Prerequisites: AME 3112, AME 3143 or equivalent or graduate standing. Introduction of experimental analysis and characterization techniques of different types of advanced materials to include polymeric micro composite materials and nanocomposites. Topics include fabrication methods. Determination of mechanical proper ties, microstructural analysis, nondestructive determination of properties of isotropic and anisotropic solids and microscopy techniques. Laboratory. (Irreg.)

AME 4960 Directed Readings 1-4 Credit Hours
1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean. May be repeated; maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)

AME 4970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: Senior standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

AME 4971 Seminar 1 Credit Hour
(Slashlisted with 5971) Prerequisite: senior standing. May be repeated without limit; maximum credit one hour for a B.S. degree. Recent developments in selected subjects in aerospace and mechanical engineering presented by invited experts from on and off campus. No student may earn credit for both 4971 and 5971. (F, Sp)

AME 4980 Undergraduate Research Studies 1-3 Credit Hours
1 to 3 hours. Prerequisite: permission of instructor. May be repeated; maximum credit six hours. Work with various faculty members on individual research projects. The nature of the research and the hours credit varies. (F, Sp, Su)

AME 4990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: Senior standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)

AME 5003 Introduction to Structural Health Monitoring 3 Credit Hours
(Slashlisted with AME 4003) Prerequisite: Graduate standing, AME 3112, AME 3143, and AME 3353. Comprehensive instruction of structural dynamics, signal processing, passive and active sensing, feature extraction, statistical pattern recognition, nondestructive evaluation methods. No student may earn credit for both 4003 and 5003. (F)

AME 5013 Introduction to Medical Device Design 3 Credit Hours
(Slashlisted with AME 4013; Crosslisted with BME 5013) Prerequisite: Graduate standing or permission of instructor. Introduction to medical device design with emphasis on the entire procedure of developing a medical device, from identifying the unmet medical need to product launching. Topics include marketing and technology survey, concept development, the biocompatible material, device prototype, bench test, in vitro/in vivo test, clinical trial, and FDA regulation. No student may earn credit for both 4013 and 5013. (Sp)

AME 5023 Elastic Stress Analysis 3 Credit Hours
Prerequisite: 3143 and Mathematics 3113; or permission. Theory of stress for continuous media, large displacement strain theory, stress-strain relations for elastic media, plane elasticity, application of theory to modern engineering problems. (F)

AME 5043 Analysis of Heat Pumping Systems 3 Credit Hours
(Slashlisted with AME 4043) Prerequisite: Graduate standing or permission of instructor. A systematic introduction of thermodynamic analysis methods for heat pumping systems, including vapor-compression, absorption, and other common heat pumping technologies. A specific focus is on the applications to air-conditioning, heat pump, and refrigeration equipment. No student may earn credit for both 4043 and 5043. (F)

AME 5063 Composite Materials 3 Credit Hours
Prerequisite: 3143 or permission. Nature and scope of composite materials; stress-strain relations and strength of a single layer of a laminated composite; laminated composite-material beams, plates and cylindrical shells; micromechanics and characterization of stiffness, fracture and transport properties; applications and optimal design. (Irreg.)

AME 5093 Applied Biomechanics - Ear Mechanics 3 Credit Hours
(Slashlisted with AME 4093; Crosslisted with BME 5093) Prerequisite: Graduate standing. The course curriculum starts with a review of some basic solid mechanics and fluid mechanics. Then the course will review the applications of mechanics in different biosystems or organs. Finally, this course will cover how to apply mechanics on ear tissue mechanical measurements, ear modeling and ear implant design. No student may earn credit for both 4093 and 5093. (F)

AME 5133 Heat Transfer in Multiphase Systems 3 Credit Hours
(Slashlisted with AME 4133) Prerequisite: MATH 2433, PHYS 2524, AME 2213, AME 3153 and AME 3173; graduate standing or permission of instructor. Basic principles for analysis of transport phenomena in multi-phase systems are developed and their applications to a wide variety of engineering systems including phase change are presented. The scope is limited to thermodynamics and heat and mass transfer fundamentals in solid-liquid, liquid-vapor and solid-vapor phase change processes with emphasis on condensation, evaporation, sublimation, vapor deposition, boiling, melting and solidification. No student may earn credit for both 4133 and 5133. (Sp)

AME 5143 Nanocomposites 3 Credit Hours
(Slashlisted with 4143) Prerequisite: 3143, graduate standing or permission of instructor. Nanostructured materials and their interactions with polymer matrices; dispersion of nanoparticles and nanotubes; surface and interfaces; structure and characterization of nanophases; synthesis and processing of structural nanocomposites; characterization of properties of nanocomposites; nanomechanics of elastic modulii; potential applications and design. No student may earn credit for both 4143 and 5143. (Irreg)

AME 5183 Design Theory and Methods 3 Credit Hours
(Slashlisted with AME 4183) Prerequisite: Graduate standing or permission of instructor. A general understanding of modern design theory and mainstream design methods for support of engineering design. Topics include game and utility theories, decision-based design, single-objective design optimization, multi-objective design optimization, gradient calculation, multi-disciplinary design optimization, and practical engineering applications. Software tools installed on students' laptops for use in lectures, to work on homework, take tests, and collaborate on class project. No student may earn credit for both 4183 and 5183. (Irreg.)

AME 5193 Introduction to Computer-Aided Design 3 Credit Hours
(Slashlisted with AME 4193) Prerequisite: Graduate standing or permission of instructor. A general understanding of computer-aided design and underline theory of commercial CAD systems for support of engineering design. Topics include: e-Design paradigm, geometric modeling, solid modeling (CSG, B-Rep, parametric modeling, direct modeling), assembly modeling, and design parametrization. Offered as a laptop course with hands-on lab sessions. No student may earn credit for both 4193 and 5193. (Irreg.)

AME 5213 Biomechanics I 3 Credit Hours
(Slashlisted with 4213; Crosslisted with BME 5213) Prerequisite: AME 3143 and AME 3153 or permission of instructor. Introduction to physiological systems with emphasis on structure and function of tissues and organs; application of continuum mechanics to understanding of tissue and organ behavior at microscopic and macroscopic levels; viscoelastic and solid biomaterials. No student may earn credit for both 4213 and 5213. (F)

AME 5263 Computer Integrated Manufacturing 3 Credit Hours
(Slashlisted with AME 4263) Prerequisite: graduate standing in engineering or permission of instructor. A general understanding of computer-based methods for manufacturing and assembly of mechanical products. The concept and methods for product manufacturing and assembly will be introduced from design viewpoint. No student may earn credit for both 4263 and 5263. (Irreg.)

AME 5273 Aerospace Systems Design I 3 Credit Hours
(Slashlisted with AME 4273) Prerequisites: AME 3103, 3253, 3333, 3523 or permission of the instructor. Analysis, design, and optimization of an aerospace system. Performance analysis, mission simulation, and multidisciplinary 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)

AME 5283 Concurrent Design and Manufacturing 3 Credit Hours
Prerequisite: graduate standing in engineering. The general concepts and methods in performing concurrent design and manufacturing for product development. Fundamental design theories and methods such as utility theory, state transition matrix method, game theory, and system life-cycle modeling and optimization will be introduced. No student may earn credit for both 4283 and 5283. (F)

AME 5303 Designing for Open Innovation 3 Credit Hours
(Slashlisted with AME 4303) Prerequisite: Graduate standing in engineering, business, natural sciences, or permission of instructor. Open innovation; designing for sustainability; realizing new complex engineered systems; system definition, verification and validation; identifying and managing dilemmas; Blooms Taxonomy; white space competencies, energy systems. No student may earn credit for both 4303 and 5303. (Irreg.)

AME 5333 Thermodynamics and Combustion 3 Credit Hours
Prerequisite: Graduate standing and AME 2213, or permission of instructor. Thermodynamics of non-reacting and reacting mixtures, chemical equilibrium, flame temperature, transport processes in combustion, chemical kinetics, fuels and their combustion properties, premixed and diffusion flames, deflagrations and detonations, practical combustion systems, and pollutant emissions. (Sp)

AME 5373 Aerospace Systems Design II 3 Credit Hours
(Slashlisted with AME 4373) 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. No student may earn credit for both 4373 and 5373. Laboratory. (Sp)

AME 5393 Renewable Energy Systems and Control 3 Credit Hours
(Slashlisted with AME 4393) Prerequisite: Graduate Standing; MATH 2934 or MATH 2443; AME 2402 or CS 1313; AME 3723 or equivalent; MATH 3333 and AME 4383 or ECE G441 are preferred but not required. This course introduces students to the fundamentals of data science methods for the design and operation of energy systems. The course is oriented towards students pursuing a technical career in cleantech or graduate study in the energy sciences and engineering. Course contents include mathematical modeling & analysis, state estimation, optimization, machine learning, and optimal control. No student may earn credit for both 4393 and 5393. (Sp)

AME 5493 Space Sciences and Astrodynamics 3 Credit Hours
(Slashlisted with AME 4493) Prerequisite: PHYS 2524, MATH 2443 or MATH 2934. Selected topics in astrophysics, the solar system; basic orbital mechanics, orbit determination and maneuvers, perturbations, numerical techniques, rendezvous and proximity operations, the N-body problem and approximations, interplanetary transfers. Design considerations. No student may earn credit for both 4493 and 5493. (F)

AME 5503 Nonlinear Dynamical Systems and Control 3 Credit Hours
(Slashlisted with AME 4503) Prerequisite: Graduate standing. Students will learn to analyze and control nonlinear dynamical systems and apply that knowledge to real engineering problems. No student may earn credit for both 4503 and 5503. (Sp)

AME 5513 Flight Controls 3 Credit Hours
(Slashlisted with AME 4513) Prerequisites: permission of instructor. Classical and modern control theory with applications to aircraft flight control system design. No student may earn credit for both 4513 and 5513. (F)

AME 5573 Advanced Engineering Analysis I 3 Credit Hours
Prerequisite: Mathematics 3413 or equivalent. Vector and tensor analysis. Calculus of variations followed by variational methods and/or the method of weighted residuals. (Irreg.)

AME 5583 Advanced Engineering Analysis II 3 Credit Hours
Prerequisite: 5573 or permission. Selected topics in Advanced Engineering Analysis, such as lie theory for ordinary differential equations; eigenvalue problems and spectral analysis; transform methods; solution methods for partial differential equations. (Irreg.)

AME 5593 Space Systems And Mission Design 3 Credit Hours
(Slashlisted with 4593) 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)

AME 5710 Topics in Solid Mechanics 1-3 Credit Hours
1 to 3 hours. Prerequisite: permission of instructor. May be repeated with change of content; maximum credit nine hours for master's degree or twelve hours for a doctoral degree. Selected topics in continuum mechanics, such as theory of continuum mechanics, finite element methods, fatigue analysis and fracture mechanics.

AME 5720 Topics in Fluid Mechanics 1-3 Credit Hours
1 to 3 hours. Prerequisite: 5903 or permission of instructor. May be repeated with change of content; maximum credit nine hours for master's or 12 hours for a doctoral degree program. Concentration in a particular field of specialization in fluid mechanics, such as: rotating flows; hypersonic flow theory; advanced aerodynamics; advanced stability theory; plasma and laser dynamics. (Irreg.)

AME 5740 Topics in Design 1-3 Credit Hours
Prerequisite: permission of instructor. May be repeated with change of content; maximum credit nine hours for master's or 12 hours for doctoral degree program. Selected topics in conceptual, preliminary and final design; CAD and optimization applications.

AME 5763 Introduction to the Finite Element Method 3 Credit Hours
(Crosslisted with CEES 5763) Prerequisite: graduate standing. Weighted residual and variational approaches. Finite element formulation for rod, truss and beam elements; plane stress and plane strain problem; axisymmetric and three-dimensional analysis; isoparametric elements; conforming and nonconforming plate and shell elements. (Sp)

AME 5803 Principles of Heat Transfer 3 Credit Hours
Prerequisite: 3173 or permission. Steady and transient heat conduction in multi-dimensional systems, convective heat transfer for external flows, convective heat transfer for internal flows, radiant heat transfer in lumped systems, integral equations of thermal radiation, and combined mode heat transfer. (F)

AME 5890 Guided Individual Studies 1-4 Credit Hours
1 to 4 hours. Prerequisite: graduate standing and permission. May be repeated; maximum credit nine hours. May be subject to restricted applicability for specific degree requirements. Guided study of selected topics not offered in regularly scheduled classes. Arrangements and work requirements established by prior agreement of instructor and student(s). Students should expect to spend at least sixty hours of reading and study for each credit hour. (F, Sp, Su)

AME 5903 Fundamental Fluid Dynamics 3 Credit Hours
Prerequisite: 3153, 5573 or concurrent enrollment, or permission. Basic laws of fluid motion; Navier-Stokes equations, kinematics of the flow field, vorticity and circulation, basic theorems for inviscid, incompressible flows, potential-flow application, exact solutions. (F)

AME 5913 Viscous Fluid Dynamics 3 Credit Hours
Prerequisite: 5903 or permission. Fundamental exact solutions of viscous flow; Stokes' flow, boundary-layer flow, drag and resistance to motion, elements of heat transfer, effects of compressibility, thin shear layers, jets and wakes, elements of turbulence. (Sp)

AME 5960 Directed Readings 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing and permission of department. May be repeated; maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)

AME 5970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

AME 5971 Seminar 1 Credit Hour
(Slashlisted with 4971) Prerequisite: graduate standing. May be repeated without limit; maximum credit two hours for master's degree or four hours for a doctoral degree. Recent developments in selected subjects in aerospace and mechanical engineering presented by invited experts from on and off campus. No student may earn credit for both 4971 and 5971. (F, Sp)

AME 5980 Research for Master's Thesis 2-9 Credit Hours
Variable enrollment, two to nine hours; maximum credit applicable toward degree, six hours. (F, Sp, Su)

AME 5983 Computational Fluid Dynamics 3 Credit Hours
Prerequisite: 5573, 5903, 5973, or permission of instructor. Methods for the numerical solution of the Euler, boundary-layer, Navier-Stokes and parabolized Navier-Stokes equations. (Irreg.)

AME 5990 Special Projects 1-9 Credit Hours
1 to 9 hours. Prerequisite: graduate standing and permission of instructor. May be repeated but total credit applicable to any degree may be limited. Individual or group R & D projects involving original laboratory, analytical or theoretical investigations and syntheses. Specific objectives and work requirements established by prior agreement of the instructor and student. Students should expect to spend at least 60 hours for each credit hour and to submit appropriate reports or papers. (F, Sp, Su)

AME 6033 Fracture Mechanics 3 Credit Hours
Prerequisite: 5023 or equivalent. Elastic crack-tip stress field, crack-tip plastic zone, energy principle, plane strain fracture toughness, crack opening displacement criterion, fatigue crack propagation and applications. (Irreg.)

AME 6663 Advanced Finite Element Methods 3 Credit Hours
(Crosslisted with CEES 6663) Prerequisite: 5763. Selected topics such as: nonlinear material problems, plasticity, creep (visco-plasticity), fracture, etc.; geometrically nonlinear problems; large displacements and structural stability; dynamic problems and analytical solution procedures; soil-structure interactions, application of the finite element method to fluid and heat transfer problem. (Irreg.)

AME 6960 Directed Readings 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing or permission of instructor. May be repeated; maximum credit six hours. Directed readings and/or literature review under the direction of a faculty member. (Irreg.)

AME 6970 Advanced Topics In Aerospace And/Or Mechanical Engineering 1-3 Credit Hours
Prerequisite: permission of instructor. May be repeated with change of content; maximum credit nine hours for a master's and twelve hours for doctoral degree program. Selected advanced topics in all aspects of aerospace and/or mechanical engineering.

AME 6980 Research for Doctoral Dissertation 2-16 Credit Hours
2 to 16 hours. Prerequisite: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (F, Sp, Su)

AME 6990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)

Faculty

Last Name	First/Middle Name	Middle init.	OU Service start	Title(s), date(s) appointed	Degrees Earned, Schools, Dates Completed
Attar	Peter		2006	ASSOCIATE PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2012	PhD, Duke Univ, 2003; MSc, Duke Univ, 1999; BS, Tufts Univ, 1997
Baldwin	James		1993	DIRECTOR, DYNAMIC STRUCTURES SENSING AND CONTROL CENTER 2006; ASSOCIATE PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING 2001	PhD, Univ of Virginia, 1993; MS, Univ of Virginia, 1990; BS, Univ of Virginia, 1983
Bashetty	Srikanth		2022	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2022	Ph.D, Texas A&M Univ - Kingsville, 2020; M. Tech, JNTU Hyderabad, 2014; B. Tech JNTU Hyderabad, 2012
Billings	Christopher		2023	RESEARCH ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2023	Ph.D , Mechanical Engineering, University Of Oklahoma 2023; B.S, Mechanical Engineering, University of Oklahoma, 2020
Cai	Jie		2017	ASSOCIATE PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2023	PhD, Purdue Univ, 2015; MS, Ball State Univ, 2011; BS, Dalian Univ of Tech, 2009
Chang	Kuang-Hua		1997	DAVID ROSS BOYD PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2013;WILLIAMS COMPANIES FOUNDATION PRESIDENTIAL PROFESSOR, 2005	PhD, Univ of Iowa, 1990; MS, Univ of Iowa; 1987; BS, Taipei Inst of Tech, 1980

Dai	Chenkai		2018	ASSOCIATE PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2018	Ph.D, Biomedical Engineering, Univ of Oklahoma, 2008; M.D., Tongji Medical College, HUST, Wuhan, China, 2000; M.S., Otorhinolaryngology Science, Tongji Medical College, HUST, Wuhan, China, 2003
Dalton	Christopher	R	2000	ASSOCIATE PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2020	PhD, Univ of Oklahoma, 2010; MS, Univ of Oklahoma, 2007; BS, Univ of Oklahoma, 2004
Ding	Hanping		2022	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING,2022	Ph.D., Univ of South Carolina, 2014; M.S, Univ of Science and Technology of China, 2009; B.S, Jilin Univ China, 2006
Diogo	Sanchez	M	2022	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2022	Ph.D Brazilian National Institute for Space Research, INPE, 2015; M.Sc São Paulo State Univ Unesp, Brazil, 2009; B.Sc São Paulo State Univ, Unesp, Brazil, 2007
Gan	Rong		1999	GEORGE LYNN CROSS RESEARCH PROFESSOR 2021; CHARLES E. FOSTER CHAIR IN MECHANICAL ENGINEERING, 2002; PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2006; PRESIDENTIAL RESEARCH PROFESSOR, 2017	PhD, Univ of Memphis, 1992; MS, Univ of Alberta, 1988; MS, Huazhong Univ of Sci & Tech, 1981; BS, Huazhong Univ of Sci & Tech, 1968
Garg	Jivtesh		2013	ASSOCIATE PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2020	PhD, Mass inst of Tech, 2011; MS, Univ of Minnesota, 2002; B Tech, Indian Inst of Tech, 1999
Ghamarian	Iman		2021	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2021	Postdoc, Univ of Michigan 2021; Ph.D., Materials Science and Engineering, Iowa State Univ, 2017; M.S., Materials Science and Engineering, Univ of North Texas, 2012; B.S., Materials Science and Engineering, Sharif Univ of Technology, Iran, 2010
Imbrie	Peter	K	2023	PROFESSOR OF AEROSPACE AND MECAHNICAL ENGINEERING AND SPECIAL ASSISTANT TO THE PROVOST OF UNIVERSITY OF OKLAHOMA, 2023	Ph.D. Aerospace Engineering, Texas A&M University,2000; MS, Aerospace Engineering, Texas A&M University,1985; BS, Aerospace Engineering , Texas A&M University, 1980
Jiang	Yijie		2023	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING,2023	Ph.D. Mechanical Engineering and Applied Mechanics, University of Pennsylvania,2017; M.S, Mechanical Engineering and Applied Mechanics, University of Pennsylvania,2013; B.S, Theoretical and Applied Mechanics, Fudan University, China, 2011
Kayacan	Erkan		2022	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2022	Ph.D., KU Leuven, Belgium 2014; M.SC System Dynamics and Control, Istanbul Technical Univ 2010; B.SC. Mechanical Engineering, Istanbul Univ 2008
Kazempoor	Pejman		2019	ASSOCIATE PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2023	Postdoc, Colorado School of Mines, 2014; Postdoc, Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg,GR,2011; PhD Tarbiat Modares University, 2009: MS, Tarbiat Modares University 2003; BS Yard University 2000
Lai	Fengchyuan		1992	ANADARKO PETROLEUM CORPORATION PRESIDENTIAL PROFESSOR, 2012; PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2009	PhD, Univ of Delaware, 1988; MS, Univ of Delaware, 1985; BS, National Tsing-Hua Univ, 1978
Liu	Yingtao		2014	WILLIAM H. BARKOW PRESIDENTIAL PROFESSOR, 2022;ASSOCIATE PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2020	PhD, Arizona State Univ, 2012; MS, Harbin Inst of Tech, 2006; BS, Harbin Inst of Tech, 2004
Merchan Merchan	Wilson	E	2006	PROFESSOR OF AEROSPACE AND MECHANICAL, 2024	PhD, Univ of Illinois, 2005; MS, Univ of Illinois, 2000; BS, Univ of Illinois, 1998

Mistree	Farrokh		2008	PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2009; L.A. COMP CHAIR IN AEROSPACE AND MECHANICAL ENGINEERING, 2009; ADJUNCT PROFESSOR OF INDUSTRIAL AND SYSTEMS ENGINEERING, 2013	PhD, Univ of California, 1974; MS, Univ of California, 1970; B Tech, Indian Inst of Tech, 1967
Ozawa	Hiroshi		2021	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2021	Ph.D., Aerospace Engineering, Nagoya Univ, 2010; M.S, Aerospace Engineering, Nagoya Univ, 2006; BS, Mechanical and Systems Engineering, Doshi, 2004
Parthasarathy	Ramkumar	N	1994	DIRECTOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2022; PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2009; ANADARKO PETROLEUM CORPORATION PRESIDENTIAL PROFESSOR, 2008	PhD, Univ of Michigan, 1989; MS, Pennsylvania State Univ, 1985; B Tech, Indian Inst of Tech, 1984
Saha	Mrinal		2006	PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2018	PhD, Old Dominion Univ, 2001; MS, Tuskegee, 1996; MS, Bangladesh Univ, 1992; BS, Bangladesh Univ, 1988
Shabgard	Hamidreza		2016	ASSOCIATE PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2022	PhD, Univ of Connecticut, 2014; MS, Amirkabir Univ of Technology, 2007; BS, Azad Univ of Mashhad, 2003
Siddique	Zahed		2000	ASSOCIATE DEAN FOR RESEARCH,2022; DICK AND SHIRLEY O'SHIELD PROFESSOR,2015; PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING,2012	PhD, Georgia Inst of Tech, 2000; MS, Georgia Inst of Tech, 1996; BS, Georgia Inst of Tech, 1994
Song	Li		2009	PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2020; LLOYD G. AND JOYCE AUSTIN PRESIDENTIAL PROFESSOR, 2019	PhD, Univ of Nebraska, 2004; MS, Harbin Inst of Tech, 1996; BS, Shengyang Univ, 1993
Sun	Wei		2018	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2018	PhD, Georgia Inst of Tech, 2017; MS, Georgia Inst of Tech, 2015; BS, Peking Univ, 2010
Vedula	Prakash		2006	PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2018	PhD, Georgia Inst of Tech, 2001; MS, Georgia Inst of Tech, 1998; BS, India Inst of Tech, 1996
Xu	Bin		2021	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2021	Ph.D., Automotive Engineering, Clemson Univ, 2017 B.S., Automotive Engineering, Hunan Univ, China, 2013
Xu	Shuozhi		2023	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING 2023	Ph.D. Georgia institute of Technology Atlanta, Georgia,2016; M.S Georgia Institute of Technology, Atlanta, Georgia, 2015; M.S China Academy of Engineering Physics, Mianyang, China, 2011;B.S, Beihang University Beijing, China, 2008
Zhang	Dong		2021	ASSISTANT PROFESSOR OF AEROSPACE AND MECHANICAL ENGINEERING, 2021	Ph.D., Systems Engineering, Univ of California, Berkeley, 2020; M.S., Systems Engineering, Univ of California, Berkeley, 2016; B.S., Electrical and Computer Engineering, Shanghai Jiao Tong Univ, China, 2015 B.S., Civil and Environmental Engineering, Univ of Michigan, Ann Arbor, 2015