Engineering: Mechanical and Aerospace Engineering

(Computer Science; Mechanical and Aerospace Engineering)

Faculty

Allan A. McKillop, Ph.D., Professor Emeritus
Bruce R. White, Ph.D., Professor Emeritus

Affiliated Faculty

James Schoaf, Ph.D., Lecturer

The Mechanical and Aerospace Engineering Undergraduate Programs

The Department of Mechanical and Aerospace Engineering administers two undergraduate programs in the College of Engineering: (1) Mechanical Engineering, (2) Aerospace Science and Engineering. For more information about our programs, please see http://mae.ucdavis.edu/ug.php.

Mission. The Department of Mechanical and Aerospace Engineering is committed to educating future engineers so that they may contribute to the economic growth and well-being of the state, the nation, and the world, and to the advancement of knowledge in the mechanical and aerospace sciences.

Objectives. The objectives of the programs offered in Mechanical and Aerospace Engineering include the following: (a) to enable graduates to practice mechanical and/or aerospace engineering in a broad range of industries, to enable interested graduates to pursue graduate education, (b) to provide students with the ability to synthesize information from a broad background in creative and innovative efforts in science, engineering, and technology and to allow interested graduates to pursue entrepreneurial endeavors.

Preparatory Requirements. In order to change to any major offered by the Department of Mechanical and Aerospace Engineering, students must:

- Be a registered student and have completed at least one quarter (minimum of 12 units) at UC Davis;
- Have completed not more than 135 cumulative units (excluding AP units);
- Be in good academic standing and meet minimum progress requirements;
- Have received a letter grade for all courses that satisfy Engineering degree requirements;
- Have: a) completed at least the following five courses: Mathematics 21A, 21B, 21C; Physics 9A and 9B; and have a GPA of 2.800 or better in all of these courses; b) have a 2.800 UC GPA in completed engineering courses.

Suggested technical electives:

- Aerospace Science and Engineering 144, Civil and Environmental Engineering 144, Chemical Engineering 161A, 161B, Mechanical Engineering 121, 134, 150B, 160 (only one unit of credit towards Technical Electives requirement)
- Mechanical Engineering 122, 160 (only one unit of credit towards Technical Electives requirement)
- Mechanical Engineering 121, 134, 150B, 151, 152, 154, 161, 163


Biomedical and Mechanical Fluid Mechanics. This field of study is based on the fundamentals of fluid mechanics and their broad range of applications in the biomedical and engineering areas. Areas of current research include biofluid circulations and their potential role in the regulation of normal physiological function and in the development of disease; groundwater and atmospheric flows and their implications for pollutant transport and environmental concerns; aerodynamic flow around transport vehicles and its impact on vehicle performance; and flow in combustion engines and other energy systems with considerations of efficiency and environmental impact. These areas are investigated both experimentally and computationally.

Suggested elective courses:

- Aerospace Science and Engineering 138 Engineering 160 (only one unit of credit towards technical requirements)
- Chemical Engineering 161A, 161B
- Mechanical Engineering 144, 149
- Mechanical Engineering 161, 163


Combustion and the Environment. Combustion is widely used for energy generation, propulsion, heating, and waste disposal, as well as for
Heat Transfer, Thermodynamics, and Energy Systems. This specialization emphasizes the fundamentals of heat transfer and thermodynamics and their applications to the design of advanced engineering systems. The objective of the program is to introduce students to the fundamental processes of heat transfer and thermodynamics in complex engineering systems and to develop effective design methods for power generation, propulsion, heat exchangers, industrial processes, reﬁning, and chemical processing. This area of specialization is important to many industries—chemical, defense, automobile—as well as to the thermal design of electronic and computer packages.

Suggested technical electives:

- Aerospace Science and Engineering 138 Mechanical Engineering 161, 163
- Aerospace Science and Engineering 138 Mechanical Engineering 161, 163
- Manufacturing, Manufacturing is concerned with the conversion of raw materials into finished products by a variety of processes, such as machining, forming, casting, and molding. Modern manufacturing technology is increasingly dependent upon integration with computer-aided design systems and precision computer controls. State-of-the-art laboratories offer the opportunity for hands-on experience with a wide spectrum of manufacturing equipment. Manufacturing engineers must have expertise in design, materials, controls, statistical methods, computer software, and microprocessor applications.

Suggested technical electives:

- Biomedical Engineering 118/Electrical and Computer Engineering 142
- Electrical and Computer Engineering 160
- Materials Science and Engineering 180, 181
- Mechanical Engineering 1508, 151, 154

Suggested Advisers:


System Dynamics and Control: Engineers are increasingly concerned with the performance of integrated dynamic systems in which it is not possible to optimize component parts without considering the overall system. System dynamics and control specialists are concerned with the modeling, analysis, and simulation of all types of dynamic systems and with the use of automatic control techniques to change the dynamic characteristics of systems in useful ways. The emphasis in this program is on the physical systems that are closely related to mechanical engineering, but the techniques for studying these systems apply to societal, economic, and biological systems. Ongoing research includes projects on continuously variable transmission systems, active and semi-active suspension systems, modeling and control of vehicle dynamics, electromechanical actuator design, electronically controlled steering, the analysis of fuel management systems, and the design of flight control systems with guaranteed closed-loop performance.

Suggested technical electives:

- Aerospace Science and Engineering 129, 139, 141
- Electrical and Computer Engineering 160, 164, 167
- Mechanical Engineering 121, 134, 154

Suggested Advisers:

- F.O. Ile, R.A. Hess, S. Jothi

Ground Vehicle Systems. An important aspect of mechanical engineering is the design of more environmentally benign surface vehicles that provide efﬁcient individual and public transportation. Innovation in this ﬁeld requires competence in vehicle dynamics, control of vehicle dynamics, power sources and power transmission, lightweight structures and systems, alternative fueled power systems, including electrical drives and fuel cells, and mechanical systems.

Suggested technical electives:

- Aerospace Science and Engineering 127, 129, 139
- Civil and Environmental Engineering 130, 149
- Engineering 122, 160 (only one unit of credit towards technical electives requirement)
- Mechanical Engineering 121, 134, 152

Suggested Advisers:

- P.A. Erickson, M. Hill, J. Park, N. Sargis/Alvillan, S. Velinsky

Transportation Systems. As society recognizes the increasing importance of optimizing transportation systems to minimize environmental degradation and energy expenditure, engineers will need to consider major innovations in the way people and goods are moved. Such innovations will require competence in vehicle dynamics, propulsion and control, and an understanding of the problems caused by present-day modes of transportation. Vehicle control requires an understanding of sensors and actuators, and the integration of yet-to-be-proposed concepts into overall vehicular dynamics. Competence in this area will serve students well as they strive towards the development of alternative propulsion concepts, such as electric, hybrid, and fuel cell.

Suggested technical electives:

- Aerospace Science and Engineering 127, 129
- Biological Systems Engineering 114, 120
- Civil and Environmental Engineering 131, 149
- Engineering 122, 160 (only one unit of credit towards Technical Electives requirement)
- Mechanical Engineering 134, 1508, 161, 163

Suggested Advisers:

- P.A. Erickson, J.W. Park, S. Velinsky

Mechanical Engineering Program Requirements

Students are encouraged to adhere carefully to all prerequisite requirements. The instructor is authorized to drop students from a course for which stated prerequisites have not been completed. Exclusively of General Education units, the minimum number of units required for the Mechanical Engineering major is 159.

Lower Division Required Courses

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<th>UNITS</th>
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<tr>
<td>Mathematics 21A-21B-21C-21D 16</td>
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<tr>
<td>Mathematics 22A-22B 6</td>
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<tr>
<td>Physics 9A-9B 9C-9D 6</td>
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<tr>
<td>Chemistry 2A-2B or 2AH-2BH 10</td>
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<tr>
<td>Engineering 4 8</td>
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<td>Engineering 6 or Mechanical Engineering 5 4</td>
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<td>Engineering 17, 35, 45 (or 45L) 12</td>
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<tr>
<td>Mechanical Engineering 50 4</td>
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English 3 or University Writing Program 1, 1Y or IV, or Comparative Literature 1, 2, 5, or 4, or Native American Studies 5 (grade of C- or better is required) 4 |

Communication 1 or 3 4

Upper Division Required Courses

Engineering 100, 102, 103, 104, 105, 190 22


Mechanical Engineering 185A & 185B (taken in consecutive quarters), or Aerospace Science and Engineering 138 & 139 8

Select one course from the following Applied Mathematics Electives: Chemical Engineering 140, Civil and Environmental Engineering 114, Computer Science Engineering 130, Mechanical Engineering 180, Mathematics 118A, 128A, 128B, Mechanical Engineering 115, 151, Statistics 130A, 131A 4

Select one course from the following System Dynamics/Mechanical Design Electives: Engineering 122, Mechanical Engineering 121, 139, 1508, 154 or 171 4

Select two courses from the following Restricted Electives: Aerospace Science and Engineering 129, 136, 140, 141, 142, Engineering 122, 160, Mechanical Engineering 180, 182, Mechanical Engineering 134, 152, 161, 163, 164.

Students may also choose from Aerospace Science and Engineering 130, 130B, Mechanical Engineering 121, 139, 1508, 151, 154, 171 if these courses are not used in satisfaction of other degree requirements.

Technical Elective Requirement 8

At least four units must be taken from any Upper Division Engineering course, which may include courses from the above System Dynamics/Mechanical Design or Restricted Elective lists if these courses are not used in satisfaction of other degree requirements.

Up to 4 units may be selected from Mechanical Engineering 185A/B or any engineering 192, 199 not used in satisfaction of other degree requirements.

Courses that cannot be used are Biomedical Engineering 110L, Engineering 160, 191, 198 [Gearing up for Grad School/undergraduate research], Computer Science Engineering 188 or any 197T course.

Up to three units may be used from the following technical electives list:

- Agricultural and Resource Economics 100A, 100B, 112
- Applied Biological Systems Technology 101, 142, 165
- Atmospheric Science 149, 160 Biological Sciences 2A, 2B, 2C Chemistry 2C, 2CH, 8A, 8B and any upper division course except Chemistry 195 and 197 Economics 100, 101, 102, 103, 122 Engineering: Any upper division course offered in the college of engineering except Mechanical Engineering 160, 191, 198 [Gearing Up for Grad School/Undergraduate Research], Computer Science Engineering 188 or any 197T course.

Environmental and Resource Sciences 100, 100L, 121, 131, 136, 185, 186, 186L Exercise Biology 102 Fiber and Polymer Science 100 (same as Materials Science Engineering 147) Food Science and Technology 159, 160 Geology 17, 32, 35, 36, 50, 50L, 60, 100, 100L, 101L, 191, 190, 131, 160, 162, 163 Hydrologic Science 110, 124, 134, 141, 142, 143, 144, 146, 151, 152 Management 11A, 11B, 128, 130, 140, 150, 160, 170, 180 Fall 2011 and on Revised General Education (GE) AA=Arts and Humanities; SC=Science and Engineering; SS=Social Sciences; OL=Other Cultural; DL=Diversity; BE=Basic Writing Experience Pre-Fall 2011 General Education (GE): ArtHum=Arts and Humanities; SciEng=Science and Engineering; SocSci=Social Sciences; Div=Diversity; Wrt=Writing Experience Quarter Offered: =Fall, W=Winter, S=Spring, Su=Summer; 2017-2018 offering in parentheses
Mathematics: any upper division course except Mathematics 97T/197T.

Physics 99E and any upper division course except Physics 160 (restricted to one unit of technical elective), 195, 197T.


Upper Division Composition Requirement: 0 or 4

One course from the following (a grade of C- or better is required): University Writing Program 101, 102E, 104A, 104E, 104T or passing the Upper-Division Composition Exam.

Division of Aerospace Science and Engineering

The Division of Aerospace Science and Engineering administers the Aerospace Science and Engineering Program within the Department of Mechanical and Aerospace Engineering.

Faculty

Roger Davis, Ph.D., Professor
Jean-Pierre Delplancke, Ph.D., Professor
Fidelis O. Eke, Ph.D., Professor
Mohamed M. Hafez, Ph.D., Professor
Ronald A. Hess, Ph.D., Professor
Nesrin Sarigul-Klijn, Ph.D., Professor
Stephen K. Robinson, Ph.D., Professor
Jean-Pierre Delplancke, Ph.D., Professor
Fidelis O. Eke, Ph.D., Professor
Mohamed M. Hafez, Ph.D., Professor
Ronald A. Hess, Ph.D., Professor
Nesrin Sarigul-Klijn, Ph.D., Professor
C. P. (Case) van Dam, D. Engr., Professor

The Aerospace Science & Engineering Undergraduate Program


Aerospace Science and Engineering majors learn to apply the principles of the physical sciences and engineering to the design of aerospace vehicles. Specific objectives include the design, development and manufacture of aerospace vehicles and other transportation systems through the integration of disciplines associated with aerodynamics, propulsion, structures and guidance/control.

Our Bachelor of Science degree in Aerospace Science and Engineering provides a broad background and specialization in mathematics, the physical sciences, and the engineering sciences. These fundamentals, when complemented by the required technical courses, prepare students for employment in government or industry, while simultaneously establishing an excellent foundation for graduate studies.

Students are encouraged to adhere carefully to all prerequisite requirements. The instructor is authorized to drop students from a course for which stated prerequisites have not been completed.

Exclusive of General Education units, the minimum number of units required for the Aerospace Science and Engineering major is 163.

Lower Division Required Courses

Upper Division Required Courses


Select one course from: Engineering 180, Mechanical Engineering 115 or Mathematics 128C.

Technical electives: 12

One course from the following astronautics electives: Aerospace Science and Engineering 140, 141 or 142.

The remaining units must be taken from: EME 139 or EAE 123 or from the above Astronautics Electives list if not used in satisfaction of other degree requirements. Up to 4 units may be selected from any upper-division engineering course including any engineering 192 or 199 or not used in satisfaction of other degree requirements. Courses that cannot be used are Biomedical Engineering 110L, 160, Computer Science Engineering 188 or any 197T course.

The Graduate Program in Mechanical and Aeronautical Engineering

M.S. and Ph.D.

Research Facilities and Partnerships:

- Center for Computational Fluid Dynamics
- Institute of Transportation Studies
- Center for Advanced Highway Maintenance and Construction Technology
- GATE Center for Hybrid Electric Vehicles
- Aeronautical Wind Tunnel Facility

Complete Information on our website at http://mae.ucdavis.edu/grad_studies/

Courses in Engineering: Mechanical (EME)

Courses in Mechanical Engineering (EME) are listed below; courses in Aerospace Science and Engineering (EAE) are listed immediately following; graduate courses in Mechanical and Aeronautical Engineering (MAE) follow.

Lower Division

1. Mechanical Engineering (1)

Lecture—1 hour. Description of the field of mechanical engineering with examples taken from industrial applications, discussions of the practice with respect to engineering principles, ethics, and responsibilities. (P/NP grading only.)—F.

5. Computer Programming for Engineering Applications (4)

Lecture—3 hours; laboratory—3 hours. Prerequisite: Mathematics 16A or 21A (may be taken concurrently). Structured programming in C for solving problems in engineering. Introduction to MATLAB and comparison study of C/C++ with MATLAB. Not open for credit to students who have completed course 124. GE credit: QL, SE, SL, VL.—F.

50. Manufacturing Processes (4)

Lecture/discussion—3 hours; laboratory—3 hours. Prerequisite: C or better in: Engineering 4 and Physics 9A. Restricted to Mechanical Engineering and Mechanical Engineering majors. Modern manufacturing methods, safety, manufacturing instructions, computer-aided manufacturing and their role in the engineer design and development process. GE credit: SciEng, QL, SE, VL.—F, W, Su. (F, W, Su.) Farouki, Linke, Sashi

92. Internship in Mechanical Engineering (1-5)

Internship. Prerequisite: lower division standing; approval of project prior to period of internship. Supervised work-study experience in engineering. May be repeated for credit. (P/NP grading only.)—F.

97TC. Mentoring and Tutoring Engineering in the Community (1-4)

Prerequisite: consent of instructor. Mentoring, coaching, tutoring and/or supervision of students in K-12 schools in Engineering-related topics. May be repeated for credit. (P/NP grading only.)—F.

99. Special Study for Undergraduates (1-5)

Prerequisite: consent of instructor; lower division standing. (P/NP grading only.)
Upper Division

106. Thermo-Fluid Dynamics (4)

139. Stability of Flexible Dynamic Systems (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: C- or better in Engineering 102 and 103. Stability of flexible systems. Introduction to fluid-structure interaction. Mechanical vibrations. Design of mechanical subsystems or systems under constraints. Dynamic instability: flutter, aerodynamic effectiveness. Stability extraction from fluid-structure interactions. Design applications to aerospace, mechanical and biomedical systems. No credit for students who have completed Aerospace and Engineering 139. GE credit: SciEng | QL, SE, SL, VL. — S. (S.) Sariguk-Klijn

150A. Mechanical Design (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in: Engineering 45 or Engineering 45Y; C- or better in both Engineering 104 and course 50 (may be taken concurrently). Restricted to Mechanical Engineering, Aerospace Science and Engineering, Mechanical Engineering/Materials Science and Engineering Majors. Principles of engineering mechanics applied to the design and selection of mechanical components. Design projects, which concentrate on conceptual design, engineering analysis, methods of manufacture, material selection, and cost. Introduction to computational design. GE credit: SciEng | QL, SE, VL, W, W. — F, S, Su. (F, S, Su.) Davis, Delplanque, Hwang, Kennedy, Robinson

150B. Mechanical Design (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in course 150A. Restricted to Mechanical Engineering, Aerospace Science and Engineering, Mechanical Engineering/Materials Science and Engineering Majors. Principles of engineering mechanics applied to the design and selection of mechanical components. Design projects, which concentrate on conceptual design, engineering analysis, methods of manufacture, material selection, and cost. Introduction to computational design. GE credit: SciEng | QL, SE, VL, W, W. — F, S, Su. (F, S, Su.) Farouki, Linke

151. Statistical Methods in Design and Manufacturing (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in course 150A. Restricted to Enrollment Text: Mechanical Engineering, Aerospace Science and Engineering, Mechanical Engineering/Materials Science and Engineering. Principles of engineering mechanics applied to the design and selection of mechanical components. Design projects, which concentrate on conceptual design, engineering analysis, methods of manufacture, material selection, and cost. Introduction to computational design. GE credit: SciEng | QL, SE, VL, W, W. — F, S, Su. (F, S, Su.) Davis, Delplanque, Hwang, Kennedy, Robinson

152. Computer-Aided Mechanism Design (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in course 150A. Restricted to Restrictions on Enrollment Text: Mechanical Engineering, Aerospace Science and Engineering, Mechanical Engineering/Materials Science and Engineering. Principles of engineering mechanics applied to the design and selection of mechanical components. Design projects, which concentrate on conceptual design, engineering analysis, methods of manufacture, material selection, and cost. Introduction to computational design. GE credit: SciEng | QL, SE, VL, W, W. — F, S, Su. (F, S, Su.) Margolis

154. Mechanotronics (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: C- or better in: course 150A and course 156. Restricted to Mechanical Engineering, Aerospace Science and Engineering, Mechanical Engineering/Materials Science and Engineering. Mechanotronics system concept and overview, control system design were architecture, microcontroller and interface technology for mechatronics control, mechatronics systems, actuator drives. GE credit: SciEng | QL, SE, VL, W. — S. (S.) Yamazaki

161. Combustion and the Environment (4)
Lecture—3 hours; lecture/discussion—1 hour. Prerequisite: C- or better in course 106. Restricted to Mechanical Engineering, Aerospace Science and Engineering, Mechanical Engineering/Materials Science and Engineering. Fundamentals of internal combustion engine design and performance. Future needs to adapt to environmental concerns, and the feasibility of better alternatives in the future. GE credit: SciEng | QL, SE, VL, W, W. — F, S, Su. (F, S, Su.) Shaw

164. Introduction to Heating, Ventilation and Air Conditioning Systems (4)
Lecture—4 hours. Prerequisite: C- or better in both courses 106 and 163. Materials, mechanisms and processes associated with heating, ventilation and air conditioning systems (HVAC), including equipment and systems used for HVAC in residential and commercial buildings. Only 2 units for students who have completed Civil and Environmental Engineering 125. Offered in alternate years. GE credit: SciEng | SE, VL, W. — F, S, Su. (F, S, Su.) Davis, Narayanan, Shaw

171. Analysis, Simulation and Design of Mechatronics Systems (4)

172. Automatic Control of Engineering Systems (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in Engineering 100 and 102. Restricted to Mechanical Engineering, Aerospace Science and Engineering, Mechanical Engineering/Materials Science and Engineering. Classical feedback control, block diagrams; control systems performance specifications; steady state errors; rise and settling times; root locus, PID controllers; control design with Bode and Nyquist plots; stability; phase and gain margin; lead and lag compensators, state variable feedback controllers. GE credit: SciEng | QL, SE, VL, W. — F, W, W, Su. (F, W, Su.) Eke, Horsley, Joshi

185A. Mechanical Engineering Systems Design Project (4)
Lecture—1 hour; laboratory—3 hours. Prerequisite: C- or better in: course 150A and course 156 (may be taken concurrently). Communications 1 or 3 recommended; upper division recommended. Restricted to Senior standing in Mechanical Engineering.
189A. Selected Topics in Mechanical Engineering: Energy Systems and the Environment (1-5)
Prerequisite: consent of instructor. Directed group study in Energy Systems and the Environment. May be repeated for credit when the topic is different. Offered irregularly.

189B. Selected Topics in Mechanical Engineering: Energy Systems and the Environment (1-5)
Prerequisite: consent of instructor. Group study in Energy Systems and the Environment. May be repeated for credit when the topic is different. Offered irregularly.

189C. Selected Topics in Mechanical Engineering: Energy Systems and the Environment (1-5)
Prerequisite: consent of instructor. Group study in Energy Systems and the Environment. May be repeated for credit when the topic is different. Offered irregularly.

189D. Selected Topics in Mechanical Engineering: Manufacturing (1-5)
Prerequisite: consent of instructor. Directed group study in Manufacturing Engineering. May be repeated for credit when the topic is different. Offered irregularly.

189E. Selected Topics in Mechanical Engineering: Manufacturing (1-5)
Prerequisite: consent of instructor. Directed group study in Manufacturing Engineering. May be repeated for credit when the topic is different. Offered irregularly.

189F. Selected Topics in Mechanical Engineering: Manufacturing (1-5)
Prerequisite: consent of instructor. Directed group study in Manufacturing Engineering. May be repeated for credit when the topic is different. Offered irregularly.

189G. Selected Topics in Mechanical Engineering: Manufacturing (1-5)
Prerequisite: consent of instructor. Directed group study in Manufacturing Engineering. May be repeated for credit when the topic is different. Offered irregularly.

189H. Selected Topics in Mechanical Engineering: Manufacturing (1-5)
Prerequisite: consent of instructor. Directed group study in Manufacturing Engineering. May be repeated for credit when the topic is different. Offered irregularly.

189I. Selected Topics in Mechanical Engineering: Manufacturing (1-5)
Prerequisite: consent of instructor. Directed group study in Manufacturing Engineering. May be repeated for credit when the topic is different. Offered irregularly.

189K. Selected Topics in Mechanical Engineering: Thermodynamics (1-5)
Prerequisite: consent of instructor. Directed group study in Thermodynamics. May be repeated for credit when the topic is different. Offered irregularly.

189L. Selected Topics in Mechanical Engineering: Vehicle and Transportation Systems (1-5)
Prerequisite: consent of instructor. Directed group study in Vehicle and Transportation Systems. May be repeated for credit when the topic is different. Offered irregularly.

192. Internship in Engineering (1-5)
Internship. Prerequisite: upper division standing; approval of project prior to period of internship. Supervised work experience in mechanical engineering. May be repeated for credit. (P/NP grading only)

197TC. Mentoring and Tutoring in Engineering in the Community (1-4)
Prerequisite: upper division standing; consent of instructor. Mentor experience and/or supervision of students in K-12 schools in Engineering-Related topics. May be repeated for credit. (P/NP grading only)

198. Directed Group Study (1-5)
Prerequisite: consent of instructor. (P/NP grading only)

199. Special Study for Undegraduates (1-5)
Prerequisite: consent of instructor. (P/NP grading only)

Courses in Aerospace Science and Engineering (EAE)
Lower Division
1. Introduction to Aerospace Science Engineering (1)
Lecture—1 hour. Description of the field of aerospace engineering with examples from industry, government, and research. Aerospace engineering principles, ethics, and responsibilities. (P/NP grading only)—F.

10. From the Wright Brothers to Drones and Quadcopters (2)
Lecture—2 hours. History of aircraft and its influence on society. Topics covered will include Unmanned Aerial Vehicles, safety considerations, economics and policy issues. Aerodynamics, stability and control will also be introduced. (P/NP grading only)—F.

10. Special Study for Undergraduates (1-5)
Prerequisite: consent of instructor and lower division standing. (P/NP grading only)

Upper Division
126. Theoretical and Computational Aerodynamics (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in course 127; C- or better in Engineering 180 or Applied Science Engineering 115 or Mechanical Engineering 115 or Mathematics 128C. Development of equations of fluid motion. Study of flow field kinematics and dynamics. Flow over a body. Thin airfoil theory. Viscous effects. Applications of potential flow and lifting analysis and design. GE credit: SciEng or SocSci | SE or SS—Su. (S.)

127. Applied Aircraft Aerodynamics (4)

129. Stability and Control of Aircraft Vehicles (4)

130A. Aircraft Performance and Design (4)
Lecture—2 hours; discussion—1 hour; laboratory—3 hours. Prerequisite: C- or better in course 127; C- or better in course 129 (may be taken concurrently). Major aircraft design experience with multiple realistic constraints including aerodynamics, propulsion, mission analysis, weight estimation, stability and control, and appropriate engineering standards. GE credit: SciEng | QL, VL—W. (W.) van Dam

130B. Aircraft Performance and Design (4)
Lecture—2 hours; discussion—1 hour; laboratory—3 hours. Prerequisite: grade of C- or better in course 130A. Restricted to upper division standing. Major aircraft design experience incorporating multiple realistic constraints including aerodynamics, stability, and control. GE credit: SciEng | VL—S. (S.) van Dam

133. Finite Element Methods in Structures (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: grade of C- or better in Engineering 104. Open to College of Engineering Students. Introduc- tion to the aerospace structural design process. History of aircraft and spacecraft materials. Effects of loading beyond elastic limit. Deflections and stresses due to combined loading. Virtual work principles, and finite element methods. Applications to aerospace structures. GE credit: QL—F. (S.) Sarrig, Klijn

135. Aerospace Structures (4)
Lecture—4 hours. Prerequisite: C- or better in Engineer- ing 104; course 126 or 127 recommended. Analysis and design methods used in aerospace structures. Shear flow in composite and multilayer beam cross-sections, buckling of flat and curved sheets, tension field beams, local buckling. GE credit: SciEng | QL, SE—W. (W.) La Saponara

137. Structural Composites (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: grade of C- or better in Engineering 104. Overview of materials and technology for creating structures from fiber reinforced resin matrix composite material systems. Elementary design analysis and case studies emphasizing aeronautical applications. GE credit: SE—La Saponara

138. Aircraft Propulsion (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in Mechanical Engineering. Aircraft Propulsion—Analysis and design of modern aircraft gas turbine engines. Development and application of cycle performance prediction techniques for important engine configurations. Introduction to the operation and design of modern aircraft gas turbine engines. GE credit: SciEng | QL, SE—W. (W.) R. Davis

140. Rocket Propulsion (4)
Lecture—4 hours. Prerequisite: C- or better in Mechanical Engineering 106. Restricted to upper division standing. Fluid and thermodynamics of rocket engines, liquid and solid rocket propulsion. Space propulsion concepts. GE credit: SciEng | SE—S. (S.) R. Davis, Delplancke

141. Space Systems Design (4)
Lecture—2 hours; discussion—2 hours. Prerequisite: grade of C- or better in Engineering 102 and Mechanical Engineering 106. Introduction to space systems design including space project organization, requirements definition and specification, concepts formulation, system tradeoffs, subsystem design. Prototype space mission concepts are presented and a multidisciplinary mission design is
developed that considers all relevant architecture elements. Offered in alternate years. GE credit: SciEng \( \equiv \) Div, SL, SL, VL, WS, CM

142. Orbital Mechanics (4)
Lecture—4 hours. Prerequisite: grade of C- or better in Engineering 102. Restricted to upper division standing. Satellite orbits, multistage rockets, current global positioning technology. Design and application problems include satellites, trajectory optimizations, and interplanetary trajectories. Not open for credit to student who have completed course Engineering 106. Winter Quarter 2013. GE credit: SciEng \( \equiv \) SE. — W. Su. (Su.)

189C. Flight Simulation and Testing in Design of Aircraft and Spacecraft (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Engineering 102; consent of the instructor. Teaches flight test techniques together with data analysis methods to prepare students for any type of flight testing including fixed wing, rotary wing and launch vehicles. Offered irregularly. GE credit: SciEng \( \equiv \) SE. — Sargil-Klijn

198. Directed Group Study (1-5)
Prerequisite: consent of instructor. (P/N grading only)

199. Special Study for Advanced Undergraduate Students
Prerequisite: consent of instructor. (P/N grading only)

Courses in Mechanical and Aeronautical Engineering (MAE)
(formerly courses in Aeronautical Science and Engineering and Mechanical Engineering.)

Graduate

207. Engineering Experimentation and Uncertainty Analysis (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103 or 105 and 107B. Design and analysis of engineering experiments with emphasis on measurement standards, data analysis, regressions and general and detailed uncertainty analysis. Offered in alternate years. — F. S. J. C. Davis

208. Measurement Methods in Fluid Mechanics and Combustion (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 165 and Engineering 103. Application of shadow, schlieren and other flow visualization methods to the detection of flow patterns, shock waves, laminar and turbulent flows and aerodynamic phenomena. Measurement of velocity and concentrations in reacting and nonreacting flows with laser diagnostic techniques including LDV, Rayleigh, Raman and fluorescence scattering. Offered irregularly. — W. Erickson, Park, Narayanan

210A. Advanced Fluid Mechanics and Heat Transfer (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103, 105 and Mechanical Engineering 165. Development of fundamental equations governing continuity, momentum and energy transfer. Solutions in laminar flow for exact cases, low and high Reynolds numbers and lubrication theory. Dynamics of inviscid flow. — W. Hwang

210B. Advanced Fluid Mechanics and Heat Transfer (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 210A. Study of stability and transition to turbulence, boundary layers, and new technologies. Modeling of turbulence for numerical determination of momentum and heat transfer. — W. (W.) Hwang

211. Fluid Flow and Heat Transfer (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103, 105 and Mechanical Engineering 165 or the equivalent. Design aspects of selected topics; heat conduction, fins; heat transport in ducts, boundary layers and separated flows; heat exchangers. — W. Erickson, Par, Narayanan

212. Biomedical Heat and Mass Transport Processes (4)
Lecture—4 hours; discussion—1 hour. Prerequisite: Mechanical Engineering 165, Biological Systems Engineering 125, Chemical Engineering 153 or the equivalent. Application of principles of heat and mass transfer to biomedical systems related to heat exchange between the biomedical system and its environment, mass transfer across cell membranes and the design and analysis of artificial human organs. (Same course as Biomedical Engineering 212.) Offered irregularly.—Alfred

213. Advanced Turbulence Modeling (4)
Lecture—4 hours. Prerequisite: course 210B. Methods of analyzing turbulence; kinematics and dynamics of homogeneous turbulence; Reynolds stress and heat-flux equations; boundary layers and their simplification; numerical methods; application to boundary-layer-type flows; two-dimensionaland three-dimensional hydraulic and thermal flows. Offered irregularly.—Alfred

215. Biomedical Fluid Mechanics and Transport Phenomena (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103 or Chemical Engineering 150B or Civil and Environmental Engineering 141. Application of fluid mechanics and transport to biomedical systems. Flow in normal physiological function and pathological conditions (e.g., circulation) and respiratory flows, effect of flow on cellular processes, transport in the arterial wall and in tumors, and tissue engineering. (Same course as Biomedical Engineering 215.) Offered irregularly.

216. Advanced Aerodynamics (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 105. Study of topics important to energy conversion systems, propulsion and other systems using high temperature gases. Classical thermodynamics and quantum statistical mechanics of nonreacting and chemically reacting gases, gas mixtures, and other substances. Offered in alternate years. — W. Shaw

217. Combustion (4)
Lecture—3 hours; lecture/discussion—1 hour. Prerequisite: Engineering 103 and 105, Mechanical Engineering 106. Restricted to graduate students. Review of chemical thermodynamics and chemical kinetics. Discussion of reacting flows, their governing equations and transport phenomena; detonations; laminar flame structure and turbulent combustion. Offered in alternate years. — W. (W.) Shaw

218. Advances in Aerohydrodynamics (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103 and 105, or the equivalent. Review of options available for advanced power generation. Detailed study of basic power balances, component efficiencies, overall powerplant performance for one advanced concept such as a fusion, magnetohydrodynamic, or solar electric powerplant. — (F.) Erickson

219. Introduction to Scientific Computing in Solid and Fluid Dynamics (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Engineering 103 and 104. Scientific calculations with finite element and finite difference methods for multidimensional problems. Solution of basic equations in solid and fluid dynamics are performed with examples in C, C++, FORTRAN, and MATLAB script files. Derivation of the basic equations of motion in finite volume form with applications to elastic solids. — (F.) Delplech

220. Mechanical Vibrations (4)
Lecture—4 hours. Prerequisite: Engineering 122. Multiple degrees of freedom; damping measurements; Rayleigh's method; vibration absorbers; eigenvalues and mode shapes; resonance; forced vibrations; random processes and vibrations; auto-correlation; spectral density; first passage and fatigue failure; nonlinear systems; phase plane. Offered in alternate years. — E. (E.) Erickson

222. Advanced Dynamics (4)
Lecture—4 hours. Prerequisite: Engineering 102. Dynamics of particles, rigid bodies and distributed systems with engineering applications; generalized coordinates; Hamilton's principle; Lagrange's equations; Hamilton-Jacobi theory; modal dynamics orthogonality; wave dynamics; dispersion; — F. (F.) Karnopp

223. Multibody Dynamics (4)
Lecture—4 hours. Prerequisite: Engineering 102. Coupled rigid-body kinematics/dynamics; reference frames; vector differentiation and motion constraints; holonomic; generalized; symbols; velocity; inertia tensor; theorem; angular momentum; generalized forces; comparing Newton/Euler; Lagrange, forces, Koiter's methods; computer-aided equation derivation; orientation; Euler; Rodrigues parameters. (Same course as Biomedical Engineering 223.) — W. S. (W.) Eke, Ravani

225. Spatial Kinematics and Robotics (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: C Language and course 222. Spatial kinematics, screw theory, spatial mechanisms analysis and synthesis, robot kinematics and dynamics, robot workspaces, path planning, inverse kinematics, architecture and software implementation. (Same course as Biomedical Engineering 225.) Offered irregularly.—Ravani

226. Acoustics and Noise Control (4)
Lecture—4 hours. Prerequisite: Engineering 122. Description of sound using normal modes and waves, interaction between vibrating solids and sound fields, sound absorption in enclosed spaces, sound transmission through partitions, applications in design, acoustic enclosures and sound walls, room acoustics, design of quiet machinery. — Sargil-Klijn

227. Research Techniques in Biomechanics (4)
Lecture—2 hours; laboratory—4 hours; term paper or discussion—1 hour. Prerequisite: Mathematics 228 and consent of instructor; Exercise Science 115 recommended. Experimental techniques for biomechanical analysis of human movement. Techniques evaluated include data acquisition and analysis by computer, force platform analysis, strength assessment, planar and three-dimensional videography, data reduction and smoothing, body segment parameter determination, electromyography, and biomechanical modeling. (Same course as Biomedical Engineering 227/Exercise Science 227.) Offered irregularly.

228. Introduction to BioMEMS (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: BS engineering discipline or consent of instructor. Ideal for beginning graduate or advanced undergraduate students interested in electrochemical and biomechanical systems (MEMS) topics related to biological applications. Covers topics from various disciplines related to BioMEMS: mechanical, electrical, biomedical, chemical engineering, and materials science. Offered in alternate years. — F. (C.) Davis

Lecture—4 hours. Prerequisite: consent of instructor; Engineering 45, 104, 109, 122. Engineering 122 recommended. Mechanical design of micro-electromechanical systems (MEMS). Device modeling: lumped parameter models; energy methods; nonlinearities; electrical and mechanical modeling and measurement methods: capacitive, piezoresistive, thermal, piezoelectric, and optical techniques. Review of basic electronics: bridge circuits, amplifiers, modulation; lock-in detection. Offered in alternate years. — S. (S.) Horsley

231. Musculo-Skeletal System Biomechanics (4)
Lecture—4 hours. Prerequisite: Engineering 102. Mechanics of skeletal muscle and connective tissues as models of muscle, solution of the inverse dynamics problem, theoretical and experimental methods of kinematic and kinetic analysis, computation of internal force load and muscle forces, applications to gait analysis and sports biomechanics. (Same course as Biomedical Engineering 231.) Offered irregularly.
232. Skeletal Tissue Mechanics (3)
Lecture—4 hours; laboratory—1 hour. Prerequisite: Engineering 104B. Overview of the mechanical properties of the various tissues in the musculoskeletal system, the relationship of these properties to anatomic and histologic structure, and the changes in these properties with aging and disease. The tissues covered include bone, cartilage and synovial fluid, ligament and tendon. (Same course as Biomedical Engineering 232.)—S. (F.) Fyhrie

234. Design and Dynamics of Road Vehicles (4)
Lecture—4 hours. Prerequisite: Mechanical Engineering 134. Analysis and numerical simulation of road vehicles with design applications. —W. (W.) Velinsky

236. Aerodynamics in Nature and Technology (4)
Lecture—4 hours. Prerequisite: Engineering 103. Introduction to aerodynamics in nature, fundamentals of turbulence in atmospheric flows, planetary boundary layers, pedestrian-level winds in urban areas. Criteria for laboratory modeling of atmospheric flows, wind-tunnel testing. Offered irregularly.

237. Analysis and Design of Composite Structures (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 104 or equivalent. Modeling and analysis methodology for composite structures including stress analysis and strain energy methods. Introduction to failure processes. Includes discussion of aerospace structural analysis. —S. (F.) La Sappa

238. Advanced Aerodynamic Design and Optimization (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: consent of instructor. Application of aerodynamic theory to obtain optimum aerodynamic shapes. Both analytic solutions and solutions obtained with numerical optimization techniques will be examined. Includes introduction to the calculus of variations and numerical optimization techniques. Offered irregularly.—W. Sarigul-Klijn

239. Advanced Finite Elements and Optimization (4)
Lecture—4 hours. Prerequisite: Engineering 180 or Applied Science 115 or Mathematics 128C. Introduction to advanced finite elements and design optimization methods, with application to modeling of complex mechanical, aerospace and biomedical systems. Application of states of the art in finite element optimization of design of components under realistic loading conditions and constraints. (Same course as Biomedical Engineering 239.) Offered in alternate years.—W. Sarigul-Klijn

240. Computational Methods in Nonlinear Mechanics (4)
Lecture—4 hours. Prerequisite: Applied Science Engineering 115 or Mathematics 128B or Engineering 180. Deformation of solids and the motion of fluids treated with state-of-the-art computer methods. Numerical treatment of nonlinear dynamics; classification of coupled problems; applications of finite element methods to mechanical, aeronautical, and biological systems. (Same course as Biomedical Engineering 240.) Offered irregularly.—Sarigul-Klijn

242. Stability of Thin-Walled Structures (4)
Lecture—4 hours. Prerequisite: Engineering 104 or equivalent. Stability of thin-walled aerospace structures treated from both theoretical and practical design perspectives. Both monolithic and composite construction considered. Buckling of stiffened panels, plates, and beam-columns, experimental methods and failure/crippling processes. Offered irregularly.—La Saponara

248. Advanced Turbomachinery (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103 and 105. Preliminary aerodynamic design of axial and radial flow compressors and turbines. Design of diffusers. Selection of turbomachinery and configurations and approximations to optimum dimensions and flow angles. Introduction to through flow analysis. Rotating stall and surge, and aeromechanics of turbomachinery. Offered in alternate years.—S. (F.) Davis

250A. Advanced Methods in Mechanical Design (4)
Lecture—4 hours. Prerequisite: Mechanical Engineering 150A and 150B or the equivalents, or consent of instructor. Applications of advanced techniques of solid mechanics to mechanical design problems. Coverage of advanced topics in stress analysis and static and dynamic analyses with emphasis in design of machine elements. Design projects emphasizing advanced analysis tools for life cycle evaluation.—F. (R.) Ravani, Velinsky

250B. Advanced Methods in Mechanical Design (4)
Lecture—4 hours. Prerequisite: course 250A. Applications of advanced techniques of solid mechanics to mechanical design problems. Advanced topics in various design problems with emphasis in design of machine elements. Design projects emphasizing advanced analysis tools.—W. Hill

250C. Mechanical Performance of Materials (4)
Lecture—4 hours. Prerequisite: undergraduate course in stress analysis and mechanical behavior of materials. Occurrence, mechanisms, and prediction of fatigue and fracture phenomena. Use of stress and strain data to predict fatigue and fracture propagation. Effects of stress concentration, manufacturing, load sequence, irregular loading, and multiaxial loading.—Hill

251. Mechatronics System Design (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Mechanical Engineering 154 and 152 or Electrical and Computer Engineering 157A, 157B. Motion mechanism design, electric actuator, power electronics, motion control sensors, personal computer-based control systems design, motion control general operating system and real time operating systems, multithread software design, discrete event control software design. Offered in alternate years.—W. (W.) Yamazaki

252. Information Processing for Autonomous Robots (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 6, Mechanical Engineering 5, or equivalent: programming experience, Mechanical Engineering 134, 171, or consent of instructor. Design of control processors and software, and navigation for autonomous robots. Offered in alternate years.—W. (W.) Joshi

253. Network Theory and Applications (4)
Lecture/discussion—4 hours. Prerequisite: Mathematics 122A, Mathematics 123 or 120-121: experience with computer software; or consent of instructor. Develops the mathematical theory underlying network structure and function of networks with applications to social and biological networks and engineered systems. Topics include network growth, resilience, epidemicology, phase transitions, software and algorithms, routing and search control, cascading failures. (Same course as Science Engineering 253.) Offered in alternate years.—F. D’Souza

254. Engineering Software Design (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Mechanical Engineering 150 and 151, or Engineering 180. Principles and design of engineering software. Advanced topics in engineering software design, applications of object-oriented programming, very high-level languages, real-time multi-thread computing and sensor fusion, web-based network computing, graphics, and GUI in engineering. Offered in alternate years.—F. Cheng

255. Computer-Aided Design and Manufacturing (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: proficiency in a high level programming language such as Fortran, Pascal, or C. Representation and processing of geometrical information in design and manufacturing. Numeric and symbolic computations. Coordinate systems and transformations. Bézier and B-spline curves and surfaces. Interpolation and approximation methods. Intersections, offsets, and blends. Path planning for machining, inspection, and robotics applications. Offered in alternate years.—F. (F.) Davis

258. Hybrid Electric Vehicle System Theory and Design (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Mechanical Engineering 150B, graduate standing in Mechanical and Aerospace Engineering. Advanced vehicle design for fuel economy, performance, and low emissions, considering regulations, societal demands and manufacturability. Analysis and verification of control and operation of vehicle systems in real vehicle tests. Advanced engine concepts. Offered irregularly.

261. Gas Dynamics (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103 and 104 or consent of instructor. Introduction to computational fluid dynamics. Offered irregularly.—Hafez

263. Introduction to Computational Aerodynamics and Fluid Dynamics (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 103 or consent of instructor. Introduction to computational fluid dynamics and fluid mechanics. Offered irregularly.

264. Computational Aerodynamics (4)
Lecture—4 hours. Prerequisite: Aeronautical Science and Engineering 126, Engineering 180, or consent of instructor. Numerical methods for aerodynamics. Numerical methods for fluid flow and wave phenomena, finite difference solutions to classical model equations pertinent to wave phenomena, diffusion phenomena, or equilibrium. Application to the incompressible Navier-Stokes equation. Offered irregularly.—Hafez

266. Advanced Wind-Tunnel Testing (4)
Lecture—2 hours; discussion—1 hour; laboratory—3 hours. Prerequisite: undergraduate course in fluid dynamics. Aspects of low-speed wind-tunnel testing for solving aeronautical and non-aeronautical problems including tunnel corrections, scale effects, force and moment measurements, and flow visualization. Offered irregularly.—van Dam

267. Parallel Computations in Fluid/Thermal Sciences (4)
Lecture—2 hours; discussion—2 hours. Prerequisite: Mechanical Engineering 106, 165, Engineering 180 or equivalent; or consent of instructor. Programming languages and constructs for engineering analysis on parallel computers and clusters, including MPI (distributed), OpenMP (shared), and Fortran90. Graduate or junior/senior undergraduate as a technical elective. Offered in alternate years.—F. (R.) Davis

268. Wind Power Engineering (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 102 and 103, or equivalent, or consent of instructor. Fundamentals for understanding the conversion of wind power to mechanical power and electricity. Related engineering, economic and societal issues. Offered in alternate years.—F. (F.) van Dam
269. Fuel Cell Systems (4)  
Lecture—2 hours; discussion—2 hours. Prerequisite: Mechanical Engineering 106, 107, 165, or equivalent, or consent of instructor; graduate or junior/senior undergraduate as a technical elective. Limited enrollment. Basics of electrochemistry and fuel cell engines in mobile and stationary applications. Aspects of fuel cell energy converters and their sub-systems including practice with existing fuel cell and hydrogen systems on campus. Offered in alternate years. —F

271. Advanced Modeling and Simulation of Mechatronic Systems (4)  
Lecture—3 hours; laboratory—3 hours. Prerequisite: Mechanical Engineering 172 or the equivalent. Multilocus models of mechatronic, electrical, hydraulic, and thermal devices; bond graphs, block diagrams and state space equations; modeling of multiple energy domain systems; three-dimensional mechanisms; digital simulation laboratory—F, F

272. Theory and Design of Control Systems (4)  
Lecture—4 hours. Prerequisite: Mechanical Engineering 172 or the equivalent. Mathematical representations of dynamical systems, feedback principles; benefits and cost of feedback. Analysis and design of control systems based on classical and modern approaches, with emphasis on applications to mechanical and aeronautical systems.—Assadian

Lecture—3 hours; discussion—1 hour. Prerequisite: Mechanical Engineering 172. Discrete system analysis; digital filtering; sample data systems; state-space and transform design techniques; quantization effects; multi-input, multi-output systems. Offered in alternate years.—S, Hess, Kong

275. Advance Aircraft Stability and Control (4)  

276. Data Acquisition and Analysis (4)  
Lecture—3 hours; discussion—1 hour. Application of computers for data acquisition and control. Topics include computer architecture, characteristics of transducers, hardware for laboratory applications of computers, fundamentals of interfaces between computers and experimental equipment, programming techniques for data acquisition and control, basic data analysis. Offered in alternate years.

290C. Graduate Research Conference (1)  
Discussion—1 hour. Prerequisite: consent of instructor. Individual and/or group conference on problems, progress, and techniques in mechanical and aeronautical engineering research. May be repeated for credit. (S/U grading only)—F, W, S

297. Seminar (1)  
Discussion—1 hour. Prerequisite: consent of instructor. Current topics in engineering including development in mechanical and aeronautical engineering with problems, research, faculty, and visitors. May be repeated for credit. (S/U grading only)—F, W, S

298. Group Study (1-5)

299. Research (1-12)  
Prerequisite: consent of instructor. (S/U grading only)

Professional  
390. The Teaching of Aeronautical Science and Engineering (1)  
Discussion—1 hour. Prerequisite: meet qualifications for teaching assistant and/or associate in Aeronautical Science and Engineering. Methods of leading discussion groups or laboratory sections, writing and grading quizzes, use of laboratory equipment, and grading laboratory reports. May be repeated for credit. (S/U grading only)—F, W, S

396. Teaching Assistant Training Practicum (1-4)  
Prerequisite: graduate standing. May be repeated for credit. (S/U grading only)—F, W, S

English

[College of Letters and Science]  
Elizabeth Miller, Ph.D., Chairperson of the Department

Department Office. 176 Voorhis Hall 5307522257, http://english.ucdavis.edu

Faculty

Gina Bloom, Ph.D., Associate Professor  
Stephanie Bax, Ph.D., Associate Professor  
Sesa Chaganti, Ph.D., Associate Professor  
Academic Senate Distinguished Teaching Award  
Joshua Clover, M.F.A., Professor  
Lucy Corin, M.F.A., Professor  
Gregory Dobbins, Ph.D., Associate Professor  
Frances D. Dolan, Ph.D., Professor  
Academic Senate Distinguished Teaching Award  
Margaret W. Gormley, Ph.D., Professor  
Academic Senate Distinguished Teaching Award  
Kathleen Frederickson, Ph.D., Associate Professor  
Elizabeth S. Freeman, Ph.D., Professor  
Academic Senate Distinguished Teaching Award  
Danneil Heard, Ph.D., Assistant Professor  
W. Jack Hicks, Ph.D., Senior Lecturer  
Fam Houston, B.A., Professor  
Huania Hsu, Ph.D., Professor  
Mark Jerg, Ph.D., Associate Professor  
Alessa Johns, Ph.D., Professor  
Richard A. Levin, Ph.D., Professor  
Academic Senate Distinguished Teaching Award  
Yyvin Li, M.F.A., Professor  
Desirèe Martin, Ph.D., Associate Professor  
John Marx, Ph.D., Professor  
Tobias Menely, Ph.D., Assistant Professor  
Calin Milburn, Ph.D., Professor  
Elizabeth Miller, Ph.D., Professor  
Katie Peterson, Ph.D., Assistant Professor  
Margaret Ronda, Ph.D., Assistant Professor  
Parama Roy, Ph.D., Professor  
Scott C. Shershaw, Ph.D., Professor  
Scott Simon, Ph.D., Professor  
David Simpson, Ph.D., Professor  
Matthew Stratton, Ph.D., Associate Professor  
Matthew Vernon, Ph.D., Assistant Professor  
Claire Waters, Ph.D., Professor  
Evan Watkins, Ph.D., Professor  
Joe Wenderoth, M.F.A., Professor  
Michael Ziser, Ph.D., Associate Professor

Emeriti Faculty

Don P. Abbott, Ph.D., Professor Emeritus
Max Byrd, Ph.D., Professor Emeritus
Peter Dale, Ph.D., Professor Emeritus
Joanne F. Diehl, Ph.D., Professor Emerita
Lynn R. Freed, Ph.D., Professor Emerita
Sandia M. Gilbert, Ph.D., Professor Emerita
Thomas A. Hanzo, Ph.D., Professor Emeritus
John O. Hayden, M.D., Ph.D., Professor Emeritus
Peter L. Hayes, Ph.D., Professor Emeritus
Michael J. Hoffman, Ph.D., Professor Emeritus
Robert H. Hopkins, Ph.D., Professor Emeritus
Clarence Major, Ph.D., Professor Emeritus
Sandia J. McPherson, B.A., Professor Emerita
Linda A. Morris, Ph.D., Professor Emerita
James J. Murphy, Ph.D., Professor Emeritus
Marjorie Samson, Ph.D., Professor Emerita
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Academic Senate Distinguished Teaching Award
Winfried Schleier, Ph.D., Professor Emeritus
Gwendolyn Schwabe, M.S., Senior Lecturer Emerita
Gary Snyder, B.A., Professor Emeritus
Raymond B. Waddington, Ph.D., Professor Emeritus
Alan B. Williamson, Ph.D., Professor Emeritus
Karl F. Zender, Ph.D., Professor Emeritus

The Major Program

The study of English develops skills in reading analytically and perceptively and in writing clearly and effectively.

The Program. The English department offers three kinds of courses: composition courses, undergraduate courses, and graduate courses. Composition courses develop skills in reading analytically and in writing persuasively. Undergraduate and graduate courses cover the entire range of English and American literature, as well as creative writing. Students majoring in English may elect a creative writing emphasis or a literature, criticism, and theory emphasis. All majors take core courses introducing them to the literatures of various periods and places, to critical theory, and to frontiers of literary expression, such as the relationship of literature to environmentalism or the emergence of new media. The creative writing emphasis focuses on fiction, poetry, and arti- cles writing. The literature, criticism, and theory emphasis focuses on advanced critical analysis and research. All majors have the opportunity to work with distinguished writers, critics, scholars, and teachers.

Career Opportunities. Graduates have found the major excellent pre-professional training for careers in teaching, writing, law, medicine, library work, journalism, and more. Many graduates are employed in publishing, marketing, advertising, or the tech sector. Others have worked in local, state, and federal government agencies, as well as the industry. Many have gone on to graduate study in a wide range of fields including English, education, counseling, and more.

A.B. Major Requirements:

Preparatory Subject Matter.................................................20

English 3 or University Writing  
Program 1.................................................................4

One course from: English 40, 43, 44, 45, 46, 100A, 108, 10C

English 10A, 10B..............................................................12

Depth Subject Matter..................................................44

English 110A or 110B......................................................4

Historical Distribution Requirements..................................20

Three courses focusing on literature written in English before 1800, at least one of which must be on literature written primarily before 1500:  
Before 1500  
English 111, 113A, 113B

1500-1800  
English 115, 117, 122, 123, 142, 150A, 155A, 185A

One course focusing on literature written in English between 1800 and 1900:  
English 130, 133, 143, 144, 155B, 158A, 181A, 185B

One course focusing on literature written in English between 1900 and present:  
English 137N, 138, 146N, 147, 150B, 155C, 156, 158B, 166, 167, 168, 181B, 185C

Non-Historical Distribution Requirements.........................8

One course on literature and ethnicity, literature and gender, or literature and sexuality:  
English 125, 139, 140, 141, 166, 167, 178, 179, 181A, 181B, 185A, 185B, 185C, 186

One course in film and media studies, language studies, cultural studies and contexts, literature and science/technology, or literature and the environment:  

Linguistics 106; Science and Technology Studies 164, 171A, 171B, 172, 173, 175, 180, 182, 183, 184, 198, 199

Please note that while some courses are designated as in a major, some courses are identified as fulfilling more than one...