289M. Special Topics in Electrical and Computer Engineering; Systems Theory (1-5)
Lecture/laboratory—1-5 units. Prerequisite: consent of instructor. Special topic in Systems Theory. May be repeated for credit when topic differs.—F, W, S. (F, W, S.)

289N. Special Topics in Electrical and Computer Engineering; Active and Passive Circuits (1-5)
Lecture/laboratory—1-5 units. Prerequisite: consent of instructor. Special topic in Active and Passive Circuits. May be repeated for credit when topic differs.—F, W, S. (F, W, S.)

289O. Special Topics in Electrical and Computer Engineering; Integrated Circuits (1-5)
Lecture/laboratory—1-5 units. Prerequisite: consent of instructor. Special topic in Integrated Circuits. May be repeated for credit when topic differs.—F, W, S. (F, W, S.)

289P. Special Topics in Electrical and Computer Engineering; Computer Software (1-5)
Lecture/laboratory—1-5 units. Prerequisite: consent of instructor. Special topic in Computer Software. May be repeated for credit when topic differs.—F, W, S. (F, W, S.)

289Q. Special Topics in Electrical and Computer Engineering; Computer Engineering (1-5)
Lecture/laboratory—1-5 units. Prerequisite: consent of instructor. Special topic in Computer Engineering. May be repeated for credit when topic differs.—F, W, S. (F, W, S.)

289R. Special Topics in Electrical and Computer Engineering; Computer Networks (1-5)
Lecture/laboratory—1-5 units. Prerequisite: consent of instructor. Special topic in Computer Networks. May be repeated for credit when topic differs.—F, W, S. (F, W, S.)

290. Seminar in Electrical and Computer Engineering (1)
Seminar—1 hour. Prerequisite: consent of instructor. Special topic in Electrical and Computer Engineering. May be repeated for credit. (S/U grading only.)—F, W, S. (F, W, S.)

291. Solid-State Circuit Research Laboratory Seminar (1)
Seminar—1 hour. Prerequisite: graduate standing. Lectures on solid-state circuits and system design by various visiting experts in the field. May be repeated for credit. (S/U grading only.)—S. (S.)

292. Seminar in Solid-State Technology (1)
Seminar—1 hour. Prerequisite: graduate standing. Lectures on solid-state technology by various visiting experts. May be repeated for credit. (S/U grading only.)—F, S. (F, S.)

293. Computer Engineering Research Seminar (1)
Seminar—1 hour. Prerequisite: graduate standing and consent of instructor. Lectures, tutorials, and seminars on topics in computer engineering. May be repeated for credit up to four times. (S/U grading only.)—F, S. (F, S.)

294. Communications, Signal and Image Processing Seminar (1)
Seminar—1 hour. Prerequisite: graduate standing. Communications, signal and image processing, video engineering and computer vision. May be repeated for credit. (S/U grading only.)—F, W, S. (F, W, S.)

295. Systems, Control and Robotics Seminar (1)
Seminar—1 hour. Prerequisite: graduate standing. Seminars on current research in systems and control by faculty and visiting experts. Technical presentations and lectures on current topics in robotics research and robotics technology. May be repeated for credit. (S/U grading only.)—W. (W.)

296. Photonics Research Seminar (1)
Seminar—1 hour. Prerequisite: graduate standing. Lectures on photonics and related areas by faculty and visiting experts. May be repeated for credit. (S/U grading only.)—F, S. (F, S.)

298. Group Study (1-5)
Prerequisite: consent of instructor. (S/U grading only.)

299. Research (1-12)
(S/U grading only.)

Professional

300. The Teaching of Electrical Engineering (1)
Discussion—1 hour. Prerequisite: meet qualifications for teaching assistant or an associate-in in Electrical Engineering. Participation as a teaching assistant or an associate-in in a designated engineering course. Methods of handling discussion groups or laboratory sections, grading examinations, use of laboratory equipment, and grading laboratory reports. May be repeated for credit. (S/U grading only.)—F. (F)

396. Teaching Assistant Training Practicum (1-12)
Prerequisite: graduate standing. May be repeated for credit. (S/U grading only.)—F, W, S. (F, W, S.)

290C. Graduate Research Group Conference in Electrical and Computer Engineering (1)
Discussion—1 hour. Prerequisite: consent of instructor. Research problems, progress, and techniques in electrical and computer engineering. May be repeated for credit. (S/U grading only.)—F, W, S. (F, W, S.)

Mission Statement.

The mission of the Department of Materials Science and Engineering is to promote excellence in innovative cross-disciplinary materials education and research within an inclusive culture of students, staff, and faculty committed to creating a climate that respects and embraces racial, gender, and ethnic diversity at every level.

Honors Program.

An Honors Program is available to qualified students in Materials Science and Engineering. It is a four-year program designed to challenge the most talented students in the major. Students invited to participate will take a one-unit honors seminar in their freshman year and will enroll in various one-unit honors courses. In the upper division, students will complete either an honors thesis or an honors seminar in their senior year. Students must maintain a grade point average of 3.500 to continue in the program. Successful completion of the Honors Program will be acknowledged on the student’s transcript.

Materials Science and Engineering Undergraduate Program

The Materials Science and Engineering program is accredited by the Engineering Accreditation Commission of ABET, see http://www.abet.org. Materials science and engineering is directed toward an understanding of the structure, properties, and processing of materials. Society demands new and improved materials with capabilities far superior to common metals, polymers, and ceramics. New materials are needed for high-speed transportation systems, surgical and dental implants, new generations of power plants, renewable energy sources, and solid-state electronic and photonics devices in
Objectives. We educate students in the fundamentals of materials science and engineering, balanced with the application of these principles to practical problems; educate students as independent, critical thinkers who can also function effectively in a team; educate students with a sense of community, ethical responsibility, and professionalism; educate students for careers in industry, government, and academia; teach students the necessity for continuing education and self-learning; and foster proficiency in written and oral communications.

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

Exclusively of General Education units, the minimum number of units required for the Materials Science and Engineering major is 156.

Lower Division Required Courses

Mathematics 21A-21B-21C-21D .......................... 16
Mathematics 22A-22B .................................... 16
Physics 9A-9B-9C-9D ............................... 19
Chemistry 2A, 2B, 2C or Chemistry 2AH, 2BH, 2CH .......................... 15
Engineering 117, 45 or 45Y ............................ 8
Materials Science and Engineering 2 .......................... 2
Chemical Engineering and Materials Science 6 .................................... 4
English 3 or University Writing Program 1 or Comparative Literature 1, 2, 3, or 4, or Native American Studies 5 (grade of C or better required) ........................................ 4 Communication 1 or 2 .................................... 4

Upper Division Required Courses

Engineering 190 ........................................... 3
Select one course from Engineering 180, 181, 280 .................. 4
Mathematics 135A, Statistics 120, 131A, Civil and Environmental Engineering 114, Mechanical Engineering 140, Mechanical Engineering 115, or Physics 104A .................................... 4
Select one course from Chemistry 110A, 124A, 128A, or Physics 108 and 108L, 110A, 122A, 151, 160 .................................... 3
A minimum of 14 units from one of the following focus areas:
Biomedical Engineering: Biology 2A, Biomedical Engineering 20, 106* .......................... 109
Biological Systems Engineering: Biology 2A, Engineering 100, Biological Systems Engineering 20 .... 106
Chemical Engineering: Chemical Engineering 51, 140, 141, 142
Civil Engineering: Engineering 35, 104, Civil Engineering 123, 125, 143
Electrical Engineering: Engineering 100, Electrical Engineering 140A, 140B, 146A
Mechanical Engineering: Engineering 35, 102, 103, 104, 14
Select one course from Chemical Engineering 158A, Materials Science Engineering 170, Engineering 106, 160, 188, or Civil Engineering 123, 125, 143 .......................... 3-4
Depending on area of focus, 6-9 units of upper division electives ................................. 6-9

Students may receive up to a maximum of 4 units of credit for engineering 199 courses, when these courses are approved by the departmental undergraduate studies committee. To receive credit, students must submit a summary of their research to the committee. A letter of support from the faculty mentor is also required to verify that you have conducted substantial research activity.

* Students would need to take the AP Biology Exam, AP Chemistry Exam, AP Physics Exam, AP Calculus Exam, AP Statistics Exam, AP Environmental Science Exam, AP Biology Lab Exam, AP Chemistry Lab Exam, AP Physics Lab Exam, AP Calculus Lab Exam, AP Statistics Lab Exam, AP Environmental Science Lab Exam, AP Biology Lab Exam, AP Chemistry Lab Exam, AP Physics Lab Exam, AP Calculus Lab Exam, AP Statistics Lab Exam, AP Environmental Science Lab Exam.

Materials Science Minor

There is a constant need for professionals with more knowledge and experience in understanding the behavior of materials from which products such as electronics, sensors, biological implants, transportation vehicles, medical devices and infrastructure are made. The goal of this minor is to prepare students for careers that require training in materials science, including the fundamentals of thermodynamics and kinetics as well as the necessary professional composition and structure, as well as the complex relationships between composition, structure, processing and behavior/performance. Topics covered include material thermodynamics and kinetics, materials structural analysis, and structure-property relationships for electronic, optical, magnetic and mechanical behavior. The minor is expected to accommodate potential coursework, such as those majoring in engineering, physical sciences, biological sciences, and mathematics.

All courses must be taken for a letter grade. A grade of C- or better is required for all courses used to satisfy minor requirements, with an overall GPA in minor requirement courses of 2.000 or better.

Minor Requirements

Mathematics Science .......................... 20
Materials Science and Engineering 160, 162, 164 .................................... 12
Choose one of the following: Materials Science 172 or 174 .................................... 4
Choose an additional four units from the following, if not used above, Materials Science 145, 149, 150, 174L, 180, 181 or 182 .................................... 4
Minor Adviser, S. Gentry (Department of Materials Science and Engineering)

Graduate Programs in the Department of Materials Science and Engineering

The Department of Materials Science and Engineering is home to a top-20 ranked graduate programs in Materials Science & Engineering. We offer a unique interdisciplinary environment for graduate studies, with renowned faculty and state-of-the-art research facilities.

The Graduate Program in Materials Science and Engineering

M. Eng., M.S., and Ph.D.

Ph.D. designated emphases are available as specializations in biotechnology, biophysics, and nuclear science.

http://chems.engineering.ucdavis.edu

530-752-7952

The Materials Science and Engineering Graduate Program provides students with a strong background in advanced materials synthesis, processing, and characterization, both from an experimental and theoretical standpoint.

Doctoral students are typically offered competitive 4- year financial offers of fellowships and research/teaching assistantships which include tuition, fees, and a stipend.

Financial offers are subject to satisfactory progress towards completion of degree requirements.

Research areas include biomaterials, catalysts, ceramics, electronic and electrochemical properties and devices, glasses, high temperature superconductors, high-temperature superconductivity, and interfaces, magnetic materials and devices, material microstructure and/or processing, mathematical modeling, mechanical properties and synthesis, metals, microbiology, molecular modeling, nanomaterials, optical properties and devices, polymers, renewable energy, sintering, structural materials, thermochromic, and thin films.

Research Facilities and Partnerships:

- Interdisciplinary Center for Electron Microscopy
- Center for Northern California Nanotechnology
- Center for Nanomaterials in the Environment, Agriculture and Technology

Complete information is available on our website.

Courses in Engineering: Materials Science and Engineering (EMS)

For courses in Chemical and Materials Science Engineering (ECM) and Chemical Engineering (ECE), see Engineering: Chemical Engineering, on page 276.

Lower Division

2. Materials Marvels (2)

Lecture/discussion — 2 hours. Restricted to lower division students only. Role of materials in technological societies and their impact on our way of living. Exploration of how materials are extracted from the earth, processed, and shaped into products, including discussion of disposal and reuse of materials.

GE credit: SciEng|SE.—Sci (S.)

6H. Honors Materials Science Computer Applications (1)

Discussion — 1 hour. Prerequisite: enrollment in the Materials Science and Engineering Honors Program; concurrent enrollment in Engineering 6 required. Restricted to students in the Materials Science and Engineering Honors Program. Examination of materials science computer applications through additional readings, discussions, collaborative work, or special activities which may include projects or computer simulations. Offered irregularly. — W. (W.)

9H. Honors Solid-State Materials Science (1)

Discussion — 1 hour. Prerequisite: enrollment in the Materials Science and Engineering Honors Program; concurrent enrollment in Physics 9D required. Restricted to students in the Materials Science and Engineering Honors Program. Examination of solid-state materials science and modern physics topics through additional readings, discussions, collaborative work, or special activities which may include projects, laboratory experience or computer simulations. Offered irregularly. — S. (S.)
Upper Division

147. Principles of Polymer Materials Science (3) Lecture—3 hours. Prerequisite: Chemistry 2A-2B; Chemistry 2A or Engineering 45; introductory physics. Basic principles of polymer science presented including polymer structure and synthesis; polymerization mechanisms, polymer classes, properties, and reaction morphology, rheology, and characterization; polymer processing. [Same course as Fiber and Polymer Science 100.] GE credit: SciEng | QL, SE. —S. (F, J) Pan

160. Thermodynamics of Materials Processes and Stability (4) Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in each of the following: Engineering 45, Physics 9B, Mathematics 228, Chemistry 2C (recommended). Review of thermodynamic principles of interest to materials scientists and engineers. Application of thermodynamics to material processing; phase stability, corrosion. GE credit: SciEng | QL, SE, SL, VR. —S. (F, J)

162. Structure and Characterization of Engineering Materials (4) Lecture—4 hours. Prerequisite: C- or better in each of the following: Engineering 45, Mathematics 228, Physics 9B. Description of the structure of engineering materials on the atomic scale by exploring the fundamentals of crystallography. The importance of this structure to materials’ properties. Description of experimental determination using x-ray diffraction techniques. GE credit: SciEng | QL, SE, SL, VR. —S. (F, J)

162L. Structure and Characterization of Materials Laboratory (2) Laboratory—3 hours; discussion—1 hour. Prerequisite: course 162 (concurrent enrollment recommended). Experimental investigations of structure of solid materials are combined with techniques for characterization of materials. Laboratory exercises emphasize methods used to study structure of solids at the atomic and microstructural levels. Methods focus on optical, x-ray and electron techniques. Only 2 units of credit allowed to students who have completed course 134L. Not open for credit to students who have completed course 132L. GE credit: SciEng | QL, SE, SL, VR. —W. (W)

164. Rate Processes in Materials Science (4) Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in Engineering 45, and course 160. Basic kinetic laws and the principles governing phase transformations. Applications in diffusion, oxidation, nucleation, growth and spinodal transformation. GE credit: SciEng | QL, SE, SL, WE. —W. (W)

170. Sustainable Energy Technologies: Batteries, Fuel Cells, and Photovoltaic Cells (4) Lecture—3 hours; discussion—1 hour. Prerequisite: Engineering 140A, and consent of instructor. Open to all students in Engineering or related fields. Basic principles of future energy devices such as lithium batteries, fuel cells, and photovoltaic cells. Examines the current status of these energy technologies and analyze challenges that still must be overcome. Offered irregularly. GE credit: SciEng | SE. —Su. (So)

172. Electronic, Optical and Magnetic Properties of Materials (4) Lecture—3 hours; discussion—1 hour. Prerequisite: Chemistry 110A or Physics 9D; Engineering 6 or Chemical and Materials Science 6 or equivalent (recommended). Electronic, optical, and magnetic properties of materials as related to structure and processing of solid state materials. Physical principles for understanding the properties of metals, semiconductors, ceramics, and amorphous solids and the applications of these materials in engineering. GE credit: SciEng | QL, SE, SL, VR. —F. (F)

172L. Electronic, Optical and Magnetic Properties Laboratory (2) Laboratory—3 hours; lecture/laboratory—1 hour. Prerequisite: course 172 (concurrent enrollment recommended). Experimental investigation of electronic, optical and magnetic properties of materials, emphasizing the fundamental relationship between microstructure and properties as well as the influences on the evolution of the microstructure and properties. GE credit: SciEng, Wr | QL, SE, SL, VL, WE. —F. (F)

174. Mechanical Behavior of Materials (4) Lecture—3 hours; discussion—1 hour. Prerequisite: C- or better in Engineering 45; course 162 (recommended). Microscopic and macroscopic aspects of the mechanical behavior of engineering materials, with emphasis on recent developments in material characterization by destructive testing. Fundamentals of test design, and reaction kinetics applied to materials processing. Effects of processing variables on the structure-property relationship. Fundamentals of the manufacturing processes for electronic, optical, functional, and structural materials. GE credit: SciEng, Wr | QL, SE, SL, VL, WE. —S. (F)


181. Materials Processing (4) Lecture—3 hours; lecture/discussion—1 hour. Prerequisite: C- or better in Engineering 45, and Engineering 105 or Chemical Engineering 152B or Electrical and Computer Engineering 140A or course 164. Principles of phase equilibria, thermodynamics and reaction kinetics applied to materials processing. Effects of processing variables on the structure-property relationship. Fundamentals of the manufacturing processes for electronic, optical, functional, and structural materials. GE credit: SciEng, Wr | QL, SE, SL, VL, WE. —S. (F)

182. Failure Analysis (4) Lecture—3 hours; laboratory—3 hours. Prerequisite: C- or better in Engineering 45; course 174 (recommended). Analysis of the way materials fail. Effects of temperature, mechanical deformation and corrosion on the properties of materials. Forensics and methodologies used in failure analysis of materials including optical microscopy, x-ray analysis and scanning electron microscopy. Investigation of practical problems. GE credit: SciEng, Wr | QL, SE, SL, VL, WE. —S. (F)

188A. Materials Design Project (4) Laboratory—4 hours; discussion—1 hour. Prerequisite: courses 160, 162, 164, 172, and 174. Major design materials design experience involving analysis of real materials systems, fabrication and technological applications including critical assessments of economic, manufacturing, and ethical constraints. Various principles of materials science are integrated into a design project. (Deferred grading only; pending completion of sequence.) GE credit: SciEng | OL, SE, SL, VL, WE. —W. (W)

188AH. Honors Materials Design Project (1) Discussion—1 hour. Prerequisite: enrollment in the Materials Science and Engineering Honors Program. Examination of special topics covered in the materials design course through additional readings, discussions, collaborative work, or special activities which may include projects, laboratory experience or computer simulations. Open only to students in the Materials Science and Engineering Honors program. Offered irregularly. —W. (W)

188B. Materials Design Project (4) Laboratory—4 hours; discussion—1 hour. Prerequisite: course 188A. Major design materials design experience involving analysis of real materials systems, fabrication and technological applications including critical assessments of economic, manufacturing, and ethical constraints. Various principles of materials science are integrated into a team design project. (Deferred grading only; pending completion of sequence.) GE credit: SciEng | OL, SE, SL, VL, WE. —W. (W)

188BH. Honors Materials Design Project (1) Discussion—1 hour. Prerequisite: enrollment in the Materials Science and Engineering Honors Program. Examination of special topics covered in the materials design course through additional readings, discussions, collaborative work, or special activities which may include projects, laboratory experience or computer simulations. Open only to students in the Materials Science and Engineering Honors Program. Offered irregularly. —S. (F)

190C. Research Group Conferences (1) Discussion—1 hour. Prerequisite: consent of instructor; upper division standing. Individual and/or group conference on progress and techniques in materials research. May be repeated for credit. (P/NP grading only) —F, W, S. (F, W, S)

199. Special Study for Advanced Undergraduates (1-3) Prerequisite: consent of instructor. Special study for advanced undergraduates. (P/NP grading only) —F, W, S. (F, W, S)

Graduate

230. Fundamentals of Electronics Microscopy (3) Lecture—2 hours; lecture/discussion—1 hour. Prerequisite: course 162. Principles and techniques of scanning and transmission of electron microscopy used in the study of real materials will be described. Emphasis upon practical applications. —W. (W)

230L. Laboratory for Electron Microscopy (2) Laboratory—6 hours. Prerequisite: course 230 concurrently. Practical application of techniques of electron scanning and transmission microscopy including x-ray microanalysis. Offered irregularly. —W. (W)

232. Advanced Topics in Transmission Electron Microscopy (3) Lecture—1 hour; discussion—2 hours. Prerequisite: course 230. Advanced course in the techniques of electron microscopy including analytical techniques, probe deflection methods, and high resolution imaging. Offered irregularly. —W. (W)

232L. Laboratory for Advanced Transmission Electron Microscopy (2) Discussion—1 hour; laboratory—3 hours. Prerequisite: course 230L. Laboratory in advanced transmission electron microscopy techniques, relevant to specific graduate research projects in materials science. Offered irregularly. —W. (W)

241. Principles and Applications of Dislocation Mechanics (4) Lecture—3 hours; discussion—1 hour. Prerequisite: graduate standing in Engineering; consent of instructor. Concepts in dislocation theory are applied to explain plasticity of crystalline solids. Glide and climb of dislocations, strain hardening, recrystallization, theories of creep processes and interaction of dislocation with solute atoms, precipitates and imperfection clouds are discussed. Offered irregularly. —W. (W)


Fall 2011 and on Revised General Education (GE) AIH—Arts and Humanities; SE—Science and Engineering; SS—Social Sciences; AGCH—American Cultures; DD—Domestic Diversity; OL—Oral Skills; QL—Quantitative; SL—Scientific; VL—Visual; WC—World Cultures; WE—Writing Experience

Pre-Fall 2011 General Education (GE): ARTH—Arts and Humanities; SciEng—Science and Engineering; SocSci—Social Sciences; Div—Domestic Diversity; WRT—Writing Experience

Quarter Offered: F=Fall, W=Winter, S=Spring, SU=Summer; 2017-2018 offering in parentheses
244. Interaction of Materials and their Environment (3)
Lecture—3 hours. Prerequisite: Engineering 45 and 105A, or consent of instructor. Thermodynamic and kinetic foundations of the corrosion and oxidation processes. Practical aspects of corrosion control and prevention. Stress-corrosion and gas-embrittlement phenomena. Special topics in corrosion, microbiological and atmospheric corrosion. Offered irregularly.—F (F)

245. Micro- and Nano-Technology in Life Sciences (4)
Lecture—4 hours. Prerequisite: graduate standing in biophysics and applied biotechnology. Survey of biomedical device design from the engineering and biological perspectives; micro-/nano-fabrication and characterization techniques; surface chemistry and mass transport; design and implementation of functional nano and microsystem models; proposal development skills to merge aforementioned themes in a multidisciplinary project. [Same course as Electrical and Computer Engineering 245 and Chemical Engineering 245. S. S.] Seker

246. Photovoltaics and Solar Cells (3)
Lecture—3 hours. Prerequisite: Electrical & Computer Engineering 140B or equivalent, or permission of instructor. Physics and applications of photovoltaics and solar cells, including design, fabrication technology, and grid incorporation. Nano and microcrystalline silicon devices, thin-film technologies, heterojunctions, and semiconductor technology. Collectors, electrical inverters and infrastructure issues. Challenges and concerns. [Same course as Electrical & Computer Engineering 248.] Offered irregularly.—W (W)

248. Fracture of Engineering Materials (3)
Lecture—3 hours. Prerequisite: course 174. Description of the failure of materials by crack propagation. Topics include the stress fields about elastic cracks, the Griffith-Irwin analysis, descriptions of plastic zones, fracture toughness testing, microstructural aspects of fracture and failure at elevated temperatures. Offered irregularly.—F (F)

249. Mechanisms of Fatigue (3)
Lecture—3 hours. Prerequisite: course 174 or consent of instructor; course 248 recommended. Microstructural description of the mechanisms of fatigue in metals. Topics include a phenomenological treatment of cyclic deformation and fatigue processes in cyclic deformation, fatigue crack nucleation, Stage I crack growth, threshold effects and high temperature cyclic deformation. Offered irregularly.—F (F)

250A. Special Topics in Polymer and Fiber Science (3)
Lecture—3 hours. Prerequisite: course 147 or consent of instructor. Selected topics of current interest in polymer and fiber sciences. Topics will vary each time the course is offered. [Same course as Fiber and Polymer Science 250A.]—S (S)

250B. Special Topics in Polymer and Fiber Science (3)
Lecture—3 hours. Prerequisite: course 147 or consent of instructor. Selected topics of current interest in polymer and fiber sciences. Topics will vary each time the course is offered. [Same course as Fiber and Polymer Science 250B.]—S (S)

250C. Special Topics in Polymer and Fiber Science (3)
Lecture—3 hours. Prerequisite: course 147 or consent of instructor. Selected topics of current interest in polymer and fiber sciences. Topics will vary each time the course is offered. [Same course as Fiber and Polymer Science 250C.] Offered irregularly.—W (W)

250D. Special Topics in Polymer and Fiber Science (3)
Lecture—3 hours. Prerequisite: course 147 or consent of instructor. Selected topics of current interest in polymer and fiber sciences. Topics will vary each time the course is offered. [Same course as Fiber and Polymer Science 250D.] Offered irregularly.—W (W)

250E. Special Topics in Polymer and Fiber Science (3)
Lecture—3 hours. Prerequisite: course 147 or consent of instructor. Selected topics of current interest in polymer and fiber sciences. Topics will vary each time the course is offered. [Same course as Fiber and Polymer Science 250E.] Offered irregularly.—F (F)

250F. Special Topics in Polymer and Fiber Science (3)
Lecture—3 hours. Prerequisite: course 147 or consent of instructor. Selected topics of current interest in polymer and fiber sciences. Topics will vary each time the course is offered. [Same course as Fiber and Polymer Science 250F.] Offered irregularly.—W (W)

251. Applications of Solid State Nuclear Magnetic Resonance Spectroscopy (3)
Lecture—3 hours. Prerequisite: graduate standing in chemistry, physics or engineering, or consent of instructor. Fundamentals of solid state NMR spectroscopy and principles of advanced NMR techniques for analyzing structure of solid materials. Offered in alternate years.

260. Advanced Thermodynamics of Solids (4)
Lecture/discussion—4 hours. Prerequisite: course 160. Thermodynamic principles, formalism and their application to solids. Study of selected examples from ceramic and solid state systems. Use of thermodynamic approach in developing understanding of and constraints for processes in real systems. Offered in alternate years.—F (F)

262. Advanced Topics in Structure of Materials (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 162; course 174 recommended; graduate standing in Engineering or consent of instructor. Nature of microstructure in engineering materials. Crystalline and non-crystalline structures, with special emphasis on grain boundary segregation in the development of polycrystalline microstructure and the radial distribution function of amorphous materials. Not open for credit to students who previously completed (cancelled) course 245.—F (F)

264. Transport Phenomena in Materials Processes (4)
Lecture/discussion—4 hours. Prerequisite: graduate standing in Engineering. Thermodynamic driving forces and atomic-scale mechanisms underlying diffusive mass transport and interface motion in materials. Nucleation, growth and coarsening dynamics of phase transformations. Not open for credit to students who previously completed course 240.—W, S (W, S)

272. Advanced Functional Properties of Materials (4)
Lecture/discussion—4 hours. Prerequisite: graduate standing in Physics, Chemistry, and Engineering. Fundamental physical and electronic solid materials important to solid state devices, specifically electronic, magnetic, and optical properties. Topics include band structures, metals, superconductors, semiconductors, dielectrics, optical properties, and magnetic properties and implementation of these properties into devices. Offered irregularly.—F (F)

274. Advanced Mechanical Properties of Materials (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: course 174. Comprehensive study of mechanical properties of materials, with special attention to dislocations and deformation and fracture control mechanisms. Emphasis on the development of conventional engineering materials as well as advanced materials such as nanocrystalline solids and thin films are considered. Offered in alternate years.—W (W)

282. Glass Science and Technology (3)
Lecture—2 hours; extensive writing—1 hour. Prerequisite: graduate standing in Chemistry, Physics or Engineering, or consent of instructor. Modern paradigms in glass science and their applications to technologies. Relation of macroscopic properties of glasses and glass-forming liquids to atomic-level structures, including principles of formation, relaxation, transport phenomena, nucleation, crystallization and phase separation in glasses. Offered irregularly.—S (S)

289A. Special Topics in Materials Science; Electronic Materials (1-5)
Lecture/laboratory. Prerequisite: consent of instructor. Special topics in Electronic Materials. May be repeated for credit when topic differs. Offered irregularly.—F, W, S (F, W, S)

289B. Special Topics in Materials Science; Materials Processes (1-5)
Lecture/laboratory. Prerequisite: consent of instructor. Special topics in Materials Processing. May be repeated for credit when topic differs. Offered irregularly.—F, W, S (F, W, S)

289C. Special Topics in Materials Science; Physics and Chemistry of Materials (1-5)
Lecture/laboratory. Prerequisite: consent of instructor. Special topics in Physics and Chemistry of Materials. May be repeated for credit when topic differs. Offered irregularly.—F, W, S (F, W, S)

289D. Special Topics in Materials Science; Materials Science and Forensics (1-5)
Lecture/laboratory. Prerequisite: consent of instructor. Special topics in Materials Science and Forensics. May be repeated for credit when topic differs. Offered irregularly.—F, W, S (F, W, S)

289G. Special Topics in Materials Science; Surface Chemistry of Metal Oxides (1-5)
Lecture/laboratory. Prerequisite: consent of instructor. Special topics in Surface Chemistry of Metal Oxides. May be repeated for credit when topic differs. Offered irregularly.—F, W, S (F, W, S)

290A. Graduate Research Conference (1)
Seminar—1 hour. Current literature and developments in materials science with presentations by individual students. May be repeated for credit. (S/U grading only.)—F, W, S (F, W, S)

290B. Group Study (1-5)
Discussion—1 hour. Prerequisite: consent of instructor. Individual and/or group conference on problems, progress, and topics in materials science and engineering research. May be repeated for credit. (S/U grading only.)—F, W, S (F, W, S)

290C. Materials Science Seminar (1-5)
Seminar—1 hour. Current literature and developments in materials science with presentations by individual students. May be repeated for credit. (S/U grading only.)—F, W, S (F, W, S)

299. Research (1-12)
Discussion—1 hour. Prerequisite: consent of instructor. Research. (S/U grading only.)—F, W, S (F, W, S)

300. Professional (1-12)
Discussion—1 hour. Prerequisite: consent of instructor. Professional. (S/U grading only.)—F, W, S (F, W, S)