

Materials Science and Engineering/Nuclear Engineering Joint Major

Bachelor of Science (BS)

The joint major programs are designed for students who wish to undertake study in two areas of engineering in order to qualify for employment in either field or for positions in which competence in two fields is required. These curricula include the core courses in each of the major fields. While they require slightly increased course loads, they can be completed in four years. Both majors are shown on the student's transcript of record.

The interface between materials science and engineering and nuclear engineering is an especially challenging and rewarding one giving students in this joint major an exciting range of career options. With a sound curriculum steeped in the fundamentals, the joint major program prepares students to fully understand the behavior of materials in a reactor or related extreme environments, including their design and optimization. Students completing this joint major will successfully compete for positions in the energy sector.

Admission to the Joint Major

Admission directly to a joint major is closed to freshmen and junior transfer applicants. Students interested in a joint program may apply to change majors during specific times in their academic progress. Please see the College of Engineering joint majors website (<http://engineering.berkeley.edu/academics/majors-minors/joint-majors>) for complete details.

In addition to the University, campus, and college requirements, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All technical courses (courses in engineering, mathematics, chemistry, physics, statistics, biological sciences, and computer science) must be taken for a letter grade.
2. No more than one upper division course may be used to simultaneously fulfill requirements for a student's major and minor programs.
3. A minimum overall grade point average (GPA) of 2.0 is required for all work undertaken at UC Berkeley.
4. A minimum GPA of 2.0 is required for all technical courses taken in satisfaction of major requirements.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

For a detailed plan of study by year and semester, please see the Plan of Study tab.

Lower division Requirements

MATH 1A	Calculus	4
MATH 1B	Calculus	4

MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
CHEM 1A & 1AL	General Chemistry and General Chemistry Laboratory ¹	4
or CHEM 4A	General Chemistry and Quantitative Analysis	
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
PHYSICS 7C	Physics for Scientists and Engineers	4
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
ENGIN 45 & 45L	Properties of Materials and Properties of Materials Laboratory	4
NUC ENG 24	Freshman Seminars	1
MEC ENG C85	Introduction to Solid Mechanics	3

¹ CHEM 4A is intended for students majoring in chemistry or a closely-related field.

Upper division Requirements

ENGIN 115	Engineering Thermodynamics	4
MAT SCI 102	Bonding, Crystallography, and Crystal Defects	3
MAT SCI 103	Phase Transformations and Kinetics	3
MAT SCI 104	Materials Characterization	4
MAT SCI 111	Properties of Electronic Materials	4
MAT SCI 112	Corrosion (Chemical Properties)	3
MAT SCI 113	Mechanical Behavior of Engineering Materials	3
MAT SCI 130	Experimental Materials Science and Design	3
NUC ENG 100	Introduction to Nuclear Engineering	3
NUC ENG 101	Nuclear Reactions and Radiation	4
NUC ENG 104	Radiation Detection and Nuclear Instrumentation Laboratory	4
NUC ENG 120	Nuclear Materials	4
NUC ENG 150	Introduction to Nuclear Reactor Theory	4
NUC ENG 170A	Nuclear Design: Design in Nuclear Power Technology and Instrumentation	3
Ethics Requirement ¹		3-4
Upper division Technical Electives: Minimum 16 units ^{2,3}		16

Must include at least 9 units of upper division NUC ENG courses, in consultation with faculty adviser

Must include at least 3 units from the MAT SCI 120 series

The additional 4 units of technical electives must be chosen in consultation with faculty adviser

¹ Students must take one course with ethics content. This may be fulfilled within the Humanities/Social Sciences requirement by taking one of the following courses: ANTHRO 156B, BIO ENG 100, ENGIN 125, ENGIN 157AC, ESPM 161, ESPM 162, GEOG 31, IAS 157AC, ISF 100E, L & S 160B, MEC ENG 191AC, PHILOS 2, PHILOS 104, PHILOS 107, PB HLTH 116, SOCIOL 116. Note: Public Health 116 taken prior to Fall 2015 fulfills only the ethics requirement.

² Students may receive up to three units of technical elective credit for graded research in MAT SCI H194 or NUC ENG H194.

³ Technical Electives cannot include:

- Any course taken on a *Pass/No Pass* basis
- Any of the following courses: BIO ENG 100, CHM ENG 185, COMPSCI 195, COMPSCI H195, DES INV courses (except DES INV 190E), ENGIN 125, ENGIN 157AC, IND ENG 172, IND ENG 185, IND ENG 186, IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 191AC, MEC ENG 190K, and MEC ENG 191K

Students in the College of Engineering must complete no fewer than 120 semester units with the following provisions:

1. Completion of the requirements of one engineering major program (<http://coe.berkeley.edu/students/guide/departments>) of study.
2. A minimum overall grade point average of 2.00 (C average) and a minimum 2.00 grade point average in upper division technical coursework required of the major.
3. The final 30 units and two semesters must be completed in residence in the College of Engineering on the Berkeley campus.
4. All technical courses (math, science and engineering), required of the major or not, must be taken on a letter graded basis (unless they are only offered P/NP).
5. Entering freshmen are allowed a maximum of eight semesters to complete their degree requirements. Entering junior transfers are allowed a maximum of four semesters to complete their degree requirements. (Note: junior transfers admitted missing three or more courses from the lower division curriculum are allowed five semesters.) Summer terms are optional and do not count toward the maximum. Students are responsible for planning and satisfactorily completing all graduation requirements within the maximum allowable semesters.
6. Adhere to all college policies and procedures (<http://engineering.berkeley.edu/academics/undergraduate-guide>) as they complete degree requirements.
7. Complete the lower division program before enrolling in upper division engineering courses.

Humanities and Social Science (H/SS) Requirement

To promote a rich and varied educational experience outside of the technical requirements for each major, the College of Engineering has a six-course Humanities and Social Sciences breadth requirement (<http://engineering.berkeley.edu/student-services/degree-requirements/humanities-and-social-sciences>), which must be completed to graduate. This requirement, built into all the engineering programs of study, includes two reading and composition courses (R&C), and four additional courses within which a number of specific conditions must be satisfied. Follow these guidelines to fulfill this requirement:

1. Complete a minimum of six courses from the approved Humanities/Social Sciences (H/SS) lists (<http://coe.berkeley.edu/hssreq>).
2. Courses must be a minimum of 3 semester units (or 4 quarter units).
3. Two of the six courses must fulfill the college's Reading and Composition (R&C) requirement. These courses must be taken for a letter grade (C- or better required) and must be completed by no later than the end of the sophomore year (fourth semester of enrollment). The first half of R&C, the "A" course, must be completed by the end of the freshman year; the second half of R&C, the "B" course, must be completed by no later than the end of the sophomore year. View a detailed lists of courses (<http://ls-advise.berkeley.edu/requirement/>

rccourses.html) that fulfill Reading and Composition requirements, or use the College of Letters and Sciences search engine (<http://ls-breadth.berkeley.edu>) to view R&C courses offered in a given semester.

4. The four additional courses must be chosen within College of Engineering guidelines from the H/SS lists (see below). These courses may be taken on a Pass/Not Passed basis (P/NP).
5. Two of the six courses must be upper division (courses numbered 100-196).
6. One of the six courses must satisfy the campus American Cultures requirement. For detailed lists of courses that fulfill American Cultures requirements, visit the American Cultures (<http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/engineering/american-cultures-requirement>) site.
7. A maximum of two exams (Advanced Placement, International Baccalaureate, or A-Level) may be used toward completion of the H/SS requirement. View the list of exams (<http://engineering.berkeley.edu/academics/undergraduate-guide/exams-ap-ib-level-and-transfer-credit-information>) that can be applied toward H/SS requirements.
8. Courses may fulfill multiple categories. For example, if you complete CY PLAN 118AC (<http://guide.berkeley.edu/search/?P=CY%20PLAN%20118AC>) that would satisfy the American Cultures requirement and one upper division H/SS requirement.
9. No courses offered by any engineering department other than BIO ENG 100 (<http://guide.berkeley.edu/search/?P=BIO%20ENG%20100>), COMPSCI C79 (<http://guide.berkeley.edu/search/?P=COMPSCI%20C79>), ENGIN 125 (<http://guide.berkeley.edu/search/?P=ENGIN%20125>), ENGIN 157AC (<http://guide.berkeley.edu/search/?P=ENGIN%20157AC>), MEC ENG 191K (<http://guide.berkeley.edu/search/?P=MEC%20ENG%20191K>) and MEC ENG 191AC (<http://guide.berkeley.edu/search/?P=MEC%20ENG%20191AC>) may be used to complete H/SS requirements.
10. Foreign language courses may be used to complete H/SS requirements. View the list of language options (<http://ls-advise.berkeley.edu/requirement/fl.html>).
11. Courses numbered 97, 98, 99, or above 196 may not be used to complete any H/SS requirement
12. The College of Engineering uses modified versions of five of the College of Letters and Science (L&S) breadth requirements lists to provide options to our students for completing the H/SS requirement. No courses on the L&S Biological Sciences or Physical Sciences breadth lists may be used to complete H/SS requirements. Within the guidelines above, choose courses from any of the lists below.
 - Arts and Literature (<http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-arts-literature>)
 - Foreign Language (<http://ls-advise.berkeley.edu/requirement/fl.html>)
 - Historical Studies (<http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-historical-studies>)
 - International Studies (<http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-international-studies>)

- Philosophy and Values (<http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-philosophy-values>)
- Social and Behavioral Studies (<http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-social-behavioral-sciences>)

Class Schedule Requirements

- Minimum units per semester: 12.0.
- Maximum units per semester: 20.5.
- Minimum technical courses: College of Engineering undergraduates must enroll each semester in no fewer than two technical courses (of a minimum of 3 units each) required of the major program of study in which the student is officially declared. (Note: for most majors, normal progress will require enrolling in 3-4 technical courses each semester).
- All technical courses (math, science, engineering), required of the major or not, must be taken on a letter graded basis (unless only offered as P/NP).
- A student's proposed schedule must be approved by a faculty adviser (or on approval from the dean or a designated staff adviser) each semester prior to enrolling in courses.

Minimum Academic (Grade) Requirements

- A minimum overall and semester grade point average of 2.00 (C average) is required of engineering undergraduates. A student will be subject to dismissal from the University if during any fall or spring semester their overall UC GPA falls below a 2.00, or their semester GPA is less than 2.00.
- Students must achieve a minimum grade point average of 2.00 (C average) in upper division technical courses required of the major curriculum each semester. A student will be subject to dismissal from the University if their upper division technical grade point average falls below 2.00.
- A minimum overall grade point average of 2.00, and a minimum 2.00 grade point average in upper division technical course work required of the major is needed to earn a Bachelor of Science in Engineering.

Unit Requirements

To earn a Bachelor of Science in Engineering, students must complete at least 120 semester units of courses subject to certain guidelines:

- Completion of the requirements of one engineering major program (<http://coe.berkeley.edu/students/guide/departments>) of study.
- A maximum of 16 units of special studies coursework (courses numbered 97, 98, 99, 197, 198, or 199) is allowed towards the 120 units; a maximum of four is allowed in a given semester.
- A maximum of 4 units of physical education from any school attended will count towards the 120 units.
- Students may receive unit credit for courses graded P (including P/ NP units taken through EAP) up to a limit of one-third of the total units taken and passed on the Berkeley campus at the time of graduation.

Normal Progress

Students in the College of Engineering must enroll in a full-time program and make normal progress each semester toward the bachelor's degree. The continued enrollment of students who fail to achieve minimum academic progress shall be subject to the approval of the dean. (Note: students with official accommodations established by the Disabled

Students' Program, with health or family issues, or with other reasons deemed appropriate by the dean may petition for an exception to normal progress rules.)

For more detailed information regarding the courses listed below (e.g., elective information, GPA requirements, etc.), please see the College Requirements and Major Requirements tab.

Freshman				
	Fall	Units	Spring	Units
CHEM 1A & 1AL, or CHEM 4A ¹		4	MATH 1B	4
MATH 1A		4	PHYSICS 7A	4
NUC ENG 24		1	ENGIN 7	4
Reading & Composition course from List A		4	Reading & Composition course from List B	4
Humanities/Social Sciences course		3-4		
		16-17		16
Sophomore				
	Fall	Units	Spring	Units
MATH 53		4	MATH 54	4
PHYSICS 7B		4	PHYSICS 7C	4
ENGIN 45 & 45L		4	MEC ENG C85	3
Humanities/Social Sciences Course		3-4	NUC ENG 10C	3
		15-16		14
Junior				
	Fall	Units	Spring	Units
ENGIN 115		4	MAT SCI 103	3
MAT SCI 102		3	MAT SCI 104	4
NUC ENG 101		4	NUC ENG 104	4
Technical Electives ^{2,3}		7	NUC ENG 15C	4
			Humanities/Social Sciences course	3-4
		18		18-19
Senior				
	Fall	Units	Spring	Units
MAT SCI 130		3	MAT SCI 111	4
NUC ENG 120		4	MAT SCI 112	3
Technical Electives ^{2,3}		9	MAT SCI 113	3
			NUC ENG 17C	3
			Humanities/Social Sciences course with Ethics content ⁴	3-4
		16		16-17
Total Units: 129-133				

¹ CHEM 4A is intended for students majoring in chemistry or a closely-related field.

² Technical electives must include at least 9 units of upper-division NUC ENG courses and at least 3 units from the MAT SCI 120 series courses. The additional 4 units of upper-division technical electives must be chosen in consultation with the faculty adviser. Students may receive up to 3 units of technical elective credit for graded research in MAT SCI H194 Honors Undergraduate Research or NUC ENG H194 Honors Undergraduate Research.

- ³ Technical Electives cannot include:
- Any course taken on a *Pass/No Pass* basis
 - Any of the following courses: BIO ENG 100, CHM ENG 185, COMPSCI 195, COMPSCI H195, DES INV courses (except DES INV 190E), ENGIN 125, ENGIN 157AC, IND ENG 172, IND ENG 185, IND ENG 186, IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 191AC, MEC ENG 190K, and MEC ENG 191K.
- ⁴ Students must take one course with ethics content. This may be fulfilled within the Humanities/Social Sciences requirement by taking one of the following courses: ANTHRO 156B, BIO ENG 100, ENGIN 125, ENGIN 157AC, ESPM 161, ESPM 162, GEOG 31, IAS 157AC, ISF 100E, L & S 160B, MEC ENG 191AC, PHILOS 2, PHILOS 104, PHILOS 107, PB HLTH 116, SOCIOL 116. Note: Public Health 116 taken prior to Fall 2015 fulfills ethics requirement only.

Courses

- Materials Sciences and Engineering (p. 4)
- Nuclear Engineering (p. 11)

Materials Science and Engineering Courses

MAT SCI 24 Freshman Seminar 1 Unit

Terms offered: Spring 2018, Spring 2017, Spring 2016

The Freshman Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. Freshman seminars are offered in all campus departments, and topics vary from department to department and semester to semester. Enrollment limited to 20 freshmen.

Freshman Seminar: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam required.

Freshman Seminar: Read Less [-]

MAT SCI 45 Properties of Materials 3 Units

Terms offered: Spring 2018, Fall 2017

Application of basic principles of physics and chemistry to the engineering properties of materials. Special emphasis devoted to relation between microstructure and the mechanical properties of metals, concrete, polymers, and ceramics, and the electrical properties of semiconducting materials. Sponsoring Department: Materials Science and Engineering
Properties of Materials: Read More [+]

Rules & Requirements

Prerequisites: Physics 7A (may be taken concurrently)

Credit Restrictions: Students will receive no credit for MSE 45 after taking E45

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Martin, Messersmith

Properties of Materials: Read Less [-]

MAT SCI 45L Properties of Materials Laboratory 1 Unit

Terms offered: Spring 2018, Fall 2017

This course presents laboratory applications of the basic principles introduced in the lecture-based course MSE45 – Properties of Materials. Properties of Materials Laboratory: Read More [+]

Rules & Requirements

Credit Restrictions: Students will receive no credit for MSE 45L after taking E45L

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of laboratory per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructors: Martin, Messersmith

Properties of Materials Laboratory: Read Less [-]

MAT SCI 102 Bonding, Crystallography, and Crystal Defects 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

Bonding in solids; classification of metals, semiconductors, and insulators; crystal systems; point, line, and planar defects in crystals; examples of crystallographic and defect analysis in engineering materials; relationship to physical and mechanical properties.

Bonding, Crystallography, and Crystal Defects: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Engineering 45

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Chrzan

Bonding, Crystallography, and Crystal Defects: Read Less [\[-\]](#)

MAT SCI 103 Phase Transformations and Kinetics 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

The nature, mechanisms, and kinetics of phase transformations and microstructural changes in the solid state. Atom diffusion in solids. Phase transformations through the nucleation and growth of new matrix or precipitate phases. Martensitic transformations, spinodal decomposition. The use of phase transformations to control microstructure.

Phase Transformations and Kinetics: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 102 and Engineering 115

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Phase Transformations and Kinetics: Read Less [\[-\]](#)

MAT SCI 104 Materials Characterization 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Physical and chemical characterization of materials: Diffraction, imaging, and spectroscopy using optical, electron, and X-ray methods for bulk and surface analysis. Measurement of mechanical and physical properties. Project laboratory focusing on mechanical, chemical, electrical, and magnetic properties of materials, and materials characterization. Field trips.

Materials Characterization: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 102

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Gronskey

Materials Characterization: Read Less [\[-\]](#)

MAT SCI 111 Properties of Electronic Materials 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Introduction to the physical principles underlying the electric properties of modern solids with emphasis on semiconductors; control of defects and impurities through physical purification, bulk and thin film crystal growth and doping processes, materials basis of electronic and optoelectronic devices (diodes, transistors, semiconductor lasers) and optical fibers; properties of metal and oxide superconductors and their applications.

Properties of Electronic Materials: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Physics 7A-7B-7C or Physics 7A-7B and consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Dubon, Wu, Yao

Properties of Electronic Materials: Read Less [\[-\]](#)

MAT SCI 112 Corrosion (Chemical Properties) 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Electrochemical theory of corrosion. Mechanisms and rates in relation to physiochemical and metallurgical factors. Stress corrosion and mechanical influences on corrosion. Corrosion protection by design, inhibition, cathodic protection, and coatings.

Corrosion (Chemical Properties): [Read More](#) [+]

Rules & Requirements

Prerequisites: Engineering 45 and Engineering 115

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Devine

Corrosion (Chemical Properties): [Read Less](#) [-]

MAT SCI 113 Mechanical Behavior of Engineering Materials 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

This course covers elastic and plastic deformation under static and dynamic loads. Prediction and prevention of failure by yielding, fracture, fatigue, wear and environmental factors are addressed. Design issues pertaining to materials selection for load bearing applications are discussed. Case studies of engineering failures are presented. Topics include engineering materials, structure-property relationships, materials selection for design, mechanical behavior of polymers and design of plastic components, complex states of stress and strain, elastic deformation and multiaxial loading, plastic deformation and yield criteria, dislocation plasticity and strengthening mechanisms, creep, effects of stress concentrations, fracture, fatigue, and contact stresses.

Mechanical Behavior of Engineering Materials: [Read More](#) [+]

Rules & Requirements

Prerequisites: C30/Mechanical Engineering C85 and Engineering 45

Credit Restrictions: Students will receive no credit for 113 after taking C113 or Mechanical Engineering C124. Deficiency in C113 or Mechanical Engineering C124 maybe removed by taking 113.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Ritchie

Mechanical Behavior of Engineering Materials: [Read Less](#) [-]

MAT SCI 117 Properties of Dielectric and Magnetic Materials 3 Units

Terms offered: Spring 2017, Spring 2011, Fall 2010

Introduction to the physical principles underlying the dielectric and magnetic properties of solids. Processing-microstructure-property relationships of dielectric materials, including piezoelectric, pyroelectric, and ferroelectric oxides, and of magnetic materials, including hard- and soft ferromagnets, ferrites and magneto-optic and -resistive materials.

The course also covers the properties of grain boundary devices (including varistors) as well as ion-conducting and mixed conducting materials for applications in various devices such as sensors, fuel cells, and electric batteries.

Properties of Dielectric and Magnetic Materials: [Read More](#) [+]

Rules & Requirements

Prerequisites: Physics 7A-7B-7C or Physics 7A-7B and consent of instructor; 111 is recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Properties of Dielectric and Magnetic Materials: [Read Less](#) [-]

MAT SCI C118 Biological Performance of Materials 4 Units

Terms offered: Fall 2017, Fall 2015, Fall 2014

This course is intended to give students the opportunity to expand their knowledge of topics related to biomedical materials selection and design. Structure-property relationships of biomedical materials and their interaction with biological systems will be addressed. Applications of the concepts developed include blood-materials compatibility, biomimetic materials, hard and soft tissue-materials interactions, drug delivery, tissue engineering, and biotechnology.

Biological Performance of Materials: [Read More](#) [+]

Objectives Outcomes

Course Objectives: The course is separated into four parts spanning the principles of synthetic materials and surfaces, principles of biological materials, biological performance of materials and devices, and state-of-the-art materials design. Students are required to attend class and master the material therein. In addition, readings from the clinical, life and materials science literature are assigned. Students are encouraged to seek out additional reference material to complement the readings assigned. A mid-term examination is given on basic principles (parts 1 and 2 of the outline). A comprehensive final examination is given as well. The purpose of this course is to introduce students to problems associated with the selection and function of biomaterials. Through class lectures and readings in both the physical and life science literature, students will gain broad knowledge of the criteria used to select biomaterials, especially in devices where the material-tissue or material-solution interface dominates performance. Materials used in devices for medicine, dentistry, tissue engineering, drug delivery, and the biotechnology industry will be addressed.

This course also has a significant design component (~35%). Students will form small teams (five or less) and undertake a semester-long design project related to the subject matter of the course. The project includes the preparation of a paper and a 20 minute oral presentation critically analyzing a current material-tissue or material-solution problem. Students will be expected to design improvements to materials and devices to overcome the problems identified in class with existing materials.

Student Learning Outcomes: Apply math, science & engineering principles to the understanding of soft materials, surface chemistry, DLVO theory, protein adsorption kinetics, viscoelasticity, mass diffusion, and molecular (i.e., drug) delivery kinetics.

- Design experiments and analyze data from the literature in the context of the class design project.

Apply core concepts in materials science to solve engineering problems related to the selection biomaterials, especially in devices where the material-tissue or material-solution interface dominates performance.

Develop an understanding of the social, safety and medical consequences of biomaterial use and regulatory issues associated with the selection of biomaterials in the context of the silicone breast implant controversy and subsequent biomaterials crisis.

Work independently and function on a team, and develop solid communication skills (oral, graphic & written) through the class design project.

- Understanding of the origin of surface forces and interfacial free energy, and how they contribute to the development of the biomaterial interface and ultimately biomaterial performance.

Rules & Requirements

Prerequisites: Engin 45; BioE 103 or equivalent; BioE 102 and BioE 104 recommended

Hours & Format

MAT SCI 120 Materials Production 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

Economic and technological significance of metals and other materials. Elementary geology (composition of lithosphere, mineralization). Short survey of mining and mineral processing techniques. Review of chemical thermodynamics and reaction kinetics. Principles of process engineering including material, heat, and mechanical energy balances. Elementary heat transfer, fluid flow, and mass transfer. Electrolytic production and refining of metals. Vapor techniques for production of metals and coatings.

Materials Production: [Read More](#) [+]

Rules & Requirements

Prerequisites: Engineering 115, Mechanical Engineering 40, Chemical Engineering 141, Chemistry 120B or equivalent thermodynamics course

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Materials Production: [Read Less](#) [-]

MAT SCI 121 Metals Processing 3 Units

Terms offered: Spring 2015, Spring 2014, Spring 2013

The principles of metals processing with emphasis on the use of processing to establish microstructures which impart desirable engineering properties. The techniques discussed include solidification, thermal and mechanical processing, powder processing, welding and joining, and surface treatments.

Metals Processing: [Read More](#) [+]

Rules & Requirements

Prerequisites: Engineering 45

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Gronsky

Metals Processing: [Read Less](#) [-]

MAT SCI 122 Ceramic Processing 3 Units

Terms offered: Fall 2012, Fall 2011, Fall 2010

Powder fabrication by grinding and chemical methods, rheological behavior of powder-fluid suspensions, forming methods, drying, sintering, and grain growth. Relation of processing steps to microstructure development.

Ceramic Processing: Read More [+]

Rules & Requirements

Prerequisites: Engineering 45, 115

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Ceramic Processing: Read Less [-]

MAT SCI 123 ELECTRONIC MATERIALS PROCESSING 4 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

This 4-unit course starts with a brief review of the fundamentals of solid-state physics including bands and defects in semiconductors and oxides, and then moves to bulk semiconductor crystals growth and processing including doping, diffusion and implantation, and then to thin film deposition and processing methods, and finishes with a discussion of materials analysis and characterization. Recent advances in nanomaterials research will also be introduced.

ELECTRONIC MATERIALS PROCESSING: Read More [+]

Objectives Outcomes

Course Objectives: To prepare students a) for work in semiconductor processing facilities and b) for graduate studies related to thin film processing and relevant materials science topics.

To present the relevant materials science issues in semiconductor and oxide processing

To provide an introduction into the principles of thin film processing and related technologies.

Student Learning Outcomes: Basic knowledge of gas kinetics and vacuum technology, including ideal gas, gas transport theory, definition, creation and measurement of vacuum.

Knowledge of electrical and optical properties of thin films.

Knowledge of the formation of p-n junction to explain the diode operation and its I-V characteristics. Understanding of the mechanisms of Hall Effect, transport, and C-V measurements, so that can calculate carrier concentration, mobility and conductivity given raw experimental data. The ability to describe major growth techniques of bulk, thin film, and nanostructured semiconductors, with particular emphasis on thin film deposition technologies, including evaporation, sputtering, chemical vapor deposition and epitaxial growths.

To have basic knowledge of doping, purification, oxidation, gettering, diffusion, implantation, metallization, lithography and etching in semiconductor processing.

To have basic knowledge of electronic material characterization methods: x-ray diffraction, SEM and TEM, EDX, Auger, STM and AFM, Rutherford Back Scattering and SIMS, as well as optical methods including photoluminescence, absorption and Raman scattering.

To understand the concepts of bands, bandgap, to distinguish direct and indirect bandgap semiconductors. Understanding of free electron and hole doping of semiconductors to determine Fermi level position.

To understand the effect of defects in semiconductors, so that can describe their electronic and optical behaviors, and the methods to eliminate and control them in semiconductors.

Rules & Requirements

Prerequisites: MSE 111 or Physics 7C or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Wu, Yao

ELECTRONIC MATERIALS PROCESSING: Read Less [-]

MAT SCI 125 Thin-Film Materials Science 3 Units

Terms offered: Spring 2016, Spring 2015, Fall 2014

Deposition, processing, and characterization of thin films and their technological applications. Physical and chemical vapor deposition methods. Thin-film nucleation and growth. Thermal and ion processing. Microstructural development in epitaxial, polycrystalline, and amorphous films. Thin-film characterization techniques. Applications in information storage, integrated circuits, and optoelectronic devices. Laboratory demonstrations.

Thin-Film Materials Science: Read More [+]

Rules & Requirements

Prerequisites: Upper division or graduate standing in engineering, physics, chemistry, and chemical engineering; Engineering 45 required; 111 or Physics 141A recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Dubon

Thin-Film Materials Science: Read Less [-]

MAT SCI 130 Experimental Materials Science and Design 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

This course provides a culminating experience for students approaching completion of the materials science and engineering curriculum. Laboratory experiments are undertaken in a variety of areas from the investigations on semiconductor materials to corrosion science and elucidate the relationships among structure, processing, properties, and performance. The principles of materials selection in engineering design are reviewed.

Experimental Materials Science and Design: Read More [+]

Rules & Requirements

Prerequisites: Senior standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Experimental Materials Science and Design: Read Less [-]

MAT SCI 136 Materials in Energy Technologies 4 Units

Terms offered: Fall 2017, Fall 2015, Fall 2011

In many, if not all, technologies, it is materials that play a crucial, enabling role. This course examines potentially sustainable technologies, and the materials properties that enable them. The science at the basis of selected energy technologies are examined and considered in case studies.

Materials in Energy Technologies: Read More [+]

Rules & Requirements

Prerequisites: Junior or above standing in Materials Science and Engineering or related field

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: Materials Science and Engineering 126

Materials in Energy Technologies: Read Less [-]

MAT SCI 140 Nanomaterials for Scientists and Engineers 3 Units

Terms offered: Spring 2015, Spring 2013, Spring 2012

This course introduces the fundamental principles needed to understand the behavior of materials at the nanometer length scale and the different classes of nanomaterials with applications ranging from information technology to biotechnology. Topics include introduction to different classes of nanomaterials, synthesis and characterization of nanomaterials, and the electronic, magnetic, optical, and mechanical properties of nanomaterials.

Nanomaterials for Scientists and Engineers: Read More [+]

Rules & Requirements

Prerequisites: 102 or equivalent recommended; Physics 7C and Engineering 45 required

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Minor

Nanomaterials for Scientists and Engineers: Read Less [-]

MAT SCI C150 Introduction to Materials Chemistry 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2015, Spring 2014, Spring 2012

The application of basic chemical principles to problems in materials discovery, design, and characterization will be discussed. Topics covered will include inorganic solids, nanoscale materials, polymers, and biological materials, with specific focus on the ways in which atomic-level interactions dictate the bulk properties of matter.

Introduction to Materials Chemistry: Read More [+]

Rules & Requirements

Prerequisites: 104A; 104B is recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: CHEM C150

Introduction to Materials Chemistry: Read Less [-]

MAT SCI 151 Polymeric Materials 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

This course is designed for upper division undergraduate and graduate students to gain a fundamental understanding of the science of polymeric materials. Beginning with a treatment of ideal polymeric chain conformations, it develops the thermodynamics of polymer blends and solutions, the modeling of polymer networks and gels, the dynamics of polymer chains, and the morphologies of thin films and other dimensionally-restricted structures relevant to nanotechnology.

Polymeric Materials: Read More [+]

Rules & Requirements

Prerequisites: Chemistry 1A or Engineering 5. 103 is recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Xu

Polymeric Materials: Read Less [-]

MAT SCI H194 Honors Undergraduate Research 1 - 4 Units

Terms offered: Fall 2016, Spring 2016, Fall 2015

Students who have completed a satisfactory number of advanced courses with a grade-point average of 3.3 or higher may pursue original research under the direction of one of the members of the staff. A maximum of 3 units of H194 may be used to fulfill technical elective requirements in the Materials Science and Engineering program or double majors (unlike 198 or 199, which do not satisfy technical elective requirements). Final report required.

Honors Undergraduate Research: Read More [+]

Rules & Requirements

Prerequisites: Upper division technical GPA of 3.3 or higher and consent of instructor and adviser

Repeat rules: Course may be repeated for credit.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer: 8 weeks - 1.5-7.5 hours of independent study per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Honors Undergraduate Research: Read Less [-]

MAT SCI 195 Special Topics for Advanced Undergraduates 1 Unit

Terms offered: Spring 2012, Spring 2011, Spring 2010

Group study of special topics in materials science and engineering. Selection of topics for further study of underlying concepts and relevant literature, in consultation with appropriate faculty members.

Special Topics for Advanced Undergraduates: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing and good academic standing. (2.0 gpa and above)

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of directed group study per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Special Topics for Advanced Undergraduates: Read Less [-]

MAT SCI 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

Group studies of selected topics.

Directed Group Studies for Advanced Undergraduates: [Read More](#) [+]

Rules & Requirements

Prerequisites: Upper division standing in Engineering

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Studies for Advanced Undergraduates: [Read Less](#) [-]

MAT SCI 199 Supervised Independent Study 1 - 4 Units

Terms offered: Fall 2016, Spring 2016, Fall 2015

Supervised independent study. Enrollment restrictions apply; see the Introduction to Courses and Curricula section of this catalog.

Supervised Independent Study: [Read More](#) [+]

Rules & Requirements

Prerequisites: Consent of instructor and major adviser

Credit Restrictions: Course may be repeated for a maximum of four units per semester.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Materials Science and Engineering/
Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study: [Read Less](#) [-]

Nuclear Engineering Courses

NUC ENG 24 Freshman Seminars 1 Unit

Terms offered: Spring 2018, Fall 2017, Spring 2017

The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley Seminars are offered in all campus departments, and topics vary from department to department and semester to semester.

Freshman Seminars: [Read More](#) [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Freshman Seminars: [Read Less](#) [-]

NUC ENG 100 Introduction to Nuclear Engineering 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

The class provides students with an overview of the contemporary nuclear energy technology with emphasis on nuclear fission as an energy source. Starting with the basic physics of the nuclear fission process, the class includes discussions on reactor control, thermal hydraulics, fuel production, and spent fuel management for various types of reactors in use around the world as well as analysis of safety and other nuclear-related issues. This class is intended for sophomore NE students, but is also open to transfer students and students from other majors.

Introduction to Nuclear Engineering: [Read More](#) [+]

Rules & Requirements

Prerequisites: Physics 7A and 7B, Physics 7C may be taken concurrently. Mathematics 53 and 54 may be taken concurrently

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Introduction to Nuclear Engineering: [Read Less](#) [-]

NUC ENG 101 Nuclear Reactions and Radiation 4 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

Energetics and kinetics of nuclear reactions and radioactive decay, fission, fusion, and reactions of low-energy neutrons; properties of the fission products and the actinides; nuclear models and transition probabilities; interaction of radiation with matter.

Nuclear Reactions and Radiation: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Physics 7C

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Bernstein, L.

Nuclear Reactions and Radiation: Read Less [\[-\]](#)

NUC ENG 102 Nuclear Reactions and Radiation Laboratory 3 Units

Terms offered: Spring 2016, Spring 2015, Spring 2013

Laboratory course in nuclear physics. Experiments will allow students to directly observe phenomena discussed in Nuclear Engineering 101. These experiments will give students exposure to (1) electronics, (2) alpha, beta, gamma radiation detectors, (3) radioactive sources, and (4) experimental methods relevant for all aspects of nuclear science. Experiments include: Rutherford scattering, x-ray fluorescence, muon lifetime, gamma-gamma angular correlations, Mossbauer effect, and radon measurements.

Nuclear Reactions and Radiation Laboratory: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 101

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture, 1 hour of discussion, and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Norman

Nuclear Reactions and Radiation Laboratory: Read Less [\[-\]](#)

NUC ENG 104 Radiation Detection and Nuclear Instrumentation Laboratory 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Basic science of radiation measurement, nuclear instrumentation, neutronics, radiation dosimetry. The lectures emphasize the principles of radiation detection. The weekly laboratory applies a variety of radiation detection systems to the practical measurements of interest for nuclear power, nuclear and non-nuclear science, and environmental applications. Students present goals and approaches of the experiments being performed.

Radiation Detection and Nuclear Instrumentation Laboratory: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 101 or equivalent or consent of instructor; 150 or equivalent recommended

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Vetter

Formerly known as: 104A

Radiation Detection and Nuclear Instrumentation Laboratory: Read Less [\[-\]](#)

NUC ENG 107 Introduction to Imaging 3 Units

Terms offered: Fall 2016, Fall 2014, Fall 2012

Introduction to medical imaging physics and systems, including x-ray computed tomography (CT), nuclear magnetic resonance (NMR), positron emission tomography (PET), and SPECT; basic principles of tomography and an introduction to unfolding methods; resolution effects of counting statistics, inherent system resolution and human factors.

Introduction to Imaging: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 101 and 104A or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Vetter

Introduction to Imaging: Read Less [\[-\]](#)

NUC ENG 120 Nuclear Materials 4 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

Effects of irradiation on the atomic and mechanical properties of materials in nuclear reactors. Fission product swelling and release; neutron damage to structural alloys; fabrication and properties of uranium dioxide fuel.

Nuclear Materials: Read More [+]

Rules & Requirements

Prerequisites: Engineering 45 and an upper division course in thermodynamics

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Wirth

Nuclear Materials: Read Less [-]

NUC ENG 124 Radioactive Waste Management 3 Units

Terms offered: Spring 2017, Spring 2016, Spring 2015

Components and material flowsheets for nuclear fuel cycle, waste characteristics, sources of radioactive wastes, compositions, radioactivity and heat generation; waste treatment technologies; waste disposal technologies; safety assessment of waste disposal.

Radioactive Waste Management: Read More [+]

Rules & Requirements

Prerequisites: Engineering 117 or equivalent course

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Ahn

Radioactive Waste Management: Read Less [-]

NUC ENG 130 Analytical Methods for Non-proliferation 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Use of nuclear measurement techniques to detect clandestine movement and/or possession of nuclear materials by third parties. Nuclear detection, forensics, signatures, and active and passive interrogation methodologies will be explored. Techniques currently deployed for arms control and treaty verification will be discussed. Emphasis will be placed on common elements of detection technology from the viewpoint of resolution of threat signatures from false positives due to naturally occurring radioactive material. Topics include passive and active neutron signals, gamma ray detection, fission neutron multiplicity, and U and Pu isotopic identification and age determination.

Analytical Methods for Non-proliferation: Read More [+]

Rules & Requirements

Prerequisites: 101 or equivalent course in nuclear physics, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Morse

Analytical Methods for Non-proliferation: Read Less [-]

NUC ENG 150 Introduction to Nuclear Reactor Theory 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Neutron interactions, nuclear fission, and chain reacting systematics in thermal and fast nuclear reactors. Diffusion and slowing down of neutrons. Criticality calculations. Nuclear reactor dynamics and reactivity feedback. Production of radionuclides in nuclear reactors.

Introduction to Nuclear Reactor Theory: Read More [+]

Rules & Requirements

Prerequisites: 101; Mathematics 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Greenspan, Vujic

Introduction to Nuclear Reactor Theory: Read Less [-]

NUC ENG 155 Introduction to Numerical Simulations in Radiation Transport 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Computational methods used to analyze radiation transport described by various differential, integral, and integro-differential equations. Numerical methods include finite difference, finite elements, discrete ordinates, and Monte Carlo. Examples from neutron and photon transport; numerical solutions of neutron/photon diffusion and transport equations. Monte Carlo simulations of photon and neutron transport. An overview of optimization techniques for solving the resulting discrete equations on vector and parallel computer systems.

Introduction to Numerical Simulations in Radiation Transport: Read More [+]

Rules & Requirements

Prerequisites: Mathematics 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Vujic, Wirth

Introduction to Numerical Simulations in Radiation Transport: Read Less [-]

NUC ENG 161 Nuclear Power Engineering 4 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

Energy conversion in nuclear power systems; design of fission reactors; thermal and structural analysis of reactor core and plant components; thermal-hydraulic analysis of accidents in nuclear power plants; safety evaluation and engineered safety systems.

Nuclear Power Engineering: Read More [+]

Rules & Requirements

Prerequisites: Course(s) in fluid mechanics and heat transfer; junior-level course in thermodynamics

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Peterson

Nuclear Power Engineering: Read Less [-]

NUC ENG 162 Radiation Biophysics and Dosimetry 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Interaction of radiation with matter; physical, chemical, and biological effects of radiation on human tissues; dosimetry units and measurements; internal and external radiation fields and dosimetry; radiation exposure regulations; sources of radiation and radioactivity; basic shielding concepts; elements of radiation protection and control; theories and models for cell survival, radiation sensitivity, carcinogenesis, and dose calculation.

Radiation Biophysics and Dosimetry: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Vujic

Radiation Biophysics and Dosimetry: Read Less [-]

NUC ENG 167 Risk-Informed Design for Advanced Nuclear Systems 3 Units

Terms offered: Fall 2017, Fall 2015, Fall 2014

Project-based class for design and licensing of nuclear facilities, including advanced reactors. Elements of a project proposal. Regulatory framework and use of deterministic and probabilistic licensing criteria. Siting criteria. External and internal events. Identification and analysis of design basis and beyond design basis events. Communication with regulators and stakeholders. Ability to work in and contribute to a design team.

Risk-Informed Design for Advanced Nuclear Systems: [Read More](#) [+]

Objectives Outcomes

Course Objectives: * Introduce students to the methods and models for event identification, accident analysis, and risk assessment and management for internally and externally initiated events.

* Introduce students to the regulatory requirements for design, construction and operation of nuclear facilities licensed by the U.S. Nuclear Regulatory Commission.

* Introduce students to the safety principles and methods used to design, construct and operate a safe nuclear facility, for a specific site and application.

* Provide a basic understanding of similarities and differences in regulation of nuclear facilities versus other technologies (biotech, commercial aviation, commercial space launch, civil infrastructure).

* Provide a basic understanding the risk-informed design process and an opportunity to experience contributing in a focused area to a design project.

* Provide students with experiential knowledge in developing schedules, allocating work responsibilities, and working in teams.

* Provide students with experiential knowledge in the preparation and evaluation a Safety Analysis Report for meeting USNRC regulatory requirements, including response to Requests for Additional Information (RAIs).

Student Learning Outcomes: * Develop a broad understanding of safety principles and methods used in design, construction and licensing of nuclear facilities.

* Develop a broad understanding of the U.S. Nuclear Regulatory Commission's regulatory requirements for nuclear facilities.

* Have awareness of key similarities and differences in regulation of nuclear facilities versus other technologies (biotech, commercial aviation, commercial space launch, civil infrastructure).

* Have awareness of the major topics covered in a Safety Analysis Report (SAR) and experience in developing and writing at least one element of a SAR.

* Have developed experience and skills in communication with the business community, the public, and regulators.

* Have developed experience and skills in establishing a project schedule, allocating work responsibilities, and working in teams.

* Have understanding of application of event identification, event frequency and consequence analysis, risk assessment and management for internally and externally initiated events in the design process.

Rules & Requirements

Prerequisites: Completion of at least two upper-division engineering courses providing relevant skills: ChemE 150A, ChemE 180, CE 111, CE 120, CE152, CE 166, CE 175, E 120, IEOR 166, IEOR 172, ME 106, ME 109, ME 128, ME 146, NE 120, NE 124, NE 150, NE 161

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

NUC ENG 170A Nuclear Design: Design in Nuclear Power Technology and Instrumentation 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Design of various fission and fusion power systems and other physically based applications. Each semester a topic will be chosen by the class as a whole. In addition to technology, the design should address issues relating to economics, the environment, and risk assessment.

Nuclear Design: Design in Nuclear Power Technology and Instrumentation: [Read More](#) [+]

Rules & Requirements

Prerequisites: Senior standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: 170

Nuclear Design: Design in Nuclear Power Technology and Instrumentation: [Read Less](#) [-]

NUC ENG 170B Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy 3 Units

Terms offered: Spring 2010, Spring 2009, Spring 2008

A systems approach to the development of procedures for nuclear medicine and radiation therapy. Each semester a specific procedure will be studied and will entail the development of the biological and physiological basis for a procedure, the chemical and biochemical characteristics of appropriate drugs, dosimetric requirements and limitations, the production and distribution of radionuclides and/or radiation fields to be applied, and the characteristics of the instrumentation to be used.

Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy: [Read More](#) [+]

Rules & Requirements

Prerequisites: 107, 161, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: 167

Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy: [Read Less](#) [-]

NUC ENG 175 Methods of Risk Analysis 3 Units

Terms offered: Fall 2013, Fall 2011, Fall 2009

Methodological approaches for the quantification of technological risk and risk based decision making. Probabilistic safety assessment, human health risks, environmental and ecological risk analysis.

Methods of Risk Analysis: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Kastenberg

Methods of Risk Analysis: Read Less [-]

NUC ENG 180 Introduction to Controlled Fusion 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

Introduction to energy production by controlled thermonuclear reactions. Nuclear fusion reactions, energy balances for fusion systems, survey of plasma physics; neutral beam injection; RF heating methods; vacuum systems; tritium handling.

Introduction to Controlled Fusion: Read More [+]

Rules & Requirements

Prerequisites: Physics 7C

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Morse

Introduction to Controlled Fusion: Read Less [-]

NUC ENG H194 Honors Undergraduate Research 1 - 4 Units

Terms offered: Spring 2018, Fall 2017, Spring 2017

Supervised research. Students who have completed three or more upper division courses may pursue original research under the direction of one of the members of the staff. A final report or presentation is required. A maximum of three units of H194 may be used to fulfill a technical elective requirement in the Nuclear Engineering general program or joint major programs.

Honors Undergraduate Research: Read More [+]

Rules & Requirements

Prerequisites: Upper division technical GPA of 3.3, consent of instructor and faculty advisor

Repeat rules: Course may be repeated for credit once. Course may be repeated once for credit. Course may be repeated for a maximum of 8 units.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer: 10 weeks - 1.5-6 hours of independent study per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Honors Undergraduate Research: Read Less [-]

NUC ENG 198 Group Study for Advanced Undergraduates 1 - 4 Units

Terms offered: Spring 2018, Fall 2017, Spring 2017

Group studies of selected topics.

Group Study for Advanced Undergraduates: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing

Repeat rules: Course may be repeated for credit.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Group Study for Advanced Undergraduates: Read Less [-]

NUC ENG 199 Supervised Independent Study 1 - 4 Units

Terms offered: Spring 2018, Fall 2017, Spring 2017

Supervised independent study. Enrollment restrictions apply; see the Introduction to Courses and Curricula section of this catalog.

Supervised Independent Study: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor and major adviser

Credit Restrictions: Course may be repeated for credit for a maximum of 4 units per semester.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study: Read Less [\[-\]](#)

NUC ENG S199 Supervised Independent Study 1 - 4 Units

Terms offered: Prior to 2007

Supervised independent study. Please see section of the for description and prerequisites.

Supervised Independent Study: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor and major adviser

Credit Restrictions: Course may be repeated for credit for a maximum of 4 units per semester.

Hours & Format

Summer: 8 weeks - 0 hours of independent study per week

Additional Details

Subject/Course Level: Nuclear Engineering/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study: Read Less [\[-\]](#)