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 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 environment 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, listed on the College Requirements tab, 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	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	Properties of Materials	3
NUC ENG 24	Freshman Seminars [2]	1
EL ENG 40	Introduction to Microelectronic Circuits	4
MEC ENG C85	Introduction to Solid Mechanics	3

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

[2] Junior transfers are exempt from completing NUC ENG 24.

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 [1]	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
Upper-division Technical Electives: Minimum 12 units		
Select 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		

[1] Junior transfers are exempt from completing NUC ENG 100.

Students in the College of Engineering must complete 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 2.000 (C average) and a minimum 2.000 grade point average in upper division technical course work required of the major.

3. The final 30 units must be completed in residence in the College of Engineering on the Berkeley campus in two consecutive semesters.

4. All technical courses (math, science & engineering), required of the major or not, must be taken on a letter graded basis (unless they are only offered P/NP).

5. Entering freshman 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. 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.

Humanities and Social Science Requirement
To promote a rich and varied educational experience outside of the technical requirements for each major, the College of Engineering has a Humanities and Social Sciences breadth requirement, which must be completed to graduate. This requirement is built into all the Engineering programs of study. The requirement includes two approved reading and composition courses and four additional approved courses, within which a number of specific conditions must be satisfied.

1. Complete a minimum of six courses (3 units or more) from the approved Humanities/Social Sciences (H/SS) lists (http://coe.berkeley.edu/hssreq) .

2. Two of the six courses must fulfill the Reading and Composition 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 (4th 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, by no later than the end of the sophomore year. For detailed lists of courses that fulfill Reading and Composition requirements, please see the Reading and Composition page (http://guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/engineering/reading-composition-requirement) in this bulletin.

3. The four additional courses must be chosen from the H/SS comprehensive list. These courses may be taken on a Pass/Not Passed Basis (P/NP).

4. At least two of the six courses must be upper division (courses numbered 100-196).

5. At least two courses must be from the same department and at least one of the two must be upper division. This is called the *Series requirement. AP tests can be combined with a course to complete the series requirement. For example, AP History (any) combined with an upper division History course would satisfy the series requirement

6. One of the six courses must satisfy the campus American Cultures Requirement. For detailed lists of courses that fulfill American Cultures requirements, please see the American Cultures page (http://guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/engineering/american-cultures-requirement) in this bulletin.

7. A maximum of two exams (Advanced Placement, International Baccalaureate, or A-Level) may be used toward completion of the H/SS requirement. Visit this link (http://coe.berkeley.edu/exams)

8. No courses offered by an Engineering department (IEOR, CE, etc.) other than BIOE 100, CS C79, ENGIN 125, ENGIN 130AC, 157AC, ME 191K and ME 191AC may be used to complete H/SS requirements.

9. Courses may fulfill multiple categories. For example, if you complete City and Regional Planning 115 and 118AC that would satisfy the series requirement, the two upper division courses requirement and the American Cultures Requirement.

10. The College of Engineering (COE) 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 Humanities and Social Science requirement. Our requirement is different than that of L & S, so the guidelines posted on the top of each L & S breadth list do NOT apply to COE students.

11. Foreign language courses MAY be used to complete H/SS requirements. L & S does not allow students to use many language courses, so their lists will not include all options open to Engineering students. For a list of language options, visit http://coe.berkeley.edu/FL

*NOTE: for the Series Requirement: The purpose of the series requirement is to provide depth of knowledge in a certain area. Therefore, a two-course sequence not in the same department may be approved by petition, in cases in which there is a clear and logical connection between the courses involved.

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

				Freshman
Fall	**Units**	**Spring**		**Units**
Chemistry: CHEM 1A & CHEM 1AL, or CHEM 4A	4	MATH 1B		4
Reading & Composition course from List A	4	Reading & Composition course from List B		4
NUC ENG 24	1	ENGIN 7		4
Humanities/Social Sciences course	3-4	PHYSICS 7A		4
MATH 1A	4			
	16-17			**16**
				Sophomore
Fall	**Units**	**Spring**		**Units**
EL ENG 40	4	MATH 54		4
MATH 53	4	MEC ENG C85		3
ENGIN 45	3	PHYSICS 7C		4
PHYSICS 7B	4	NUC ENG 100		3
	15			**14**
				Junior
Fall	**Units**	**Spring**		**Units**
ENGIN 115	4	MAT SCI 103		3
MAT SCI 102	3	NUC ENG 104		4
NUC ENG 104	4	NUC ENG 150		4
Technical Elective	3	Humanities/ Social Sciences course		3-4
Humanities/Social Science course	3-4	MAT SCI 104		4
	17-18			**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	9	MAT SCI 113	3
		NUC ENG 170	3
		Humanities/ Social Sciences course	3-4
	16		**16-17**

Total Units: 128-132

Materials Science and Engineering/Nuclear Engineering

MAT SCI 24 Freshman Seminar 1 Unit
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.
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.

MAT SCI 39A Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

Instructor: Sastry

MAT SCI 39B Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39C Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39D Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39E Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39F Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39G Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39H Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39I Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39J Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39K Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39L Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39M Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39N Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39O Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39P Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39Q Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

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

MAT SCI 39R Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39S Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39T Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-8 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39U Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39V Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39W Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39X Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39Y Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

MAT SCI 39Z Freshman/Sophomore Seminar 1.5 - 4 Units
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollments limits are set by the faculty, but the suggested limit is 25.
Rules & Requirements

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

Hours & Format

Fall and/or spring:
6 weeks - 3.5-10 hours of seminar per week
8 weeks - 3-8 hours of seminar per week
10 weeks - 2-6 hours of seminar per week
15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Materials Science and Engineering/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam not required.

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

MAT SCI 103 Phase Transformations and Kinetics 3 Units
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.
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.

MAT SCI 104 Materials Characterization 4 Units
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.
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: Gronsky

MAT SCI 111 Properties of Electronic Materials 4 Units
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.
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

MAT SCI 112 Corrosion (Chemical Properties) 3 Units
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.
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

MAT SCI 113 Mechanical Behavior of Engineering Materials 3 Units
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.
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

MAT SCI 117 Properties of Dielectric and Magnetic Materials 3 Units
Introduction to the physical principles underlying the dielectric and magnetic properties of solids. Processing-microstructure-property relationships of dielectric materials, including piezoelectric, pryoelectric, 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.
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.

MAT SCI C118 Biological Performance of Materials 4 Units
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.
Rules & Requirements

Prerequisites: Engineering 45; Chemisty C130/Mollecular Cell Biology C100A or Engineering 115 or equivalent; Bioengineering 102 & Bioengineering 104 recommended

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: Healy

Also listed as: BIO ENG C118

MAT SCI 120 Materials Production 3 Units
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.
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.

MAT SCI 121 Metals Processing 3 Units
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.
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

MAT SCI 122 Ceramic Processing 3 Units
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.
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.

MAT SCI 123 Semiconductor Processing 3 Units
Semiconductor purification and crystal growth techniques; impurity doping by diffusion, ion implantation and alloy regrowth; contact formation, mechanical and chemical processing; semiconductor analysis.
Rules & Requirements

Prerequisites: 111 or PHYSICS 7A-7B-7C and consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 2 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: Wu, Yao

MAT SCI 125 Thin-Film Materials Science 3 Units
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.
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

MAT SCI 130 Experimental Materials Science and Design 3 Units
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.
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.

MAT SCI 136 Materials in Energy Technologies 4 Units
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.
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

MAT SCI 140 Nanomaterials for Scientists and Engineers 3 Units
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.
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

MAT SCI C150 Introduction to Materials Chemistry 3 Units
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.
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

MAT SCI 151 Polymeric Materials 3 Units
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 polmyer blends and solutions, the modeling of polymer networks and gelations, the dynamics of polymer chains, and the morphologies of thin films and other dimensionally-restricted structures relevant to nanotechnology.
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

MAT SCI H194 Honors Undergraduate Research 1 - 4 Units
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.
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. Course may be repeated for credit when topic changes.

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.

MAT SCI 195 Special Topics for Advanced Undergraduates 1 Unit
Group study of special topics in materials science and engineering. Selection of topics for further study of underlying concepts and relevent literature, in consultion with appropriate faculty members.
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.

MAT SCI 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units
Group studies of selected topics.
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.

MAT SCI 199 Supervised Independent Study 1 - 4 Units
Supervised independent study. Enrollment restrictions apply; see the Introduction to Courses and Curricula section of this catalog.
Rules & Requirements

Prerequisites: Consent of instructor and major adviser

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

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

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.