Chemical Engineering

Bachelor of Science (BS)

The College of Chemistry offers a major in Chemical Engineering leading to the Bachelor of Science (BS) degree, through the Department of Chemical and Biomolecular Engineering. The program equips the student for professional work in development, design, and operation of chemical processes and of process equipment. Students with high scholastic attainment are well prepared to enter graduate programs. The curriculum is accredited by ABET (http://www.abet.org).

Admission to the Major

For information on admission to the major, please see the College of Chemistry Admissions tab (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/#admissionstext) in this Guide.

Minor Program

The Department of Chemical and Biomolecular Engineering offers an undergraduate minor in Chemical Engineering. For information regarding how to declare the minor, please contact the department. Please be sure to consult with your college or school for information on rules regarding overlap of courses between majors and minors.

Joint Major Programs with the College of Engineering

Chemical Engineering/Materials Science and Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/chemical-engineering-materials-science-joint-major/): BS
Chemical Engineering/Nuclear Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/chemical-engineering-nuclear-joint-major/): BS

In addition to the University, campus, and college requirements, listed in the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. A minimum grade point average (GPA) of 2.0 must be maintained in all courses undertaken at UC Berkeley, including those from UC Summer Sessions, UC Education Abroad Program, UC Berkeley in Washington Program, and XB courses from University Extension.
2. A minimum GPA of 2.0 in all courses taken in the college is required in order to advance and continue in the upper division.
3. A minimum GPA of 2.0 in all upper division courses taken at the University is required to satisfy major requirements.
4. Students in the College of Chemistry who receive a grade of D+ or lower in a chemical and biomolecular engineering or chemistry course for which a grade of C- or higher is required must repeat the course at UC Berkeley.

For information regarding grade requirements in specific courses, please see the notes sections below.

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

Please note, the Academic Guide is updated only once a year. For the most current information on requirements please a look at the College of Chemistry website (https://chemistry.berkeley.edu/ugrad/degrees/cheme/).

Lower Division Requirements

CHEM 4A	General Chemistry and Quantitative Analysis	5
CHEM 4B	General Chemistry and Quantitative Analysis	5
CHEM 12A	Organic Chemistry	5
CHM ENG 40	Introduction to Chemical Engineering Design	2
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
BIOLOGY 1A	General Biology Lecture	3
or BIO ENG 11	Engineering Molecules 1	
	Students in the Biotechnology concentration are required to take BIO ENG 11 or MCELLBI 102 or CHEM 135 instead of BIOLOGY 1A (even with a score of 4 or 5 on the AP Bio test). Please note that Biology 1A is a prerequisite for Chemistry 135 and Molecular and Cell Biology 102.	
MAT SCI 45	Properties of Materials	3
MAT SCI 45L	Properties of Materials Laboratory	1

Notes

1. Students should take CHEM 4A and CHEM 4B during their freshman year, and CHEM 12A and CHEM 12B during their sophomore year.
2. A grade of C- or better is required in CHEM 4A before taking CHEM 4B, in CHEM 4B before taking more advanced courses, and in CHEM 12A before taking CHEM 12B.
3. A grade of C- or better is required in CHEM 12A before taking BIOLOGY 1A or CHEM 12B.
4. A grade of C- or better in CHM ENG 140 is required before enrolling in any other chemical engineering courses.
5. ENGIN W7 may be substituted for ENGIN 7.
6. ENGIN 7 must be taken before or concurrently with CHM ENG 140 and before CHM ENG 150B.
7. Students should start MATH 1A in the first semester of their freshman year.
8. Students should start PHYSICS 7A in the second semester of the freshman year.

Upper Division Requirements

CHEM 120A	Physical Chemistry	3-4
or PHYSICS 137A	Quantum Mechanics	
CHM ENG 140	Introduction to Chemical Process Analysis	4
CHM ENG 141	Chemical Engineering Thermodynamics	4
CHM ENG 142	Chemical Kinetics and Reaction Engineering	4
CHM ENG 150A	Transport Processes	4
CHM ENG 150B	Transport and Separation Processes	4
CHM ENG 154	Chemical Engineering Laboratory	4
CHM ENG 160	Chemical Process Design	4
CHM ENG 162	Dynamics and Control of Chemical Processes	4

3 units engineering electives chosen from the Lower Division Engineering Electives List OR the Upper Division Engineering Electives List [1]	3
Electives and Concentrations: Select one of the following: [2]	
Open Elective Program: 12 units (see below for details)	
Concetration (see below for details)	

1 Effective Fall 2017, MSE 45/L is replacing E 45/L. MSE 45L is not required if the student took E 45 during spring 2016 or earlier. However, these students must complete 4 units of engineering elective instead of 3.

2 A course used toward satisfaction of the open elective program or a concentration cannot also be used toward satisfaction of another college or major requirement.
A maximum of 6 units of research can be applied toward electives.

Open Elective Program

Students who do not choose a concentration must complete the following requirements for the open elective program:

One science elective, selected from physical and biological sciences electives list (see below)	3
CBE elective [1]	3
Engineering electives, selected from the engineering electives list [2]	6

1 CHM ENG 196 may not be used to fulfill this elective requirement.

2 Other engineering courses may be approved by the CBE Department.

Physical and Biological Sciences Electives List

ANTHRO 1	Introduction to Biological Anthropology	4
ANTHRO C100	Human Paleontology	5
ANTHRO C103	Introduction to Human Osteology	6
ANTHRO 107	Evolution of the Human Brain	4
ANTHRO 134	Analysis of the Archaeological Record	4
ANTHRO 135	Paleoethnobotany: Archaeological Methods and Laboratory Techniques	4
ASTRON 3	Introduction to Modern Cosmology	2
ASTRON 7A	Introduction to Astrophysics	4
ASTRON 7B	Introduction to Astrophysics	4
ASTRON 10	Introduction to General Astronomy	4
ASTRON C10	Introduction to General Astronomy	4
ASTRON C12	The Planets	3
ASTRON C162	Planetary Astrophysics	4
BIOLOGY 1B	General Biology Lecture and Laboratory	4
CHEM 12B	Organic Chemistry	5
CHEM 103	Inorganic Chemistry in Living Systems	3
CHEM 104A	Advanced Inorganic Chemistry	3
CHEM 104B	Advanced Inorganic Chemistry	3
CHEM 105	Instrumental Methods in Analytical Chemistry	4
CHEM 108	Inorganic Synthesis and Reactions	4
CHEM 113	Advanced Mechanistic Organic Chemistry	3
CHEM 114	Advanced Synthetic Organic Chemistry	3
CHEM 115	Organic Chemistry--Advanced Laboratory Methods	4
CHEM 120B	Physical Chemistry	3
CHEM 122	Quantum Mechanics and Spectroscopy	3
CHEM 125	Physical Chemistry Laboratory	3
CHEM C130	Biophysical Chemistry: Physical Principles and the Molecules of Life	4
CHEM 135	Chemical Biology	3
CHEM 143	Nuclear Chemistry	2
CHEM 146	Course Not Available	
CHEM C150	Introduction to Materials Chemistry	3
CHEM C182	Atmospheric Chemistry and Physics Laboratory	3
CHEM C191	Quantum Information Science and Technology	3
CHEM 192	Individual Study for Advanced Undergraduates	1-3
CHEM H194	Research for Advanced Undergraduates	2-6
CHEM 196	Special Laboratory Study	2-6
CIV ENG C106	Air Pollution	3
CIV ENG C116	Chemistry of Soils	3
COG SCI C102	Scientific Approaches to Consciousness	3
COG SCI C126	Perception	3
COG SCI C127	Cognitive Neuroscience	3
EPS 3	The Water Planet	3
EPS C12	The Planets	3
EPS 20	Earthquakes in Your Backyard	3
EPS C20	Earthquakes in Your Backyard	3
EPS 50	The Planet Earth	4
EPS 80	Environmental Earth Sciences	3
EPS 100A	Minerals: Their Constitution and Origin	4
EPS 103	Introduction to Aquatic and Marine Geochemistry	4
EPS 108	Geodynamics	4
EPS 117	Geomorphology	4
EPS C129	Biometeorology	3
EPS 130	Strong Motion Seismology	3
EPS C146	Geological Oceanography	4
EPS C162	Planetary Astrophysics	4
EPS C180	Air Pollution	3
EPS C181	Atmospheric Physics and Dynamics	3
EPS C182	Atmospheric Chemistry and Physics Laboratory	3
ENE,RES 102	Quantitative Aspects of Global Environmental Problems	4
ESPM 2	The Biosphere	3
ESPM 6	Environmental Biology	3
ESPM 15	Introduction to Environmental Sciences	3
ESPM C10	Environmental Issues	4
ESPM C11	Americans and the Global Forest	4
ESPM 40	Insects and Human Society	3
ESPM 42	Natural History of Insects	3
ESPM 44	Biological Control	2
ESPM 100	Environmental Problem Solving	4
ESPM 102B	Natural Resource Sampling	2
ESPM 102C	Resource Management	4
ESPM C103	Principles of Conservation Biology	4
ESPM 106	American Wildlife: Management and Policy in the 21st Century	3
ESPM C107	Biology and Geomorphology of Tropical Islands	13
ESPM 108A	Trees: Taxonomy, Growth, and Structures	3
ESPM 108B	Environmental Change Genetics	3

ESPM 110	Primate Ecology	4
ESPM 112	Microbial Ecology	3
ESPM 113	Insect Ecology	3
ESPM 114	Wildlife Ecology	3
ESPM 115B	Biology of Aquatic Insects	2
ESPM 117	Urban Garden Ecosystems	4
ESPM 118	Agricultural Ecology	4
ESPM 119	Chemical Ecology	2
ESPM 120	Science of Soils	3
ESPM C128	Chemistry of Soils	3
ESPM C129	Biometeorology	3
ESPM C130	Terrestrial Hydrology	4
ESPM 131	Soil Microbiology and Biogeochemistry	3
ESPM 134	Fire, Insects, and Diseases in Forest Ecosystems	3
ESPM 137	Landscape Ecology	3
ESPM C138	Introduction to Comparative Virology	4
ESPM 140	General Entomology	4
ESPM 142	Insect Behavior	3
ESPM 144	Insect Physiology	3
ESPM C148	Pesticide Chemistry and Toxicology	3
ESPM C149	Course Not Available	
ESPM 152	Global Change Biology	3
ESPM 172	Remote Sensing of the Environment	3
ESPM 174	Design and Analysis of Ecological Research	4
ESPM C180	Air Pollution	3
ESPM 185	Applied Forest Ecology	4
ESPM 186	Management and Conservation of Rangeland Ecosystems	4
ESPM 187	Restoration Ecology	4
GEOG N1	Global Environmental Change	3
GEOG 35	Global Ecology and Development	4
GEOG 40	Introduction to Earth System Science	4
GEOG C136	Terrestrial Hydrology	4
GEOG 137	Top Ten Global Environmental Problems	4
GEOG 140A	Physical Landscapes: Process and Form	4
GEOG 143	Global Change Biogeochemistry	3
GEOG 144	Principles of Meteorology	3
GEOG C145	Geological Oceanography	4
GEOG 171	Special Topics in Physical Geography	3
GEOG C148	Biogeography	4
INTEGBI 31	The Ecology and Evolution of Animal Behavior	3
INTEGBI 41	Marine Mammals	2
INTEGBI 102LF	Introduction to California Plant Life with Laboratory	4
INTEGBI 103LF	Invertebrate Zoology with Laboratory	5
INTEGBI 104LF	Natural History of the Vertebrates with Laboratory	5
INTEGBI 106A	Physical and Chemical Environment of the Ocean	4
INTEGBI C107L	Principles of Plant Morphology with Laboratory	4
INTEGBI 115	Introduction to Systems in Biology and Medicine	4
INTEGBI 117	Medical Ethnobotany	2
INTEGBI 118	Organismal Microbiomes and Host-Pathogen Interactions	4
INTEGBI 123AL	Exercise and Environmental Physiology with Laboratory	5
INTEGBI 131	General Human Anatomy	3
INTEGBI 135	The Mechanics of Organisms	4
INTEGBI 137	Human Endocrinology	4
INTEGBI C142L	Introduction to Human Osteology	6
INTEGBI C143A	Biological Clocks: Physiology and Behavior	3
INTEGBI C143B	Hormones and Behavior	3
INTEGBI 148	Comparative Animal Physiology	3
INTEGBI C149	Course Not Available	
INTEGBI 151	Plant Physiological Ecology	4
INTEGBI 152	Environmental Toxicology	4
INTEGBI 153	Ecology	3
INTEGBI 154	Plant Ecology	3
INTEGBI 154L	Plant Ecology Laboratory	2
INTEGBI C156	Principles of Conservation Biology	4
INTEGBI 158LF	Biology and Geomorphology of Tropical Islands	13
INTEGBI 159	The Living Planet: Impact of the Biosphere on the Earth System	3
INTEGBI 161	Population and Evolutionary Genetics	4
INTEGBI 162	Ecological Genetics	4
INTEGBI 164	Human Genetics and Genomics	4
INTEGBI 168	Course Not Available	
INTEGBI 168L	Plants: Diversity and Evolution	4
INTEGBI 169	Evolutionary Medicine	4
INTEGBI 174LF	Ornithology with Laboratory	4
INTEGBI 183L	Evolution of the Vertebrates with Laboratory	4
INTEGBI 184L	Morphology of the Vertebrate Skeleton with Laboratory	4
INTEGBI C185L	Human Paleontology	5
INTEGBI C187	Human Biogeography of the Pacific	3
L & S C30U	Americans and the Global Forest	4
L & S C30V	Environmental Issues	4
L & S C70T	The Planets	3
L & S C70U	Introduction to General Astronomy	4
L & S C70W	Physics and Music	3
L & S C70Y	Earthquakes in Your Backyard	3
MAT SCI C150	Introduction to Materials Chemistry	3
MCELLBI 32	Introduction to Human Physiology	3
MCELLBI 41	Genetics and Society	3
MCELLBI 50	The Immune System and Disease	4
MCELLBI C61	Brain, Mind, and Behavior	3
MCELLBI C62	Course Not Available	
MCELLBI C100A	Biophysical Chemistry: Physical Principles and the Molecules of Life	4
MCELLBI 100B	Biochemistry: Pathways, Mechanisms, and Regulation	4
MCELLBI 102	Survey of the Principles of Biochemistry and Molecular Biology	4
MCELLBI C103	Bacterial Pathogenesis	3
MCELLBI 104	Genetics, Genomics, and Cell Biology	4
MCELLBI C112	General Microbiology	4
MCELLBI C114	Introduction to Comparative Virology	4
MCELLBI C116	Microbial Diversity	3
MCELLBI 130	Cell and Systems Biology	4

MCELLBI 132	Biology of Human Cancer	4
MCELLBI 133L	Physiology and Cell Biology Laboratory	4
MCELLBI 135A	Topics in Cell and Developmental Biology: Molecular Endocrinology	3
MCELLBI 136	Physiology	4
MCELLBI 140	General Genetics	4
MCELLBI 140L	Genetics Laboratory	4
MCELLBI 141	Developmental Biology	4
MCELLBI 143	Evolution of Genomes, Cells, and Development	3
MCELLBI C148	Microbial Genomics and Genetics	4
MCELLBI 150	Molecular Immunology	4
MCELLBI 160L	Neurobiology Laboratory	4
MCELLBI 163L	Mammalian Neuroanatomy Lab	4
MCELLBI 166	Biophysical Neurobiology	3
NUSCTX 10	Introduction to Human Nutrition	3
NUSCTX 11	Introduction to Toxicology	3
NUSCTX 108A	Introduction and Application of Food Science	3
NUSCTX 110	Toxicology	4
NUSCTX 160	Metabolic Bases of Human Health and Diseases	4
NUSCTX 171	Nutrition and Toxicology Laboratory	4
PHYSICS 7C	Physics for Scientists and Engineers	4
PHYSICS C21	Physics and Music	3
PHYSICS 105	Analytic Mechanics	4
PHYSICS 110A	Electromagnetism and Optics	4
PHYSICS 110B	Electromagnetism and Optics	4
PHYSICS 112	Introduction to Statistical and Thermal Physics	4
PHYSICS 129	Particle Physics	4
PHYSICS 130	Quantum and Nonlinear Optics	3
PHYSICS 137B	Quantum Mechanics	4
PHYSICS 138	Modern Atomic Physics	3
PHYSICS 141A	Solid State Physics	4
PHYSICS 177	Principles of Molecular Biophysics	3
PLANTBI 10	Plants, Agriculture, and Society	2
PLANTBI 40	The (Secret) Life of Plants	3
PLANTBI C103	Bacterial Pathogenesis	3
PLANTBI C107L	Principles of Plant Morphology with Laboratory	4
PLANTBI C112	General Microbiology	4
PLANTBI C114	Introduction to Comparative Virology	4
PLANTBI C116	Microbial Diversity	3
PLANTBI 120	Biology of Algae	2
PLANTBI 120L	Laboratory for Biology of Algae	2
PLANTBI 122	Bioenergy	2
PLANTBI 135	Physiology and Biochemistry of Plants	3
PLANTBI C148	Microbial Genomics and Genetics	4
PLANTBI 150	Plant Cell Biology	3
PLANTBI 160	Plant Molecular Genetics	3
PLANTBI 170	Modern Applications of Plant Biotechnology	2
PLANTBI 180	Environmental Plant Biology	2
PSYCH 110	Introduction to Biological Psychology	3
PSYCH C113	Biological Clocks: Physiology and Behavior	3
PSYCH 114	Biology of Learning	3
PSYCH C116	Hormones and Behavior	3
PSYCH 117	Human Neuropsychology	3
PSYCH 122	Introduction to Human Learning and Memory	3
PSYCH C126	Perception	3
PSYCH C127	Cognitive Neuroscience	3
PSYCH C129	Scientific Approaches to Consciousness	3
PB HLTH 162A	Public Health Microbiology	4

Lower Division Engineering Electives List

CHM ENG 90	Science and Engineering of Sustainable Energy	3
COMPSCI 61B	Data Structures	4
COMPSCI C8	Foundations of Data Science	4
EECS 16A	Designing Information Devices and Systems I	4
EECS 16B	Designing Information Devices and Systems II	4

Upper Division Engineering Electives List

BIO ENG 101	Instrumentation in Biology and Medicine	4
BIO ENG 102	Biomechanics: Analysis and Design	4
BIO ENG 103	Engineering Molecules 2	4
BIO ENG 104	Biological Transport Phenomena	4
BIO ENG 110	Biomedical Physiology for Engineers	4
BIO ENG 111	Functional Biomaterials Development and Characterization	4
BIO ENG C112	Molecular Biomechanics and Mechanobiology of the Cell	4
BIO ENG 113	Stem Cells and Technologies	4
BIO ENG 114	Cell Engineering	4
BIO ENG 115	Tissue Engineering Lab	4
BIO ENG 116	Cell and Tissue Engineering	4
BIO ENG C117	Structural Aspects of Biomaterials	4
BIO ENG C118	Biological Performance of Materials	4
BIO ENG C119	Orthopedic Biomechanics	4
BIO ENG 121	BioMEMS and Medical Devices	4
BIO ENG 121L	BioMems and BioNanotechnology Laboratory	4
BIO ENG 124	Basic Principles of Drug Delivery	3
BIO ENG C125	Introduction to Robotics	4
BIO ENG C125B	Robotic Manipulation and Interaction	4
BIO ENG 131	Introduction to Computational Molecular and Cell Biology	4
BIO ENG 132	Genetic Devices	4
BIO ENG 135	Frontiers in Microbial Systems Biology	4
BIO ENG C136L	Laboratory in the Mechanics of Organisms	3
BIO ENG 140L	Synthetic Biology Laboratory	4
BIO ENG 143	Computational Methods in Biology	4
BIO ENG 144	Introduction to Protein Informatics	4
BIO ENG 144L	Protein Informatics Laboratory	3
BIO ENG C145L	Introductory Electronic Transducers Laboratory	3
BIO ENG C145M	Introductory Microcomputer Interfacing Laboratory	3
BIO ENG 147	Principles of Synthetic Biology	4
BIO ENG 148	Bioenergy and Sustainable Chemical Synthesis: Metabolic Engineering and Synthetic Biology Approaches	3
BIO ENG 150	Introduction of Bionanoscience and Bionanotechnology	4

BIO ENG 151	Micro/Nanofluidics for Bioengineering and Lab-On-A-Chip	4
BIO ENG 163	Principles of Molecular and Cellular Biophotonics	4
BIO ENG 163L	Molecular and Cellular Biophotonics Laboratory	4
BIO ENG 164	Optics and Microscopy	4
BIO ENG C165	Medical Imaging Signals and Systems	4
BIO ENG 168L	Practical Light Microscopy	3
BIO ENG C181	The Berkeley Lectures on Energy: Energy from Biomass	3
BIO ENG 196	Undergraduate Design Research	2-4
CHM ENG 143	Computational Methods in Chemical Engineering	4
CHM ENG 170A	Biochemical Engineering	3
CHM ENG 170B	Biochemical Engineering	4
CHM ENG C170L	Biochemical Engineering Laboratory	3
CHM ENG 171	Transport Phenomena	3
CHM ENG 176	Principles of Electrochemical Processes	3
CHM ENG C178	Polymer Science and Technology	3
CHM ENG 179	Process Technology of Solid-State Materials Devices	3
CHM ENG 180	Chemical Engineering Economics	3
CHM ENG 182	Nanoscience and Engineering Biotechnology	3
CHM ENG 183	Climate Solutions Technologies	3
CHM ENG H194	Research for Advanced Undergraduates	2-4
CHM ENG C195A	The Berkeley Lectures on Energy: Energy from Biomass (may be repeated for credit when the topic changes)	3
CHM ENG 196	Special Laboratory Study	2-4
CHEM C138	The Berkeley Lectures on Energy: Energy from Biomass	3
CIV ENG 101	Fluid Mechanics of Rivers, Streams, and Wetlands	3
CIV ENG 103	Introduction to Hydrology	3
CIV ENG 105	Design for Global Transformation	3
CIV ENG C106	Air Pollution	3
CIV ENG 107	Climate Change Mitigation	3
CIV ENG 110	Water Systems of the Future	3
CIV ENG 111	Environmental Engineering	3
CIV ENG 111L	Water and Air Quality Laboratory	1
CIV ENG 112	Environmental Engineering Design	3
CIV ENG 114	Environmental Microbiology	3
CIV ENG 115	Water Chemistry	3
CIV ENG C116	Chemistry of Soils	3
CIV ENG 120	Structural Engineering	3
CIV ENG 121	Structural Analysis	3
CIV ENG 122L	Structural Steel Design Project	1
CIV ENG 122N	Design of Steel Structures	3
CIV ENG 123L	Structural Concrete Design Project	1
CIV ENG 123N	Design of Reinforced Concrete Structures	3
CIV ENG 124	Structural Design in Timber	3
CIV ENG 130N	Mechanics of Structures	3
CIV ENG C133	Engineering Analysis Using the Finite Element Method	3
CIV ENG 153	Transportation Facility Design	3
CIV ENG 155	Transportation Systems Engineering	3
CIV ENG 156	Infrastructure Planning and Management	3
CIV ENG 167	Engineering Project Management	3
CIV ENG 171	Rock Mechanics	3
CIV ENG 173	Groundwater and Seepage	3
CIV ENG 175	Geotechnical and Geoenvironmental Engineering	3
CIV ENG 176	Environmental Geotechnics	3
CIV ENG C178	Applied Geophysics	3
CIV ENG 180	Life-Cycle Design and Construction	4
CIV ENG 186	Design of Internet-of-Things for Smart Cities	3
CIV ENG 191	Civil and Environmental Engineering Systems Analysis	3
CIV ENG 193	Engineering Risk Analysis	3
COMPSCI C100	Principles & Techniques of Data Science	4
COMPSCI 161	Computer Security	4
COMPSCI 162	Operating Systems and System Programming	4
COMPSCI 184	Foundations of Computer Graphics	4
COMPSCI 188	Introduction to Artificial Intelligence	4
COMPSCI 189	Introduction to Machine Learning	4
EL ENG 105	Microelectronic Devices and Circuits	4
EL ENG C106A	Introduction to Robotics	4
EL ENG C106B	Robotic Manipulation and Interaction	4
EL ENG 113	Power Electronics	4
EL ENG 118	Introduction to Optical Engineering	4
EL ENG 130	Integrated-Circuit Devices	4
EL ENG 134	Fundamentals of Photovoltaic Devices	4
EL ENG 137A	Introduction to Electric Power Systems	4
EL ENG 137B	Introduction to Electric Power Systems	4
EL ENG 140	Linear Integrated Circuits	4
EL ENG 142	Integrated Circuits for Communications	4
EL ENG 143	Microfabrication Technology	4
EL ENG C145B	Medical Imaging Signals and Systems	4
EL ENG C145L	Introductory Electronic Transducers Laboratory	3
EL ENG C145O	Laboratory in the Mechanics of Organisms	3
EL ENG 147	Introduction to Microelectromechanical Systems (MEMS)	3
ENGIN 117	Methods of Engineering Analysis	3
ENGIN 120	Principles of Engineering Economics	3
IND ENG 153	Logistics Network Design and Supply Chain Management	3
IND ENG 160	Nonlinear and Discrete Optimization	3
IND ENG 162	Linear Programming and Network Flows	3
IND ENG 165	Engineering Statistics, Quality Control, and Forecasting	4
IND ENG 166	Decision Analytics	3
IND ENG 170	Industrial Design and Human Factors	3
MAT SCI 102	Bonding, Crystallography, and Crystal Defects	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 117	Properties of Dielectric and Magnetic Materials	3
MAT SCI C118	Biological Performance of Materials	4
MAT SCI 120	Materials Production	3

MAT SCI 121	Metals Processing	3
MAT SCI 122	Ceramic Processing	3
MAT SCI 123	ELECTRONIC MATERIALS PROCESSING	4
MAT SCI 125	Thin-Film Materials Science	3
MAT SCI 136	Materials in Energy Technologies	4
MAT SCI 140	Nanomaterials for Scientists and Engineers	3
MAT SCI 151	Polymeric Materials	3
MAT SCI H194	Honors Undergraduate Research	1-4
MEC ENG 102B	Mechatronics Design	4
MEC ENG 104	Engineering Mechanics II	3
MEC ENG 106	Fluid Mechanics	3
MEC ENG 108	Mechanical Behavior of Engineering Materials	4
MEC ENG 109	Heat Transfer	3
MEC ENG 110	Introduction to Product Development	3
MEC ENG C115	Molecular Biomechanics and Mechanobiology of the Cell	4
MEC ENG C117	Structural Aspects of Biomaterials	4
MEC ENG 119	Introduction to MEMS (Microelectromechanical Systems)	3
MEC ENG 122	Processing of Materials in Manufacturing	3
MEC ENG 130	Design of Planar Machinery	3
MEC ENG 131	Vehicle Dynamics and Control	4
MEC ENG 133	Mechanical Vibrations	3
MEC ENG 135	Design of Microprocessor-Based Mechanical Systems	4
MEC ENG 138	Introduction to Micro/Nano Mechanical Systems Laboratory	3
MEC ENG 140	Combustion Processes	3
MEC ENG 146	Energy Conversion Principles	3
MEC ENG 150A	Solar-Powered Vehicles: Analysis, Design and Fabrication	3
MEC ENG 151	Advanced Heat Transfer	3
MEC ENG 163	Engineering Aerodynamics	3
MEC ENG 164	Marine Statics and Structures	3
MEC ENG 165	Ocean-Environment Mechanics	3
MEC ENG 167	Microscale Fluid Mechanics	3
MEC ENG 170	Engineering Mechanics III	3
MEC ENG 173	Fundamentals of Acoustics	3
MEC ENG 175	Intermediate Dynamics	3
MEC ENG C176	Orthopedic Biomechanics	4
MEC ENG C180	Engineering Analysis Using the Finite Element Method	3
MEC ENG 185	Introduction to Continuum Mechanics	3
NUC ENG 100	Introduction to Nuclear Energy and Technology	3
NUC ENG 101	Nuclear Reactions and Radiation	4
NUC ENG 102	Nuclear Reactions and Radiation Laboratory	3
NUC ENG 120	Nuclear Materials	4
NUC ENG 124	Radioactive Waste Management	3
NUC ENG 130	Analytical Methods for Non-proliferation	3
NUC ENG 150	Introduction to Nuclear Reactor Theory	4
NUC ENG 155	Introduction to Numerical Simulations in Radiation Transport	3
NUC ENG 161	Nuclear Power Engineering	4
NUC ENG 162	Radiation Biophysics and Dosimetry	3
NUC ENG 167	Risk-Informed Design for Advanced Nuclear Systems	3
NUC ENG 175	Methods of Risk Analysis	3
NUC ENG 180	Introduction to Controlled Fusion	3
PLANTBI C124	The Berkeley Lectures on Energy: Energy from Biomass	3

Concentrations

The concentrations are Biotechnology, Chemical Processing, Energy and Environment, Materials Science and Technology, Business and Management, and Applied Physical Science. Students who plan to declare a concentration must do so no later than the end of their junior year. Double concentrations are not permitted.

Biotechnology

CHM ENG 170A	Biochemical Engineering	4
CHM ENG 170B	Biochemical Engineering (Students graduating before May 2021 may opt to replace CHM ENG 170B with a second course from the list of options below.)	3
CHEM 12B	Organic Chemistry	5
or MCELLBI C102	General Microbiology	
or MCELLBI 104	Genetics, Genomics, and Cell Biology	

Choose one of the following:

CHM ENG C17	Biochemical Engineering Laboratory [3]
CHM ENG 182	Nanoscience and Engineering Biotechnology [3]
CHM ENG 274	Biomolecular Engineering [3]
BIO ENG 103	Engineering Molecules 2 [4]
BIO ENG 111	Functional Biomaterials Development and Characterization [4]
BIO ENG 116	Cell and Tissue Engineering [4]
BIO ENG 140L	Synthetic Biology Laboratory [4]
BIO ENG 144 & 144L	Introduction to Protein Informatics and Protein Informatics Laboratory (Students must sign up for Bio Eng 144L (3) if taking 144)
BIO ENG 148	Bioenergy and Sustainable Chemical Synthesis: Metabolic Engineering and Synthetic Biology Approaches [3]
BIO ENG C213	Fluid Mechanics of Biological Systems [3]
MCELLBI 130	Cell and Systems Biology [4]
MCELLBI 150	Molecular Immunology [4]
CHM ENG H19	Research for Advanced Undergraduates [3-4] (Use of CHM ENG H194 or 196 toward the concentration for undergraduate research in a biotechnology research laboratory will be considered. Requires approval from the faculty. Send requests for approval to the Director of Undergraduate Education.)
CHM ENG 196	Special Laboratory Study [3-4] (Use of CHM ENG H194 or 196 toward the concentration for undergraduate research in a biotechnology research laboratory will be considered. Requires approval from the faculty. Send requests for approval to Professor Wenjun Zhang.)

Students in the Biotechnology concentration are required to take BIO ENG 11 or MCELLBI 102 or CHEM 135 instead of BIOLOGY 1A (even with a score of 4 or 5 on the AP Bio test).

Chemical Processing

CHEM 104A	Advanced Inorganic Chemistry	3-5
or CHEM 12B	Organic Chemistry	
Select 6 units from the following:		
CHM ENG 170A	Biochemical Engineering [4]	
CHM ENG 170B	Biochemical Engineering [4]	
CHM ENG C170L	Biochemical Engineering Laboratory [3]	
CHM ENG 171	Transport Phenomena [3]	
CHM ENG 176	Principles of Electrochemical Processes	3
CHM ENG C177	Polymer Science and Technology [3]	
CHM ENG 179	Process Technology of Solid-State Materials Devices [3]	
CHM ENG 180	Chemical Engineering Economics [3]	
CHM ENG H194	Research for Advanced Undergraduates [2-4] (up to 3 units)	
Select 3 units from the following:		
CIV ENG C30	Introduction to Solid Mechanics [3]	
CIV ENG 111	Environmental Engineering [3]	
CIV ENG 114	Environmental Microbiology [3]	
CIV ENG 173	Groundwater and Seepage [3]	
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 C118	Biological Performance of Materials [4]	
MAT SCI 120	Materials Production [3]	
MAT SCI 121	Metals Processing [3]	
MAT SCI 122	Ceramic Processing [3]	
MAT SCI 123	ELECTRONIC MATERIALS PROCESSING [4]	
MEC ENG 140	Combustion Processes [3]	
MEC ENG 151	Advanced Heat Transfer [3]	

Energy and Environment

3 units chosen from the following science courses:

EPS 80	Environmental Earth Sciences	3
EPS 102	History and Evolution of Planet Earth	4
EPS C180	Air Pollution	3
EPS C181	Atmospheric Physics and Dynamics	3
EPS C183	Carbon Cycle Dynamics	3
ESPM 15	Introduction to Environmental Sciences	3
ESPM C46	Climate Change and the Future of California	4
ESPM C125	Biogeography	4
ESPM 152	Global Change Biology	3
ESPM C170	Carbon Cycle Dynamics	3
ESPM C133	Water Resources and the Environment	3
GEOG 40	Introduction to Earth System Science	4
GEOG C135	Water Resources and the Environment	3
GEOG C139	Atmospheric Physics and Dynamics	3
GEOG 142	Climate Dynamics	4
GEOG C148	Biogeography	4

Students graduating Fall 2021 or earlier may also use these science courses:

CHEM 12B	Organic Chemistry [5]	
CHEM 104A	Advanced Inorganic Chemistry [3]	
CHEM 143	Nuclear Chemistry [2]	
PHYSICS 7C	Physics for Scientists and Engineers [4]	

9 units chosen from the following engineering courses:

CHM ENG 90	Science and Engineering of Sustainable Energy	3
CHM ENG 176	Principles of Electrochemical Processes	3
CHM ENG 183	Climate Solutions Technologies	3
CHM ENG C195A	The Berkeley Lectures on Energy: Energy from Biomass	3
	Other approved CHM ENG 195 courses with energy or environment topics as the main focus, including Carbon Capture and Sequestration	
CIV ENG 11	Engineered Systems and Sustainability	3
CIV ENG 105	Design for Global Transformation	3
CIV ENG C106	Air Pollution	3
CIV ENG 107	Climate Change Mitigation	3
CIV ENG 110	Water Systems of the Future	3
CIV ENG 111	Environmental Engineering	3
CIV ENG 111L	Water and Air Quality Laboratory	1
CIV ENG 113	Ecological Engineering for Water Quality Improvement	3
CIV ENG 114	Environmental Microbiology	3
CIV ENG C116	Chemistry of Soils	3
CIV ENG 130N	Mechanics of Structures	3
CIV ENG 173	Groundwater and Seepage	3
EL ENG 134	Fundamentals of Photovoltaic Devices	4
EL ENG 137A	Introduction to Electric Power Systems	4
EL ENG 137B	Introduction to Electric Power Systems	4
MAT SCI 136	Materials in Energy Technologies	4
MEC ENG 140	Combustion Processes	3
MEC ENG 146	Energy Conversion Principles	3
NUC ENG 100	Introduction to Nuclear Energy and Technology	3
NUC ENG 101	Nuclear Reactions and Radiation	4
NUC ENG 150	Introduction to Nuclear Reactor Theory	4
NUC ENG 161	Nuclear Power Engineering	4
NUC ENG 180	Introduction to Controlled Fusion	3

Students graduating Fall 2021 or earlier may also use these engineering courses:

CHM ENG 170A	Biochemical Engineering [4]	
CHM ENG C177	Polymer Science and Technology [3]	
CHM ENG 179	Process Technology of Solid-State Materials Devices [3]	

A maximum of 4 units of lower division coursework total can be applied from the courses above.

Courses with significant overlap are restricted, such that students may use one, but not both of the paired courses to fulfill the concentration: ESPM 153 OR GEOG 142; EPS C180 OR CIV ENG 106

Materials Science and Technology

Select one of the following:		
CHEM 104A	Advanced Inorganic Chemistry [3]	
CHEM 108	Inorganic Synthesis and Reactions [4]	
CHEM 12B	Organic Chemistry [5]	
Select 3 units from the following:		
CHM ENG 176	Principles of Electrochemical Processes [3]	
CHM ENG C178	Polymer Science and Technology [3]	
CHM ENG 179	Process Technology of Solid-State Materials Devices [3]	
Select 6 units from the following:		
CIV ENG C30	Introduction to Solid Mechanics [3]	
EL ENG 130	Integrated-Circuit Devices [4]	
EL ENG 143	Microfabrication Technology [4]	
MAT SCI 102	Bonding, Crystallography, and Crystal Defects [3]	
MAT SCI 103	Phase Transformations and Kinetics [3]	
MAT SCI 111	Properties of Electronic Materials [4]	
MAT SCI 112	Corrosion (Chemical Properties) [3]	
MAT SCI 120	Materials Production [3]	
MAT SCI 121	Metals Processing [3]	
MAT SCI 122	Ceramic Processing [3]	
MAT SCI 123	ELECTRONIC MATERIALS PROCESSING [4]	
MAT SCI 125	Thin-Film Materials Science [3]	
MEC ENG 122	Processing of Materials in Manufacturing [3] [1]	
MEC ENG 127	Introduction to Composite Materials	3

[1] Students may take MEC ENG 122 without the prerequisites of CIV ENG 130N and MEC ENG 108.

Business and Management

CHM ENG 180	Chemical Engineering Economics	3
3 units of science electives selected from the list of Physical and Biological Science electives		3
3 units of engineering electives selected from the list of Engineering Electives		3
6 units chosen from the following UGBA courses:		
UGBA 102A	Financial Accounting [3]	
UGBA 105	Leading People [3]	
UGBA 106	Marketing [3]	
UGBA 119	Course Not Available [3]	
UGBA 152	Negotiation and Conflict Resolution [3]	
UGBA 155	Leadership [3]	
UGBA 160	Customer Insights [3]	
UGBA 161	Market Research: Tools and Techniques for Data Collection and Analysis [3]	
UGBA 162	Brand Management and Strategy [3]	
UGBA 169	Pricing [3]	
UGBA 175	Legal Aspects of Management [3]	
UGBA 179	International Consulting for Small and Medium-Sized Enterprises [3]	
UGBA 192P	Sustainable Business Consulting Projects [3]	
UGBA 195A	Entrepreneurship [3]	
UGBA 195P	Entrepreneurship: How to Successfully start a New Business [3]	

Applied Physical Science

6 units of chemistry or physics courses selected from the Physical and Biological Sciences List	6
3 units of CHM ENG electives (excluding CHM ENG 196)	3
3 units chosen from the Engineering electives list	3

Students who have a strong interest in an area of study outside their major often decide to complete a minor program. These programs have set requirements and are noted officially on the transcript in the memoranda section but are not noted on diplomas.

General Guidelines

1. All minors must be declared no later than one semester before a student's Expected Graduation Term (EGT). If the semester before EGT is fall or spring, the deadline is the last day of RRR week. If the semester before EGT is summer, the deadline is the final Friday of Summer Sessions. To declare a minor, contact the department advisor for information on requirements, and the declaration process.
2. All courses taken to fulfill the minor requirements below must be taken for graded credit.
3. A minimum of three of the upper division courses taken to fulfill the minor requirements must be completed at UC Berkeley.
4. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.
5. Students must consult with their college/school for information regarding an overlap of courses between their majors and minors.

Requirements

Upper Division		
CHM ENG 140	Introduction to Chemical Process Analysis	4
CHM ENG 141	Chemical Engineering Thermodynamics [1]	4
CHM ENG 150A	Transport Processes [1]	4
Select two of the following:		
CHM ENG 142	Chemical Kinetics and Reaction Engineering	4
CHM ENG 143	Computational Methods in Chemical Engineering	4
CHM ENG 150B	Transport and Separation Processes	4
CHM ENG 162	Dynamics and Control of Chemical Processes	4
CHM ENG 170A	Biochemical Engineering	4
CHM ENG 170B	Biochemical Engineering	4
CHM ENG 171	Transport Phenomena	3
CHM ENG 176	Principles of Electrochemical Processes	3
CHM ENG C178	Polymer Science and Technology	3
CHM ENG 179	Process Technology of Solid-State Materials Devices	3
CHM ENG 180	Chemical Engineering Economics	3
CHM ENG 182	Nanoscience and Engineering Biotechnology	3
CHM ENG 183	Climate Solutions Technologies	3
CHM ENG C195A	The Berkeley Lectures on Energy: Energy from Biomass	3

[1] Students who have completed courses in other departments at Berkeley that are essentially equivalent to CHM ENG 141 and CHM ENG 150A can substitute other courses from the above list.

All students in the College of Chemistry are required to complete the University requirements of American Cultures (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/american-cultures-requirement/), American History and Institutions (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/american-history-institutions-requirements/), and Entry-Level Writing (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/entry-level-writing-requirement/). In addition, they must satisfy the following College requirements:

Reading and Composition (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/reading-composition-requirement/)

In order to provide a solid foundation in reading, writing, and critical thinking the College requires lower division work in composition.

- Chemical Engineering majors: A-level Reading and Composition course (e.g., English R1A) by end of the first year
- Chemical Biology and Chemistry majors: A- and B-level courses by end of the second year (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/reading-composition-requirement/)
- R&C courses must be taken for a letter grade
- English courses at other institutions may satisfy the requirement(s); check with your Undergraduate Adviser
- After admission to Berkeley, credit for English at another institution will not be granted if the Entry Level Writing requirement has not been satisfied

Humanities and Social Sciences Breadth Requirement: Chemistry & Chemical Biology majors

The College of Chemistry's humanities and social sciences breadth requirement promotes educational experiences that enrich and complement the technical requirements for each major.

- 15 units total; includes Reading & Composition and American Cultures courses
- Remaining units must come from the following L&S breadth areas, excluding courses which only teach a skill (such as drawing or playing an instrument):

  Arts and Literature
  Foreign Language (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/approved-foreign-language-courses/)[1,2]
  Historical Studies
  International Studies
  Philosophy and Values
  Social and Behavioral Sciences

  To find course options for breadth, go to the Berkeley Academic Guide Class Schedule (http://classes.berkeley.edu/), select the term of interest, and use the 'Breadth Requirements' filter to select the breadth area(s) of interest.

- Breadth courses may be taken on a *Pass/No Pass* basis (excluding Reading and Composition)
- AP, IB, and GCE A-level exam credit (http://chemistry.berkeley.edu/students/current-undergraduates/exam-credit-info/) may be used to satisfy the breadth requirement

[1] Elementary-level courses may not be in the student's native language and may not be structured primarily to teach the reading of scientific literature.

[2] For Chemistry and Chemical Biology majors, elementary-level foreign language courses are not accepted toward the 15 unit breadth requirement if they are used (or are duplicates of high school courses used) to satisfy the Foreign Language requirement.

Foreign Language (Language Other Than English [LOTE]) Requirement

Applies to Chemistry and Chemical Biology majors only.

The LOTE requirement may be satisfied with one language other than English, in one of the following ways:

- By completing in high school the third year of one language other than English with minimum grades of C-.
- By completing at Berkeley the second semester of a sequence of courses in one language other than English, or the equivalent at another institution. Only LOTE courses that include reading and composition, as well as conversation, are accepted in satisfaction of this requirement. LOTE courses may be taken on a Pass/No Pass basis.
- By demonstrating equivalent knowledge of a language other than English through examination, including a College Entrance Examination Board (CEEB) Advanced Placement Examination with a score of 3 or higher (if taken before admission to college), an SAT II: Subject Test with a score of 590 or higher, or a proficiency examination offered by some departments at Berkeley or at another campus of the University of California.

Humanities and Social Sciences Breadth Requirement: Chemical Engineering major

- 22 units total; includes Reading and Composition and American Cultures courses
- Breadth Series requirement: As part of the 22 units, students must complete two courses, at least one being upper division, in the same or very closely allied humanities or social science department(s). AP credit may be used to satisfy the lower division aspect of the requirement.
- Breadth Series courses and all remaining units must come from the following lists of approved humanities and social science courses, excluding courses which only teach a skill (such as drawing or playing an instrument):

  Arts and Literature
  Foreign Language (http://guide.berkeley.edu/undergraduate/colleges-schools/chemistry/approved-foreign-language-courses/)[1,2]

Historical Studies
International Studies
Philosophy and Values

To find course options for breadth, go to the Berkeley Academic Guide Class Schedule (http://classes.berkeley.edu/), select the term of interest, and use the 'Breadth Requirements' filter to select the breadth area(s) of interest.

- Breadth courses may be taken on a *Pass/No Pass* basis (excluding Reading and Composition)
- AP, IB, and GCE A-level exam (http://chemistry.berkeley.edu/students/current-undergraduates/exam-credit-info/) credit may be used to satisfy the breadth requirement

[1] Elementary-level courses may not be in the student's native language and may not be structured primarily to teach the reading of scientific literature.

[2] For chemical engineering majors, no more that six units of language other than English may be counted toward the 22 unit breadth requirement.

Class Schedule Requirements

- Minimum units per semester: 13
- Maximum units per semester: 19.5
- 12 units of course work each semester must satisfy degree requirements
- Chemical Engineering freshmen and Chemistry majors are required to enroll in a minimum of one chemistry course each semester
- After the freshman year, Chemical Engineering majors must enroll in a minimum of one chemical engineering course each semester

Semester Limit

- Students who entered as freshmen: 8 semesters
- Chemistry & Chemical Biology majors who entered as transfer students: 4 semesters
- Chemical Engineering and Joint majors who entered as transfer students: 5 semesters

Summer sessions are excluded when determining the limit on semesters. Students who wish to delay graduation to complete a minor, a double major, or simultaneous degrees must request approval for delay of graduation before what would normally be their final two semesters. The College of Chemistry does not have a rule regarding maximum units that a student can accumulate.

Senior Residence

After 90 units toward the bachelor's degree have been completed, at least 24 of the remaining units must be completed in residence in the College of Chemistry, in at least two semesters (the semester in which the 90 units are exceeded, plus at least one additional semester).

To count as a semester of residence for this requirement, a program must include at least 4 units of successfully completed courses. A summer session can be credited as a semester in residence if this minimum unit requirement is satisfied.

Juniors and seniors who participate in the UC Education Abroad Program (EAP) for a *full year*#may meet a modified senior residence requirement. After 60 units toward the bachelor's degree have been completed, at least 24 (excluding EAP) of the remaining units must be completed in residence in the College of Chemistry, in at least two semesters. At least 12 of the 24 units must be completed after the student has already completed 90 units. Undergraduate Dean's approval for the modified senior residence requirement must be obtained before enrollment in the Education Abroad Program.

Minimum Total Units

A student must successfully complete at least 120 semester units in order to graduate.

Minimum Academic Requirements

A student must earn at least a C average (2.0 GPA) in all courses undertaken at UC, including those from UC Summer Sessions, UC Education Abroad Program, and UC Berkeley Washington Program, as well as XB courses from University Extension.

Minimum Course Grade Requirements

Students in the College of Chemistry who receive a grade of D+ or lower in a chemical engineering or chemistry course for which a grade of C- or higher is required must repeat the course at Berkeley.

Students in the College of Chemistry must achieve:

- C- or higher in CHEM 4A before taking CHEM 4B
- C- or higher in CHEM 4B before taking more advanced courses
- C- or higher in CHEM 12A before taking CHEM 12B
- GPA of at least 2.0 in all courses taken in the college in order to advance to and continue in the upper division

Chemistry or chemical biology majors must also achieve:

- C- or higher in CHEM 120A and CHEM 120B if taken before CHEM 125 or CHEM C182
- 2.0 GPA in all upper division courses taken at the University to satisfy major requirements

Chemical engineering students must also achieve:

- C- or higher in CHM ENG 140 before taking any other CBE courses
- C- or higher in CHM ENG 150A to be eligible to take any other course in the 150 series
- 2.0 GPA in all upper division courses taken at the University to satisfy major requirements

Chemical engineering students who do not achieve a grade of C- or higher in CHM ENG 140 on their first attempt are advised to change to another major. If the course is not passed with a grade of C- or higher on the second attempt, continuation in the Chemical Engineering program is normally not allowed.

Minimum Progress

To make normal progress toward a degree, undergraduates must successfully complete 30 units of coursework each year. The continued enrollment of students who do not maintain normal progress will be subject to the approval of the Undergraduate Dean. To achieve minimum academic progress, the student must meet two criteria:

1. Completed no fewer units than 15 multiplied by the number of semesters, less one, in which the student has been enrolled at Berkeley. Summer sessions do not count as semesters for this purpose.
2. A student's class schedule must contain at least 13 units in any term, unless otherwise authorized by the staff adviser or the Undergraduate Dean.

Mission

The mission of the Department of Chemical and Biomolecular Engineering is:

- To educate people for careers of leadership and innovation in chemical engineering and related fields.
- To expand the base of engineering knowledge through original research and by developing technology to serve the needs of society.
- To benefit the public through service to industry, government, and the engineering profession.

Fulfillment of this mission is achieved in part by the Department of Chemical and Biomolecular Engineering's accredited undergraduate degree program in chemical engineering. The undergraduate curriculum comprises both a technical curriculum and breadth requirements.

The goals of chemical engineering breadth requirements are to teach the arts of writing clearly and persuasively, to develop the skills to read carefully and evaluate evidence effectively, and to instill an awareness of humanity in historical and social contexts. The Berkeley American Cultures requirement affirms the value of diversity in acquiring knowledge.

The technical curriculum in chemical engineering seeks to provide students with a broad education emphasizing an excellent foundation in scientific and engineering fundamentals.

Learning Goals for the Major

1-An ability to identify, formulate, and solve complx engineering problems by applying the principles of engineering, science, and mathematics

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

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

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

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

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

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

Major Maps help undergraduate students discover academic, co-curricular, and discovery opportunities at UC Berkeley based on intended major or field of interest. Developed by the Division of Undergraduate Education in collaboration with academic departments, these experience maps will help you:

- **Explore** your major and gain a better understanding of your field of study
- **Connect** with people and programs that inspire and sustain your creativity, drive, curiosity and success
- **Discover** opportunities for independent inquiry, enterprise, and creative expression
- **Engage** locally and globally to broaden your perspectives and change the world
- **Reflect** on your academic career and prepare for life after Berkeley

Use the major map below as a guide to planning your undergraduate journey and designing your own unique Berkeley experience.

View the Chemical Engineering Major Map PDF. **(**https://vcue.berkeley.edu/sites/default/files/chemical_engineering.pdf**)**

Chemical Engineering

Expand all course descriptions [+]Collapse all course descriptions [-]

CHM ENG 24 Freshman Seminars 1 Unit

Terms offered: Spring 2020, Spring 2019, Spring 2015
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 when topic changes.

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular 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 [-]

CHM ENG 40 Introduction to Chemical Engineering Design 2 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Design and analysis of processes involving chemical change. Strategies for design, such as creative thinking and (re)definition of the design goal. Methods for analyzing designs, such as mathematical modeling, empirical analysis by graphics, and dynamic scaling by dimensional analysis. Design choices in light of process efficiency, product quality, economics, safety, and environmental issues.
Introduction to Chemical Engineering Design: Read More [+]
Rules & Requirements

Prerequisites: Math 1B OR Chem 4A

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Introduction to Chemical Engineering Design: Read Less [-]

CHM ENG 84 Sophomore Seminar 1 or 2 Units

Terms offered: Spring 2013, Spring 2012, Spring 2010
Sophomore seminars are small interactive courses offered by faculty members in departments all across the campus. Sophomore seminars offer opportunity for close, regular intellectual contact between faculty members and students in the crucial second year. The topics vary from department to department and semester to semester. Enrollment limited to 15 sophomores.
Sophomore Seminar: Read More [+]
Rules & Requirements

Prerequisites: At discretion of instructor

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

Hours & Format

Fall and/or spring:
5 weeks - 3-6 hours of seminar per week
10 weeks - 1.5-3 hours of seminar per week
15 weeks - 1-2 hours of seminar per week

Summer:
6 weeks - 2.5-5 hours of seminar per week
8 weeks - 2-4 hours of seminar per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Sophomore Seminar: Read Less [-]

CHM ENG 90 Science and Engineering of Sustainable Energy 3 Units

Terms offered: Spring 2021, Spring 2020, Spring 2019
An introduction is given to the science and technologies of producing electricity and transportation fuels from renewable energy resources (biomass, geothermal, solar, wind, and wave). Students will be introduced to quantitative calculations and comparisions of energy technologies together with the economic and political factors affecting the transition from nonrenewable to sustainable energy resources. Mass and energy balances are used to analyze the conversion of energy resources.
Science and Engineering of Sustainable Energy: Read More [+]
Rules & Requirements

Prerequisites: Chemistry 1A or 4A

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Instructors: Bell, Segalman

Science and Engineering of Sustainable Energy: Read Less [-]

CHM ENG 98 Directed Group Studies for Lower Division Undergraduates 1 - 3 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Supervised research on a specific topic.
Directed Group Studies for Lower Division Undergraduates: Read More [+]
Rules & Requirements

Prerequisites: Consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of directed group study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Directed Group Studies for Lower Division Undergraduates: Read Less [-]

CHM ENG 98W Directed Group Study 1 Unit

Terms offered: Fall 2015
Directed group study consisting of supplementary problem sets, review sessions, and discussions related to chemical engineering. Topics vary with instructor.
Directed Group Study: Read More [+]
Rules & Requirements

Prerequisites: This Chemical Engineering 98W is planned for students who are concurrently enrolled in Chemical Engineering 140

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

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Directed Group Study: Read Less [-]

CHM ENG 140 Introduction to Chemical Process Analysis 4 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Material and energy balances applied to chemical process systems. Determination of thermodynamic properties needed for such calculations. Sources of data. Calculation procedures.
Introduction to Chemical Process Analysis: Read More [+]
Rules & Requirements

Prerequisites: Chemical Engineering 40 and Chemistry 4B (may be taken concurrently) or Chemistry 1B; and Physics 7B (may be taken concurrently)

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Introduction to Chemical Process Analysis: Read Less [-]

CHM ENG 141 Chemical Engineering Thermodynamics 4 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Thermodynamic behavior of pure substances and mixtures. Properties of solutions, phase equilibria. Thermodynamic cycles. Chemical equilibria for homogeneous and heterogeneous systems.
Chemical Engineering Thermodynamics: Read More [+]
Rules & Requirements

Prerequisites: 140 with a grade of C- or higher; Engineering 7, which may be taken concurrently

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Chemical Engineering Thermodynamics: Read Less [-]

CHM ENG 142 Chemical Kinetics and Reaction Engineering 4 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Analysis and prediction of rates of chemical conversion in flow and nonflow processes involving homogeneous and heterogeneous systems.
Chemical Kinetics and Reaction Engineering: Read More [+]
Rules & Requirements

Prerequisites: 141 with a grade of C- or higher; 150B, which may be taken concurrently

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Chemical Kinetics and Reaction Engineering: Read Less [-]

CHM ENG 143 Computational Methods in Chemical Engineering 4 Units

Terms offered: Spring 2021, Spring 2020, Spring 2019
The purpose of Chemical Engineering Modeling and Computations in Chemical Engineering is to teach students the methodologies used in setting up mathematical models of simple chemical processes and operations, and the numerical techniques used to simulate them. Included are techniques to obtain physical properties of mixtures/solutions using equations of state. This is followed by simple processes such as vapor liquid equilibrium, separation operations such as distillation, heat transfer, and chemical reactions in ideal reactors such as stirred tank and plug flow. Later on, real chemical process equipment and processes are modeled and simulated, using many of the techniques learned earlier. Programming languages such as Matlab and...
Computational Methods in Chemical Engineering: Read More [+]
Objectives & Outcomes

Course Objectives: The focus of this course is on developing insights into chemical processes and operations through the use of modeling and computations. This is not a programming course. The instructors will provide introduction to the use of Aspen and the other codes, but the majority of the learning will be through the active use of these programs by the students in solving assigned problems.

Student Learning Outcomes: The course will be consistent with the overall objectives of the Chemical Engineering curriculum as outlined in the ABET guidelines.

Rules & Requirements

Prerequisites: E7 and CHM ENG 140

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Computational Methods in Chemical Engineering: Read Less [-]

CHM ENG 150A Transport Processes 4 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Principles of fluid mechanics and heat transfer with application to chemical processes. Laminar and turbulent flow in pipes and around submerged objects. Flow measurement. Heat conduction and convection; heat transfer coefficients.
Transport Processes: Read More [+]
Rules & Requirements

Prerequisites: 140 with a grade of C- or higher; Math 54, which may be taken concurrently

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate

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

Transport Processes: Read Less [-]

CHM ENG 150B Transport and Separation Processes 4 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Principles of mass transfer with application to chemical processes. Diffusion and convection. Simultaneous heat and mass transfer; mass transfer coefficients. Design of staged and continuous separations processes.
Transport and Separation Processes: Read More [+]
Rules & Requirements

Prerequisites: Chemical and Biomolecular Engineering 141 with a grade of C- or higher; Chemical and Biomolecular Engineering 150A with a grade of C- or higher; Engineering 7

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Undergraduate

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

Transport and Separation Processes: Read Less [-]

CHM ENG 154 Chemical Engineering Laboratory 4 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Experiments in physical measurements, fluid mechanics, heat and mass transfer, kinetics, and separation processes. Emphasis on investigation of basic relationships important in engineering. Experimental design, analysis of results, and preparation of engineering reports are stressed.
Chemical Engineering Laboratory: Read More [+]
Rules & Requirements

Prerequisites: Chemical and Biomolecular Engineering 141, 142, and 150B

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 8 hours of laboratory per week

Summer: 8 weeks - 2 hours of lecture and 16 hours of laboratory per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Chemical Engineering Laboratory: Read Less [-]

CHM ENG 160 Chemical Process Design 4 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Design principles of chemical process equipment. Design of integrated chemical processes with emphasis upon economic considerations.
Chemical Process Design: Read More [+]
Rules & Requirements

Prerequisites: Chemical and Biomolecular Engineering 142, 150B, and 154. 154 can be taken concurrently

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 6 hours of laboratory per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Chemical Process Design: Read Less [-]

CHM ENG 161S Industrial Chemical Process Design 6 Units

Terms offered: Prior to 2007
Design of chemical processes and equipment, with an emphasis on industry-sponsored and/or industry-tailored processes
Industrial Chemical Process Design: Read More [+]
Objectives & Outcomes

Course Objectives: Teach students the strategies used in the design of chemical processes through an authentic industrial project.

Student Learning Outcomes: • Develop an ability to function on multi-disciplinary teams.
• Develop the ability to design an integrated chemical engineering-based process to meet stated objectives within realistic constraints.
• Establish proficiency in the design process and project management fundamentals.
• Gain an understanding of professional and ethical responsibilities.

Rules & Requirements

Prerequisites: Prerequisites: Chemical and Biomolecular Engineering 142, 150B, and 154

Hours & Format

Summer: 8 weeks - 6 hours of lecture and 6 hours of discussion per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Instructors: Bryan, Sciamanna

Industrial Chemical Process Design: Read Less [-]

CHM ENG 162 Dynamics and Control of Chemical Processes 4 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Analysis of the dynamic behavior of chemical processes and methods and theory of their control. Implementation of computer control systems on process simulations.
Dynamics and Control of Chemical Processes: Read More [+]
Rules & Requirements

Prerequisites: Chemical and Biomolecular Engineering 142 and 150B; Mathematics 53 and 54

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Dynamics and Control of Chemical Processes: Read Less [-]

CHM ENG 170A Biochemical Engineering 4 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
This course intends to introduce chemical engineers to the essential concepts of bioprocessing for applications in the biopharmaceutical, industrial biotech, and food tech industries. The course focuses on the use of chemical engineering skills and principles, including but not limited to kinetics and reactor design, thermodynamics and transport phenomena in the analysis and design of biologically-based processes, as well as the economical analysis and ethics. The main emphasis of 170A, the first of a two-semester sequence will be on the upstream bioprocess of how to make products by designing unit operations and processes around living systems of cells.
Biochemical Engineering: Read More [+]

Rules & Requirements

Prerequisites: BIO ENG 11 or MCB 102 (or equivalent) highly recommended. Chem Eng 150B and Chem Eng 142 or concurrent, or consent of instructor(s)

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Instructors: Zhang, Ryder

Biochemical Engineering: Read Less [-]

CHM ENG 170B Biochemical Engineering 4 Units

Terms offered: Spring 2021, Spring 2020, Spring 2019
This course intends to introduce chemical engineers to the essential concepts of bioprocessing for applications in the biopharmaceutical, industrial biotech, and food tech industries. The course focuses on the use of chemical engineering skills and principles, including but not limited to kinetics and reactor design, thermodynamics and transport phenomena in the analysis and design of biologically-based processes, as well as the economical analysis and ethics. The main emphasis of 170B, the second of a two-semester sequence will be on the downstream bioprocess of recovery, separations and purification of bio-based products.
Biochemical Engineering: Read More [+]

Rules & Requirements

Prerequisites: BIO ENG 11 or MCB 102 (or equivalent) highly recommended. Chem Eng 150B and Chem Eng 142 or concurrent, or consent of instructor(s)

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Instructors: Zhang, Ryder

Formerly known as: 170

Biochemical Engineering: Read Less [-]

CHM ENG C170L Biochemical Engineering Laboratory 3 Units

Terms offered: Fall 2020, Spring 2020, Spring 2019, Fall 2018, Spring 2014, Spring 2013
Laboratory techniques for the cultivation of microorganisms in batch and continuous reactions. Enzymatic conversion processes. Recovery of biological products.
Biochemical Engineering Laboratory: Read More [+]
Rules & Requirements

Prerequisites: Chemical Engineering 170A (may be taken concurrently) or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 7 hours of laboratory and 1 hour of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Also listed as: CHEM C170L

Biochemical Engineering Laboratory: Read Less [-]

CHM ENG 171 Transport Phenomena 3 Units

Terms offered: Spring 2021, Fall 2018, Spring 2011
Study of momentum, energy, and mass transfer in laminar and turbulent flow.
Transport Phenomena: Read More [+]
Rules & Requirements

Prerequisites: 150B

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Transport Phenomena: Read Less [-]

CHM ENG 176 Principles of Electrochemical Processes 3 Units

Terms offered: Spring 2021, Spring 2019, Spring 2018
Principles and application of electrochemical equilibria, kinetics, and transport processes. Technical electrolysis and electrochemical energy conversion.
Principles of Electrochemical Processes: Read More [+]
Rules & Requirements

Prerequisites: Chemical and Biomolecular Engineering 141, 142, and 150B

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Principles of Electrochemical Processes: Read Less [-]

CHM ENG C178 Polymer Science and Technology 3 Units

Terms offered: Fall 2020, Spring 2020, Spring 2019, Fall 2016, Spring 2016, Spring 2015
An interdisciplinary course on the synthesis, characterization, and properties of polymer materials. Emphasis on the molecular origin of properties of polymeric materials and technological applications. Topics include single molecule properties, polymer mixtures and solutions, melts, glasses, elastomers, and crystals. Experiments in polymer synthesis, characterization, and physical properties.
Polymer Science and Technology: Read More [+]
Rules & Requirements

Prerequisites: Junior standing

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Also listed as: CHEM C178

Polymer Science and Technology: Read Less [-]

CHM ENG 179 Process Technology of Solid-State Materials Devices 3 Units

Terms offered: Spring 2021, Fall 2019, Fall 2018
Chemical processing and properties of solid-state materials. Crystal growth and purification. Thin film technology. Application of chemical processing to the manufacture of semiconductors and solid-state devices.
Process Technology of Solid-State Materials Devices: Read More [+]
Rules & Requirements

Prerequisites: Engineering 45; one course in electronic circuits recommended; senior standing

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Process Technology of Solid-State Materials Devices: Read Less [-]

CHM ENG 180 Chemical Engineering Economics 3 Units

Terms offered: Fall 2020, Fall 2019, Spring 2019
Optimal design of chemical processes and unit operations, emphasizing the interactions between technical and economic considerations. Analysis of process risks. Chemical and biomolecular process design in the presence of uncertainties. Interest rate determinants and their effects on chemical process feasibility and choices. Relationships between structure and behavior of firms in the chemical processing industries. Multivariable input-output analyses.
Chemical Engineering Economics: Read More [+]
Rules & Requirements

Prerequisites: Chemical and Biomolecular Engineering 142 and 150B. Consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Chemical Engineering Economics: Read Less [-]

CHM ENG 182 Nanoscience and Engineering Biotechnology 3 Units

Terms offered: Spring 2020, Fall 2018
This nanoscale science and biomolecular engineering course will cover emerging topics in applied biotechnology and nanotechnology. Topics include enzyme kinetics, enzyme inhibition, recombinant protein generation, cell culture, genome editing, drug design, nanoparticle-based gene and drug delivery, fluorescence imaging, and sensors. The course will also probe the interface of biology with nanomaterials, and standard microscopic techniques to image biological structures and nanoscale materials.
Nanoscience and Engineering Biotechnology: Read More [+]
Rules & Requirements

Prerequisites: Bio 1A or BioE 11 and Physics 7A

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

Instructor: Landry

Nanoscience and Engineering Biotechnology: Read Less [-]

CHM ENG 183 Climate Solutions Technologies 3 Units

Terms offered: Fall 2020
This course for upper division students in science and engineering disciplines covers energy and climate and specific technologies that can be implemented to reduce global warming. Topics include renewable energy (wind and solar), carbon management technologies including Carbon Capture, Utilization and Storage, and Negative Emissions Technologies. The technologies will be described and compared from an upper level chemical engineering perspective that includes fundamental concepts in thermodynamics and separations. We will also cover carbon economics and policies and life-cycle analysis. The course will be framed from a systems-thinking perspective. Throughout the course we will focus on key aspects of communicating climate science.
Climate Solutions Technologies: Read More [+]
Objectives & Outcomes

Course Objectives: After taking this course, students should be able to discuss and explain to peers the role of CO2 in the earth's climate, the greenhouse effect, the carbon cycle and how it relates to the fate of greenhouse gases on many time scales, and the role of fossil fuel combustion in the energy landscape and in CO2 emissions.
Students in this class will gain experience in applying principles of systems thinking, engineering design and analysis to specific technologies that are relevant for mitigating climate change in the immediate future.
Students will appreciate the critical role that communication plays in the path to implementation of solutions and will be comfortable engaging in a discussion about climate solutions with technical and non-technical peers.
Students will gain a basic understanding of economics relative to climate policies, and of climate solutions currently being discussed by policymakers; they will gain an understanding of how these individual solutions fit into a global scheme.
Students will gain knowledge about the most current technologies available for producing energy renewably, managing carbon, and reducing atmospheric greenhouse gas concentrations.

Rules & Requirements

Prerequisites: Chem 1A,B or 4A,B, Phys 7A,B, Math 1A,B

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructor: Went

Climate Solutions Technologies: Read Less [-]

CHM ENG H193 Senior Honors Thesis 3 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015
A senior honors thesis is written in consultation with the student's faculty research advisor. This is a required course for students wishing to graduate with honors in Chemical Engineering.
Senior Honors Thesis: Read More [+]
Rules & Requirements

Prerequisites: Senior standing, approval of faculty research advisor, overall GPA of 3.4 or higher

Hours & Format

Fall and/or spring: 15 weeks - 9 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Senior Honors Thesis: Read Less [-]

CHM ENG H194 Research for Advanced Undergraduates 2 - 4 Units

Terms offered: Spring 2021, Spring 2020, Spring 2019
Original research under direction of one of the members of the staff.
Research for Advanced Undergraduates: Read More [+]
Rules & Requirements

Prerequisites: Minimum GPA of 3.4 overall at Berkeley and consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

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: Chemical & Biomolecular Engineering/ Undergraduate

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

Research for Advanced Undergraduates: Read Less [-]

CHM ENG 195 Special Topics 2 - 4 Units

Terms offered: Spring 2021, Spring 2020, Fall 2019
Lectures and/or tutorial instruction on special topics. Please refer to the Notes section in the Academic Guide for the current course description.
Special Topics: Read More [+]

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Special Topics: Read Less [-]

CHM ENG C195A The Berkeley Lectures on Energy: Energy from Biomass 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013
After an introduction to the different aspects of our global energy consumption, the course will focus on the role of biomass. The course will illustrate how the global scale of energy guides the biomass research. Emphasis will be placed on the integration of the biological aspects (crop selection, harvesting, storage and distribution, and chemical composition of biomass) with the chemical aspects to convert biomass to energy. The course aims to engage students in state-of-the-art research.
The Berkeley Lectures on Energy: Energy from Biomass: Read More [+]

Rules & Requirements

Prerequisites: Chemistry 1B or Chemistry 4B, Mathematics 1B, Biology 1A

Repeat rules: Course may be repeated for credit under special circumstances: Repeatable when topic changes with consent of instructor.

Hours & Format

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

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Instructors: Bell, Blanch, Clark, Smit, C. Somerville

Also listed as: BIO ENG C181/CHEM C138/PLANTBI C124

The Berkeley Lectures on Energy: Energy from Biomass: Read Less [-]

CHM ENG 196 Special Laboratory Study 2 - 4 Units

Terms offered: Spring 2021, Spring 2020, Spring 2019
Special laboratory or computational work under direction of one of the members of the staff.
Special Laboratory Study: Read More [+]

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2-3 hours of independent study per week

Summer:
6 weeks - 5-8 hours of independent study per week
8 weeks - 3.5-6 hours of independent study per week
10 weeks - 3-4.5 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Special Laboratory Study: Read Less [-]

CHM ENG 197 Field Study in Chemical Engineering 1 - 4 Units

Terms offered: Spring 2021, Spring 2020, Spring 2016
Supervised experience in off-campus organizations relevant to specific aspects and applications of chemical engineering. Written report required at the end of the term. Course does not satisfy unit or residence requirements for the bachelor's degree.
Field Study in Chemical Engineering: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing and consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

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

Summer:
6 weeks - 2.5-10 hours of fieldwork per week
8 weeks - 1.5-7.5 hours of fieldwork per week
10 weeks - 1.5-6 hours of fieldwork per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Instructor: Strauss

Field Study in Chemical Engineering: Read Less [-]

CHM ENG 198 Directed Group Study for Undergraduates 1 - 3 Units

Terms offered: Spring 2021, Fall 2020, Spring 2020
Supervised research on a specific topic. Enrollment is restricted; see Introduction to Courses and Curricula section in the General Catalog.
Directed Group Study for Undergraduates: Read More [+]
Rules & Requirements

Prerequisites: Completion of 60 units of undergraduate study and in good academic standing

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

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

Summer: 6 weeks - 2.5-7.5 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Directed Group Study for Undergraduates: Read Less [-]

CHM ENG 199 Supervised Independent Study and Research 1 - 4 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015
Supervised Independent Study and Research: Read More [+]
Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

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

Summer:
6 weeks - 2.5-10 hours of independent study per week
8 weeks - 1.5-7.5 hours of independent study per week
10 weeks - 1.5-6 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Undergraduate

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

Supervised Independent Study and Research: Read Less [-]