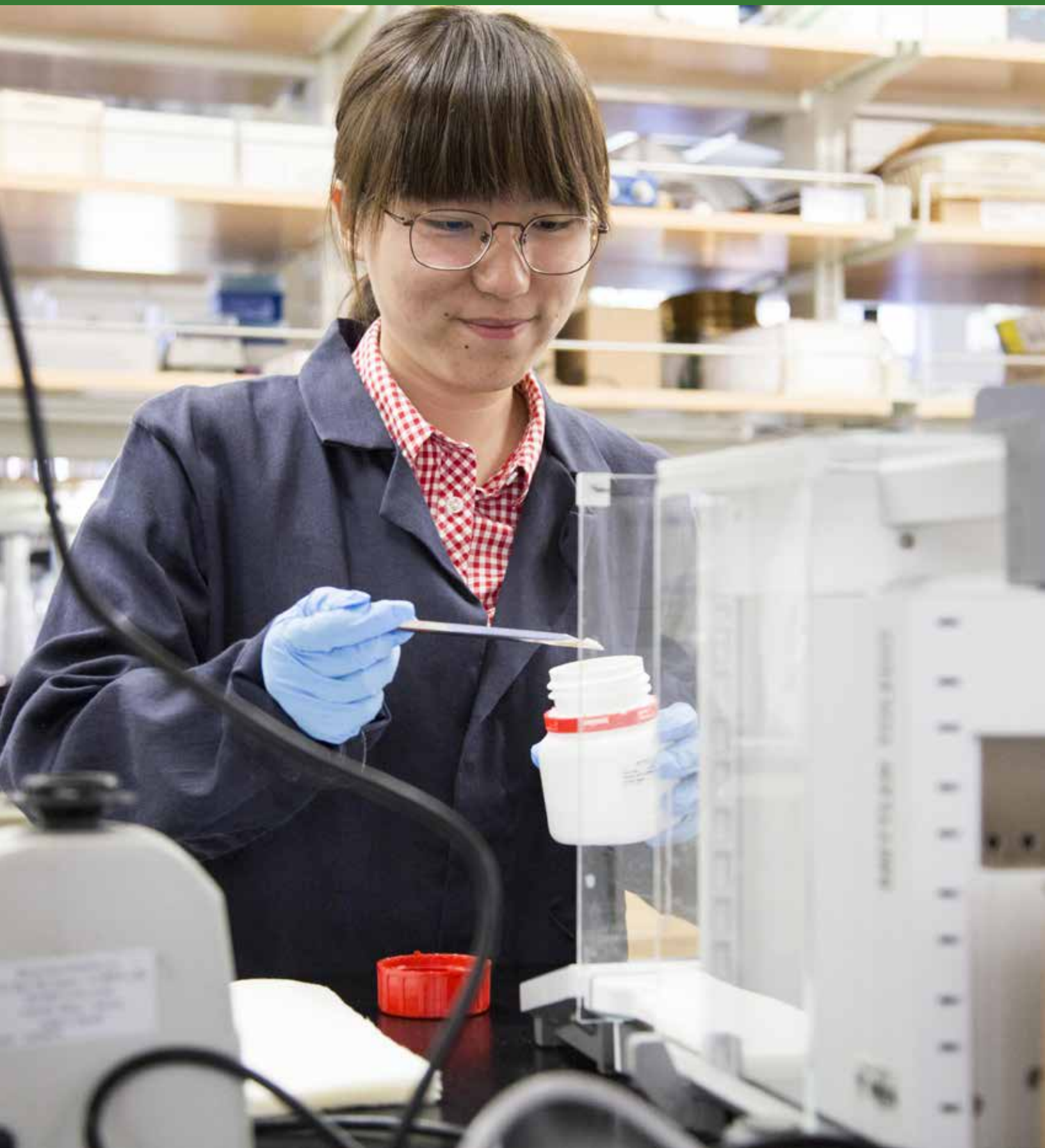
Chemical Engineering

THE MORK FAMILY DEPARTMENT OF CHEMICAL ENGINEERING & MATERIALS SCIENCE



Chemical Engineers design, control, and optimize large-scale chemical, physiochemical and biochemical processes. They are also involved in the development and design of new materials ranging from advanced composites used in automotive and space-related industries to materials used in the biomedical and electronics fields.

MAJORS & AREAS OF EMPHASIS

- Chemical Engineering
- Chemical (Biochemical) Engineering
- Chemical (Environmental) Engineering
- Chemical (Nanotechnology) Engineering
- Chemical (Petroleum) Engineering
- Chemical (Polymers/Materials Science) Engineering
- Chemical (Sustainable Energy) Engineering

CONCOCT MATERIALS, ENABLE ENERGY, AND MORE

Chemical Engineers are employed in areas as diverse as the chemical, pharmaceutical, energy, materials, and environmental industries. Emerging fields in chemical engineering include biotechnology, the design of environmentally benign processes and the synthesis of new materials (including bio and nanomaterials). Chemical engineers are uniquely qualified to provide solutions to many pressing problems in the areas of energy, the environment, and materials science.

EMPHASES & OPTIONS

While many students choose a primary degree in chemical engineering with no added specialization, we also offer the opportunity to deepen your education in six emphasis programs: Biochemical (CHEB), Environmental (CHEE), Nanotechnology (CHEN), Petroleum (CHPE), Polymers/ Materials (CHPM), and Sustainable Energy (CHSE).

The Biochemical option (CHEB) is a great option for students considering going on to Medical, Dental or Pharmacy Schools; and for students who wish to enter the growing biochemical industry (with companies such as Amgen, Genetech, Merck, etc.).

The Environmental option (CHEE) is for students interested in a career in protecting the environment either through pollution control (by changing manufacturing processes for example) or in environmental remediation.

The Nanotechnology option (CHEN) is for students who are interested in learning the properties of materials on the nanometer scale, and will study specialized probes capable of visualizing matter on these length scales. Nanotechnology involves the study of matter at length scales that are intermediate between the molecular and the bulk.

The Petroleum option (CHPE) is most appropriate for students interested in the exploration and production aspects of the energy industry. There is currently a great demand but limited supply of petroleum engineers because there are only a small number of universities training petroleum engineers.

The Polymers/Materials Science option (CHPM) is most appropriate for students interested in the polymer industry (plastic companies like DuPont, Dow, Hercules, etc.), and for students interested in electronic materials, for example, in microelectronics fabrication (Computer chip makers such as Intel, Motorola, etc. are typical employers).

The Sustainable Energy option (CHSE) provides students access to careers where a variety of energy sources are being developed, including biofuels, solar, geothermal, and clean hydrocarbons.

RESEARCH

Researchers in the Mork Family Department of Chemical Engineering & Materials Science are at the forefront of investigations that will aid in emerging technologies. Research areas include technologies that impact oil and gas performance and maximize the world's fossil fuel supply, the latest polymers and composites, and ways to remediate contaminated soils. In addition, researchers are creating new technologies for a more efficient, environmentally sensitive future.

The Mork Family Department is well-equipped for experimental research with modern instrumentation located in core laboratories across campus, including NMR spectrometers, electron microscopes, surface analysis instrumentation, and nanofabrication tools located in clean room space.

Undergraduate students undertake senior design projects in plant design and also have many opportunities to work in the laboratories of our faculty in the areas of Chemical Engineering, Materials Science, and Petroleum Engineering. Our students also attend national conferences (e.g. AICHE, MRS, and SPE), participate in summer internships, and compete in national and international design projects such as the World Solar Challenge.

COMPANIES HIRING YOU

Amgen, Baxter, CH2MHill, Chevron, ConocoPhillips, Dow Chemical, DuPont, Environ, ExxonMobil, Halliburton, Hewlett- Packard, Intel, Proctor & Gamble... And many more!

CAREER OPTIONS

- Design and optimize cost-effective ways to produce energy, drugs, plastics and chemicals
- Develop new biological and therapeutic agents
- Establish new methods for chemical processing
- Find solutions for environmental problems
- Streamline petroleum exploration and refining
- Create new consumer products and manufacturing systems
- Regulate environmental health and safety standards
- Production, design, development and research in all fields that involve chemical changes

FACULTY HIGHLIGHTS

Dr. Shaama Sharada received her Bachelor's and Master's in Chemical Engineering from the Indian Institute of Technology, Bombay (India) where she was awarded the Institute Gold Medal. She received her PhD in Chemical Engineering from UC Berkeley and completed postdoctoral training at Stanford University. Her research focuses on the development and application of quantum chemistry methods to design catalysts for sustainable chemical transformations. She is a Scialog Fellow and recipient of the ACS Petroleum Research Fund Doctoral New Investigator award. She is also the founding faculty advisor of the Women in Chemical Engineering (WChE) student organization.

Dr. Noah Malmstadt earned a B.S. degree in Chemical Engineering from Caltech and a Ph.D. in Bioengineering from the University of Washington. His research focuses on developing micro- and millifluidic flow systems for fabricating nanomaterials with sustainability applications. This approach involves developing scalable, automated, and massively parallel flow reactors that can translate microscale chemical technologies to socially relevant manufacturing throughput. Control, optimization, and machine learning technologies are used to optimize the operational efficiency of these reactors and minimize their climate impact. These reactor systems have been used to generate materials for biofuel generation, carbon dioxide sequestration, fuel cells, and photocatalysis .

Dr. Malancha Gupta earned her PhD at MIT followed by postdoctoral work at Harvard. Her research focuses on vapor deposition of functional polymer films, bio-inspired nanomaterials, and microfluidic device fabrication. She is a recipient of the NSF Career Award and her research has been funded by NSF, ACS, DOE, and industry. She has served as the Chair of the Viterbi School of Engineering Women in Science and Engineering (WiSE) Committee since 2015.

Dr. Wade Zeno earned his B.S. in Chemical Engineering from the University of Nevada, Reno and his Ph.D. in Chemical Engineering from the University of California, Davis. He then worked as a postdoctoral fellow in the Biomedical Engineering Department at the University of Texas at Austin until 2020. His research expertise is in biological membrane engineering. Specifically, he examines the molecules that comprise cellular membranes (i.e. proteins and lipids) to understand (1) how they function at a fundamental level and (2) how they can be exploited to make functional biomaterials. The broader impacts of this work are far-reaching, ranging from understanding mechanisms of diseases to developing and delivering therapeutics.

ALUMNI HIGHLIGHTS

Martin Siron | B.S. Chemical Engineering, '17
Martin is currently a Ph.D. candidate at UC Berkeley where he joined the Materials Genome Initiative research lab, focusing on finding novel photocatalysts for CO_2 reduction - a material that uses sunlight to convert CO_2 to carbon-neutral fuels. His research leverages the use of big data, machine learning, and quantum mechanical calculations to find novel materials for this process, without ever having to spend time in a physical lab. His USC experience taught him foundational mathematical, and chemical knowledge to approach this problem, and his time in Prof. Armani's research lab was crucial to deciding to pursue research post-undergrad.

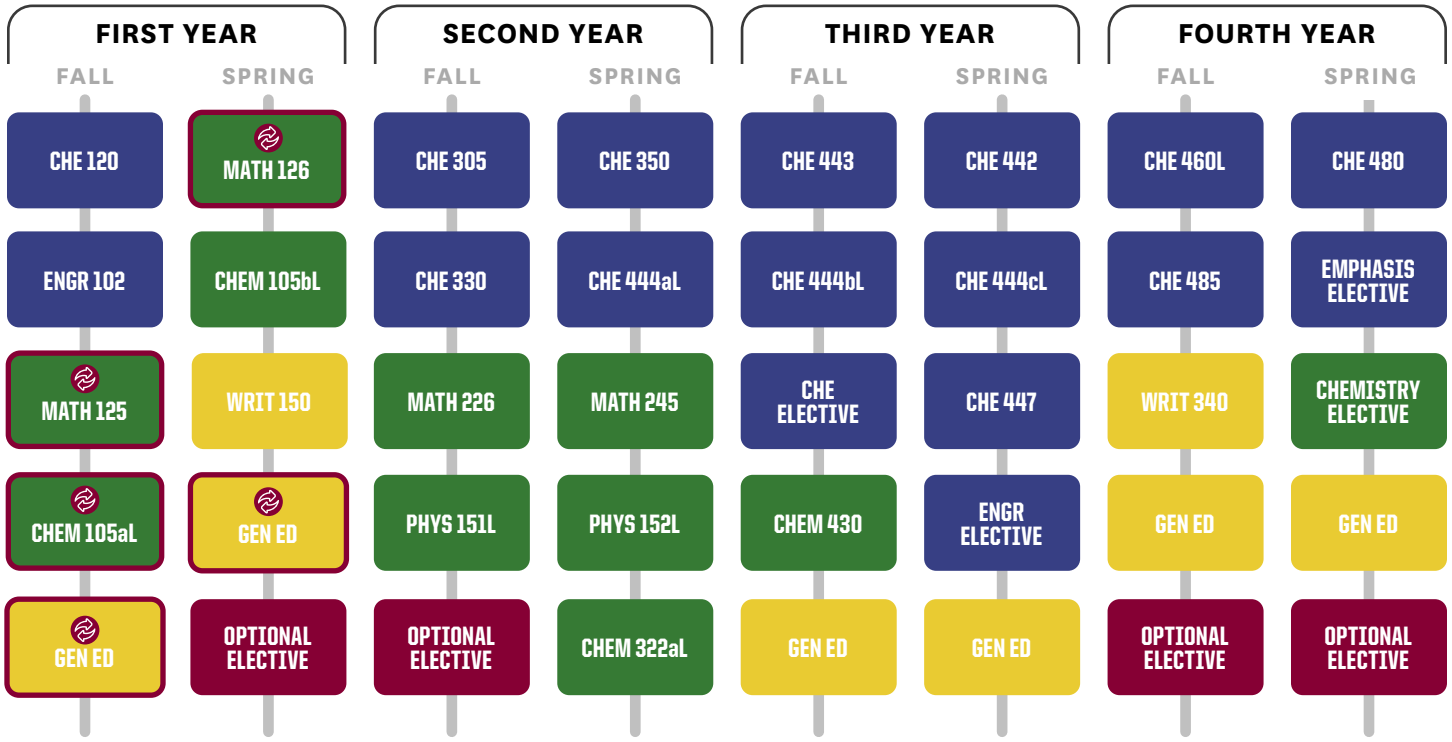
Erynn Naccarelli | B.S. Chemical Engr., '18
Erynn is currently a Ph.D. student at UT Austin where she joined the Laboratory for Applied Surface Science (LASS), focusing on advanced methods for lubrication additives. She is the former USC Chapter AIChE President and was actively involved in research as an undergraduate. Her time at Professor Steven Nutt's lab: the M.C. Gill Composite Center at USC, helped develop an interest for recycling composite materials and prepared her for graduate school.

Joelle Burkhardt B.S. | Chemical Engr., '18
Joelle works at Microsoft Devices on the Strategic Sourcing team. She manages a global supply base including Fortune 500 companies to drive the Surface Enclosures and Mechanicals technology strategy. Joelle focuses on creative solutions to deliver beautiful device experiences while also achieving competitive costs at minimal risks. For example, one of her key projects is leading the cross-functional team to develop materials and manufacturing process innovation to meet Microsoft's zero waste and carbon negative sustainability goals.

Nichole Spence | M.S. Materials Science, '21, B.S. Chemical Engineering, '20
Nichole is currently finishing her last Masters course for her M.S. in Materials Engineering at USC while working full time. She just started working at SpaceX as a Build Reliability Engineer on the Raptor engine for Starship in Los Angeles, CA.

Nathan Barba | M.S. Finance, '20, B.S. Chemical Engineering, '20 Nathan completed his MS through the progesive degree program (PDP) in December 2020. He will start working as an investment banker at GCA Advisors in San Francisco in February 2021.

Chemical Engineering



ENGINEERING

CHE 120: Introduction to Chemical Engineering
CHE 305: Numerical & Statistical Analysis for Chemical Engineers
CHE 330: Chemical Engineering Thermodynamics
CHE 350: Introduction to Separation Processes
CHE 442: Chemical Reactor Design
CHE 443: Viscous Flow
CHE 444aL: Chemical Engineering Lab
CHE 444bL: Chemical Engineering Lab
CHE 444cL: Chemical Engineering Lab
CHE 447: Heat & Mass Transfer in Chemical Engineering Processes
CHE 460L: Chemical Process Dynamics & Control
CHE 480: Chemical Process & Plant Design
CHE 485: Computer-Aided Chemical Process Design
ENGR 102: Engineering Freshman Academy
CHE, ENGR, & EMPHASIS ELECTIVES: Specialized upper division courses you choose for your major/specialization.

MATHEMATICS

MATH 125: Calculus I
MATH 126: Calculus II
MATH 226: Calculus III
MATH 245: Mathematics of Phys. & Engr.

SCIENCE

BISC 220L: Cell Biology & Physiology
BISC 320L: Molecular Biology
CHEM 105abL: General Chemistry
CHEM 322aL: Organic Chemistry
CHEM 430: Physical Chemistry: Thermodynamics & Kinetics
CHEMISTRY ELECTIVES: Specialized upper division courses you choose for your major/specialization.
PHYS 151L: Mechanics & Thermodynamics
PHYS 152L: Electricity & Magnetism

GENERAL EDUCATION

As a USC Viterbi student your General Education (Gen Ed) curriculum will include courses in the Arts, Humanistic Inquiry and Social Analysis.

WRITING

WRIT 150: Writing & Critical Reasoning
WRIT 340: Advanced Writing

ELECTIVES

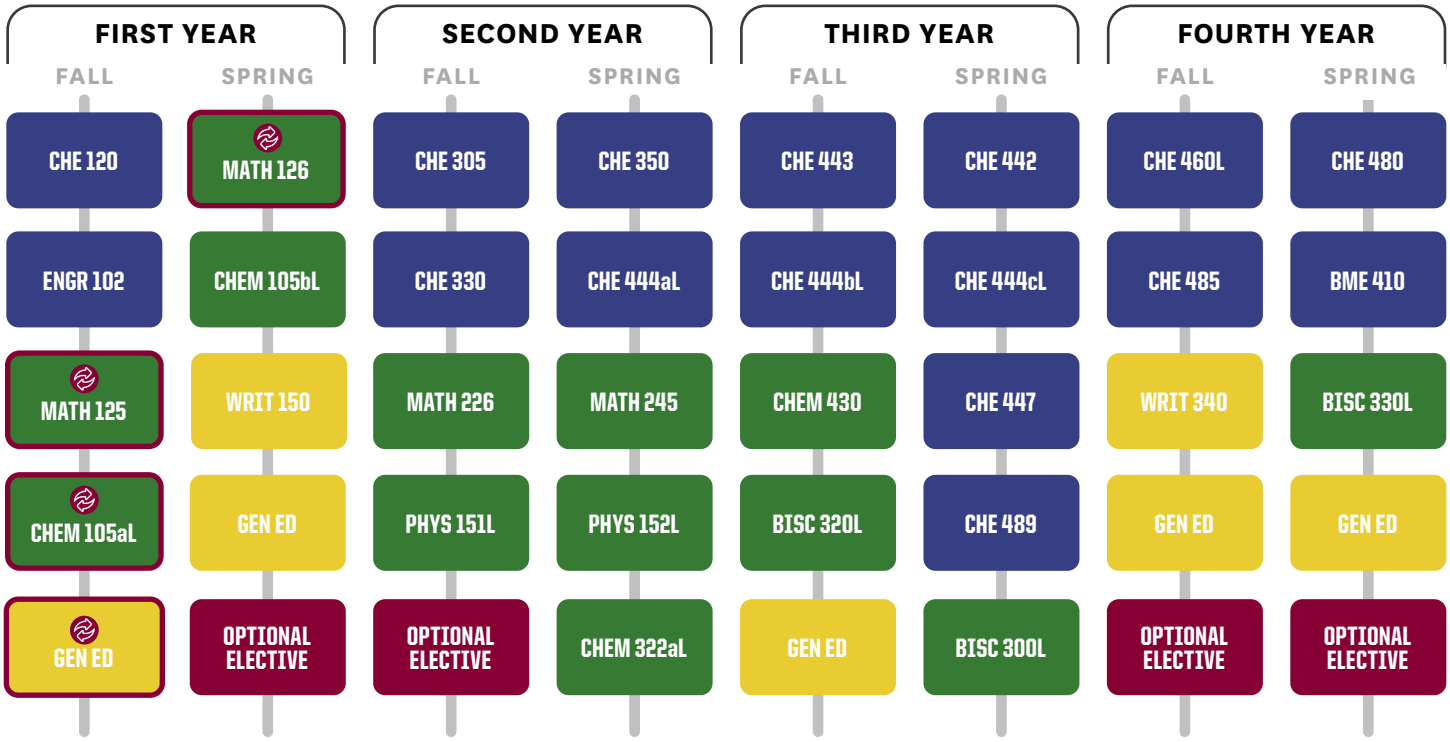
Your optional electives are one way to build engineering+ into your curriculum by choosing classes of interest to you.

Courses with this symbol may be satisfied with certain AP, IB or A-Level exams. With each requirement you replace with prior credit, you increase your optional electives, creating more flexibility for you to pursue additional electives and increase your engineering+ education.

This is a simplified version of a complex curriculum with options and choices made between advisor and student. Course choices can vary by semester and adjust to include relevant topics and materials. Although every attempt has been made to ensure accuracy, the program requirements listed in the USC Catalogue supersede any information which may be contained in this or any other publication of any school or department. The information found in this document is not intended for advising purposes. The University reserves the right to change its policies, rules, regulations, requirements and course offerings at any time.

USC Viterbi
School of Engineering

Chemical (Biochemical) Engr.



ENGINEERING

CHE 120: Introduction to Chemical Engineering
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CHE 330: Chemical Engineering Thermodynamics
CHE 350: Introduction to Separation Processes
CHE 442: Chemical Reactor Design
CHE 443: Viscous Flow
CHE 444aL: Chemical Engineering Lab
CHE 444bL: Chemical Engineering Lab
CHE 444cL: Chemical Engineering Lab
CHE 447: Heat & Mass Transfer in Chemical Engineering Processes
CHE 460L: Chemical Process Dynamics & Control
CHE 480: Chemical Process & Plant Design
CHE 485: Computer-Aided Chemical Process Design
CHE 489: Biomedical Engineering
BME 410L: Introduction to Biomaterials & Tissue Engineering
ENGR 102: Engineering Freshman Academy

MATHEMATICS

MATH 125: Calculus I
MATH 126: Calculus II
MATH 226: Calculus III
MATH 245: Mathematics of Phys. & Engr.

SCIENCE

BISC 300L: Introduction to Microbiology
BISC 320L: Molecular Biology
BISC 330L: Biochemistry
CHEM 105abL: General Chemistry
CHEM 322aL: Organic Chemistry
CHEM 430: Physical Chemistry: Thermodynamics & Kinetics
PHYS 151L: Mechanics & Thermodynamics
PHYS 152L: Electricity & Magnetism

GENERAL EDUCATION

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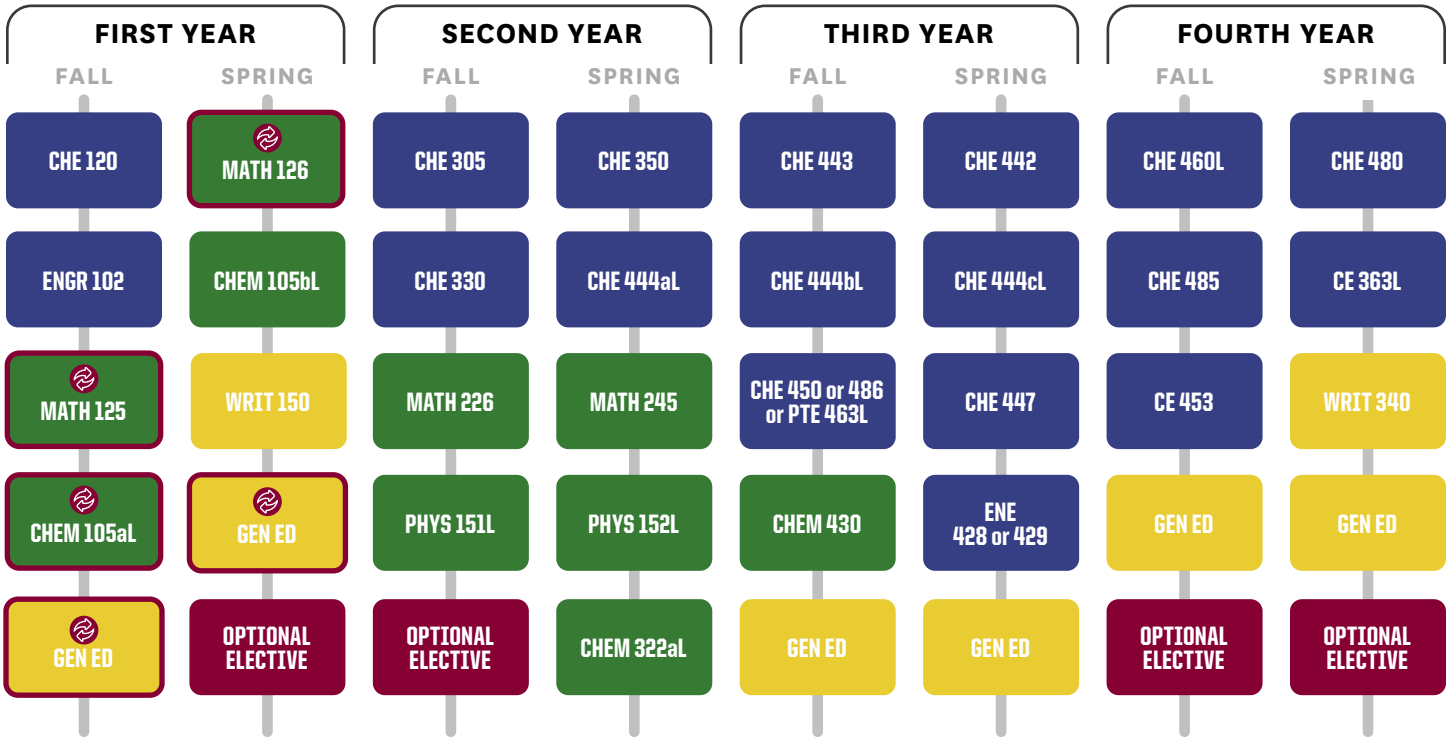
USC Viterbi
School of Engineering

Chemical (Environmental) Engr.



ENGINEERING

CHE 120: Introduction to Chemical Engineering
CHE 305: Numerical & Statistical Analysis for Chemical Engineers
CHE 330: Chemical Engineering Thermodynamics
CHE 350: Introduction to Separation Processes
CHE 442: Chemical Reactor Design
CHE 443: Viscous Flow
CHE 444aL: Chemical Engineering Lab
CHE 444bL: Chemical Engineering Lab
CHE 444cL: Chemical Engineering Lab
CHE 447: Heat & Mass Transfer in Chemical Engineering Processes
CHE 450: Sustainable Energy
CHE 460L: Chemical Process Dynamics & Control
CHE 480: Chemical Process & Plant Design
CHE 485: Computer-Aided Chemical Process Design
CHE 486: Design of Environmentally Benign Process Plants
CE 363L: Water Chemistry & Analysis
CE 453: Water Quality Science & Engineering
ENE 428: Air Pollution Fundamentals
ENE 429: Air Pollution Control
PTE 463L: Introduction to Transport Processes in Porous Media
ENGR 102: Engineering Freshman Academy

MATHEMATICS

MATH 125: Calculus I
MATH 126: Calculus II
MATH 226: Calculus III
MATH 245: Mathematics of Phys. & Engr.

SCIENCE

CHEM 105abL: General Chemistry
CHEM 322aL: Organic Chemistry
CHEM 430: Physical Chemistry: Thermodynamics & Kinetics
PHYS 151L: Mechanics & Thermodynamics
PHYS 152L: Electricity & Magnetism

GENERAL EDUCATION

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WRITING

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WRIT 340: Advanced Writing

ELECTIVES

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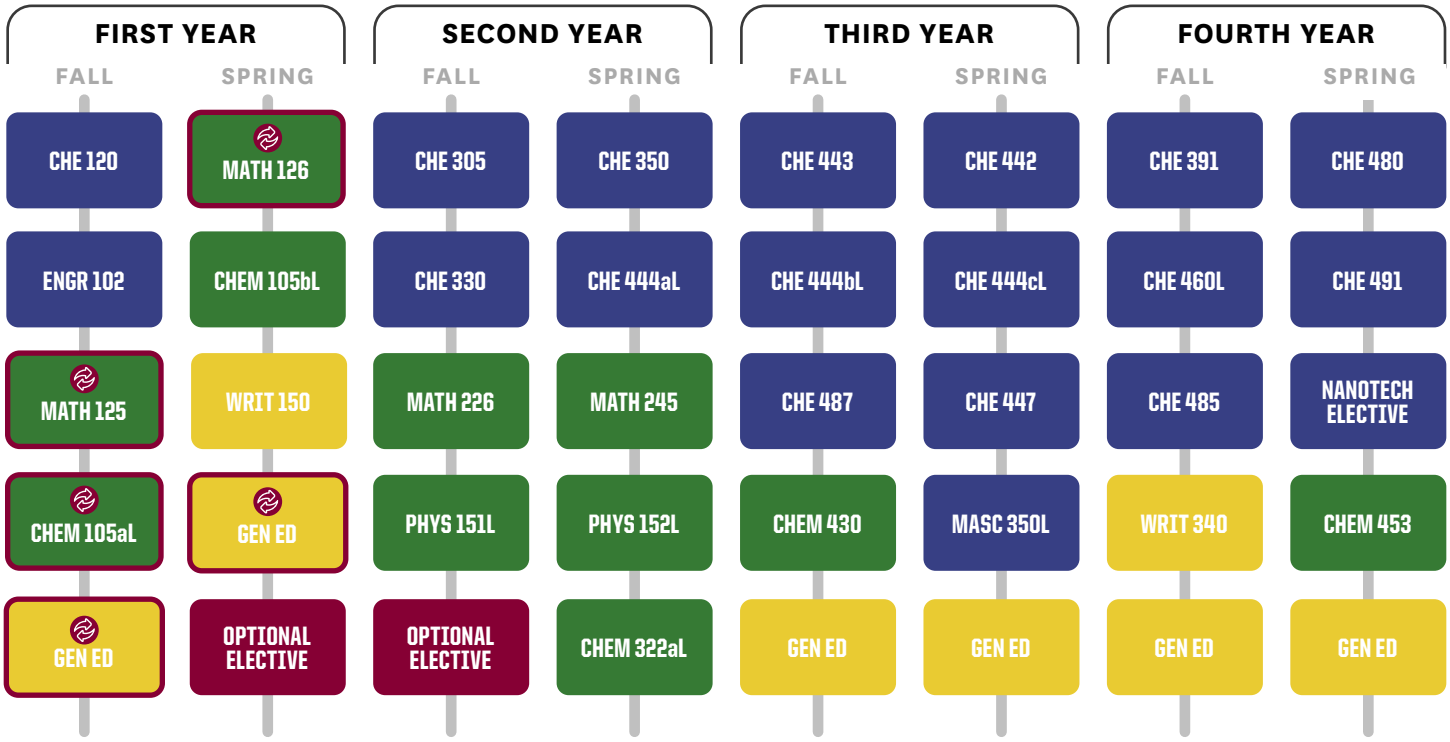
USC Viterbi
School of Engineering

Chemical (Nanotechnology) Engr.



ENGINEERING

CHE 120: Introduction to Chemical Engineering
CHE 305: Numerical & Statistical Analysis
CHE 330: Chemical Engineering Thermodynamics
CHE 350: Introduction to Separation Processes
CHE 391: Intro. to Nanotechnology Research
CHE 442: Chemical Reactor Design
CHE 443: Viscous Flow
CHE 444aL: Chemical Engineering Lab
CHE 444bL: Chemical Engineering Lab
CHE 444cL: Chemical Engineering Lab
CHE 447: Heat & Mass Transfer in Chemical Engineering Processes
CHE 460L: Chemical Process Dynamics & Control
CHE 480: Chemical Process & Plant Design
CHE 485: Computer-Aided Chemical Process Design
CHE 487: Nanotechnology & Nanoscale Engineering through Chemical Processes
CHE 491: Nanotechnology Research for Undergraduates
ENGR 102: Engineering Freshman Academy
MASC 350L: Nanostructured Materials: Design, Synthesis, & Processing Design
NANOTECH ELECTIVE: Specialized upper division course you choose for your major/ specialization.

MATHEMATICS

MATH 125: Calculus I
MATH 126: Calculus II
MATH 226: Calculus III
MATH 245: Mathematics of Phys. & Engr.

SCIENCE

CHEM 105abL: General Chemistry
CHEM 322aL: Organic Chemistry
CHEM 430: Physical Chemistry: Thermodynamics & Kinetics
CHEM 453: Advanced Inorganic Chemistry
PHYS 151L: Mechanics & Thermodynamics
PHYS 152L: Electricity & Magnetism

GENERAL EDUCATION

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WRITING

WRIT 150: Writing & Critical Reasoning
WRIT 340: Advanced Writing

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USC Viterbi
School of Engineering

Chemical (Petroleum) Engr.

ENGINEERING

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CHE 305: Numerical & Statistical Analysis for Chemical Engineers
CHE 330: Chemical Engineering Thermodynamics
CHE 350: Introduction to Separation Processes
CHE 442: Chemical Reactor Design
CHE 443: Viscous Flow
CHE 444aL: Chemical Engineering Lab
CHE 444bL: Chemical Engineering Lab
CHE 444cL: Chemical Engineering Lab
CHE 447: Heat & Mass Transfer in Chemical Engineering Processes
CHE 460L: Chemical Process Dynamics & Control
CHE 480: Chemical Process & Plant Design
CHE 485: Computer-Aided Chemical Process Design
ENGR 102: Engineering Freshman Academy
PTE 461: Formation Data Sensing with Well Logs
PTE 463L: Introduction to Transport Processes in Porous Media
PTE 464L: Modeling & Simulation of Subsurface Flow Systems
PTE 465L: Drilling Technology & Subsurface Methods

MATHEMATICS

MATH 125: Calculus I
MATH 126: Calculus II
MATH 226: Calculus III
MATH 245: Mathematics of Phys. & Engr.

SCIENCE

BISC 220L: Cell Biology & Physiology
BISC 320L: Molecular Biology
CHEM 105abL: General Chemistry
CHEM 322aL: Organic Chemistry
CHEM 430: Physical Chemistry: Thermodynamics & Kinetics
PHYS 151L: Mechanics & Thermodynamics
PHYS 152L: Electricity & Magnetism

GENERAL EDUCATION

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WRITING

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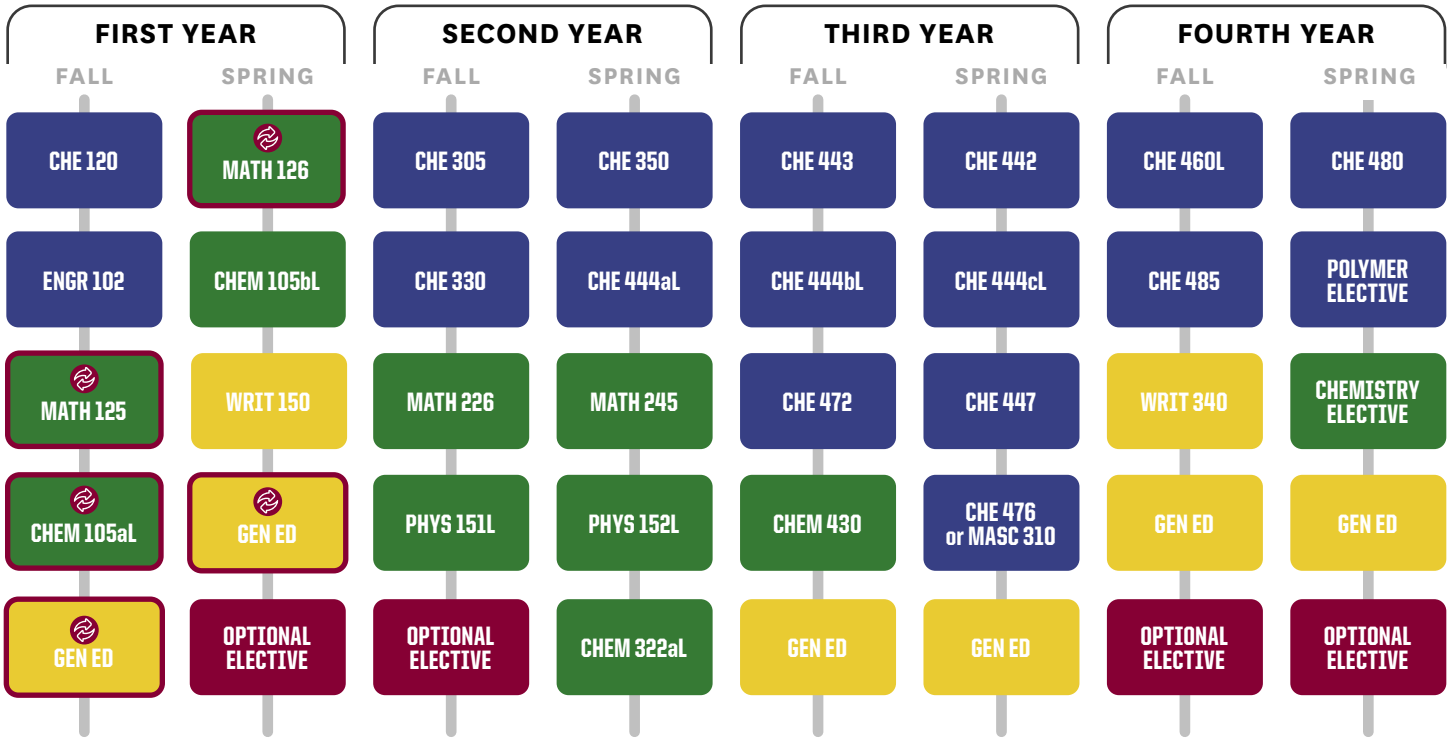
USC Viterbi
School of Engineering

Chemical (Polymers/Materials Science) Engr.



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CHE 444cL: Chemical Engineering Lab
CHE 447: Heat & Mass Transfer in Chemical Engineering Processes
CHE 460L: Chemical Process Dynamics & Control
CHE 472: Polymer Science & Engineering
CHE 476: Chemical Engineering Materials
CHE 480: Chemical Process & Plant Design
CHE 485: Computer-Aided Chemical Process Design
ENGR 102: Engineering Freshman Academy
MASC 310: Materials Behavior & Processing
POLYMERS ELECTIVE: Specialized upper division courses you choose for your major/ specialization.

MATHEMATICS

MATH 125: Calculus I
MATH 126: Calculus II
MATH 226: Calculus III
MATH 245: Mathematics of Phys. & Engr.

SCIENCE

CHEM 105abL: General Chemistry
CHEM 322aL: Organic Chemistry
CHEM 430: Physical Chemistry: Thermodynamics & Kinetics
CHEMISTRY ELECTIVES: Specialized Upper Division courses you choose for your major/ specialization
PHYS 151L: Mechanics & Thermodynamics
PHYS 152L: Electricity & Magnetism

GENERAL EDUCATION

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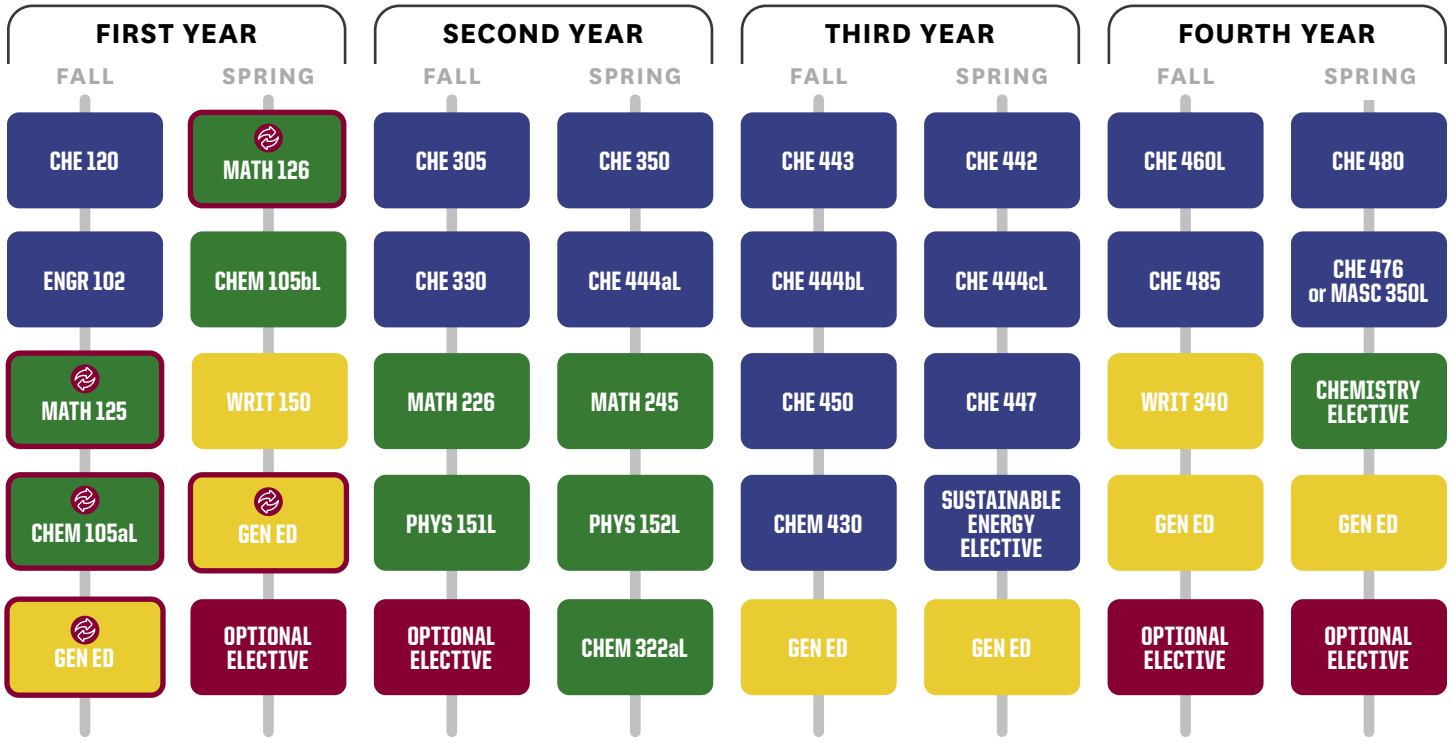
USC Viterbi
School of Engineering

Chemical (Sustainable Energy) Engr.



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CHE 447: Heat & Mass Transfer in Chemical Engineering Processes
CHE 450: Sustainable Energy
CHE 460L: Chemical Process Dynamics & Control
CHE 476: Chemical Engineering Materials
CHE 480: Chemical Process & Plant Design
CHE 485: Computer-Aided Chemical Process Design
ENGR 102: Engineering Freshman Academy
MASC 350L: Nanostructured Materials: Design, Synthesis & Processing
SUSTAINABLE ENERGY ELECTIVES: Specialized upper division courses you choose for your major/specialization.

MATHEMATICS

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