Chemical Engineering Technical Electives

Technical Electives: Students must complete at least 6 credits of technically oriented subject-related courses approved by their advisor. Acceptable subjects include, but are not limited to: composites processing, biochemical engineering, electronic materials, environment, advanced mathematics, transport phenomena, advanced chemistry, food, legal and regulatory issues, advanced materials, statistics, biomedical engineering, and polymers.

- You may select two courses from one of the groups listed below or request approval from your advisor for an alternate set of courses.
- At least one course must include 3 credits of engineering topics, denoted by superscript “e” in front of the course listing.
- Engineering topics, “e,” courses include courses taught in the College of Engineering as well as some advanced courses taught outside the college.
- You may replace one technical elective with 3 credits of EGR X (internship/co-op course). This must be paired with an “e” course from any category.

BIOLOGICAL SCIENCES AND ENGINEERING

ANTR 350, Human Gross Anatomy for Pre-Health Professionals (p: BS 161) F/S/Su

BE 440, Entrepreneurial Engr. for Innovation in Health & Safety (p: MTH 132; recc: BS 161; jr/sr standing) S

BE 444, Biosensors for Medical Diagnostics (p: BS 161; CEM 151; ECE 345 or approval of dept.) S

*CHE 481, Biochemical Engineering (p: CHE 431; BMB 401 or BMB 461 & BMB 462) F

CHE 882, Advanced Biochemical Engineering (p: CHE 481; approval of instructor) S of EVEN yrs.

CHE 883, Multidisciplinary Bioprocessing Lab (p: CHE 481; approval of instructor) S of ODD yrs.

CSS 350, Introduction to Plant Genetics (p: BS 161 or PLB 105) S

EGR 440, Engineering Entrepreneurship F

FSC 211, Principles of Food Science F/Su

FSC 401, Food Chemistry (p: CEM 352 or BMB 401 or cc) S

FSC 440, Food Microbiology (p: MMG 201 or MMG 301; WRA) F

IBIO 341, Fundamental Genetics (p: BS 161; BS 162) F/S/Su

ME 494, Biofluid Mechanics and Heat Transfer (p: CHE 311 or cc) F

ME 495, Tissue Mechanics (p: ME 222) S

MMG 301, Introductory Microbiology (p: BS 161; CEM 351 or cc) F/S

MMG 409, Eukaryotic Cell Biology (p: BS 161; BMB 401 or cc or BMB 462 or cc) S

MMG 413, Virology (p: BMB 401 or BMB 462 or cc) S

MMG 425, Microbial Ecology (Recc: MMG 301) S

*MMG 445, Microbial Biotechnology (p: MMG 301 or BMB 461 or BMB 401; WRA) F/Su

MMG 451, Immunology (p: BS 161; BMB 401 or cc or BMB 461 or cc) F

*MSE 425, Biomaterials and Biocompatibility (p: MSE 250 or approval of dept.) F

PHM 350, Introductory Human Pharmacology (p: PSL 250 or PSL 310 or PSL 431 & PSL 432) F/S/Su

PSL 250, Introductory Physiology F/S/Su

*PSL 425, Physiological Biophysics (p: PSL 250 or PSL 310 or PSL 431 & PSL 432) F/S

PSL 431, Human Physiology I (p: BS 161; CEM 152) F

PSL 432, Human Physiology II (p: PSL 431; BS 161; CEM 152) S

*Note: Completion of CHE 472 or CHE 481 is a program requirement. Therefore, CHE 472 or CHE 481 taken alone cannot count as both a technical elective and a program requirement.

If BMB 462 is taken to fulfill major requirements, it will count as a technical elective in biological sciences and engineering but is not an “e” denoted course.
CHEMICAL ENGINEERING
AFRE 829, Economics of Environmental Resources (p: undergraduate intermediate microeconomics, calculus and statistics) S

BE 469, Sustainable Bioenergy Systems (p: CHE 201; CHE 321) S
CHE 468, Biomass Conversion Engineering (p: CHE 321; CHE 431) F
*CHE 472, Composite Materials Processing (p: CHE 311) F
*CHE 481, Biochemical Engineering (p: CHE 431; BMB 401 or BMB 461 & BMB 462) F
CHE 483, Brewing & Distilled Beverage Technology (p: CHE 311; must be 21 yrs; override required) F or S
CHE 490, Independent Study (p: approval of dept.)
CHE 882, Advanced Biochemical Engineering (p: CHE 481; approval of instructor) S of EVEN yrs.
CHE 883, Multidisciplinary Bioprocessing Lab (p: CHE 481; approval of instructor) S of ODD yrs.
CSS 467, BioEnergy Feedstock Production (p: MTH 103 or higher) F

ADVANCED CHEMISTRY AND PHYSICS
CEM 411, Advanced Inorganic Chemistry (p: CEM 311 or CEM 384 or CEM 483) F
CEM 444, Chemical Safety (p: CEM 152; CEM 352) F, 1 credit
*CEM 483, Quantum Chemistry (p: MTH 235; PHY 184; CEM 152) F
*CEM 484, Molecular Thermodynamics (p: MTH 235; CEM 152) S
CEM 485, Modern Nuclear Chemistry (p: CEM 152; PHY 184) S of EVEN yrs.
PHY 215, Thermodynamics and Modern Physics (p: PHY 184; MTH 234 or cc) F/S
PHY 321, Classical Mechanics I (p: PHY 215 or cc; MTH 235 or cc) F/S
PHY 422, Classical Mechanics II (p: PHY 321) F
PHY 480, Computational Physics (Recc: CSE 231) S

ELECTRICAL ENGINEERING
CSE 231, Programming I (Python) (p: MTH 132 or cc) F/S/Su
CSE 232, Programming II (C++) (p: CSE 231; MTH 132) F/S/Su
CSE 260, Discrete Structures in Computer Science (p: MTH 133) F/S/Su
ECE 201, Circuits and Systems I (p: CSE 231 or cc or CSE 220 or cc or EGR 102 or cc; MTH 234 or cc) F/S
ECE 202, Circuits and Systems II (p: ECE 201; MTH 235 or cc) F/S
ECE 230, Digital Logic Fundamentals (p: CSE 231 or cc or CSE 220 or cc) F/S
ECE 280, Electrical Engineering Analysis (p: MTH 234; ECE 201 or cc) F/S
ECE 345, Electronic Instrumentation and Systems (p: MTH 234 or cc; PHY 184; WRA) F/S/Su
EGR 440, Engineering Entrepreneurship F

ENVIRONMENTAL ENGINEERING
AFRE 265, Ecological Economics (p: EC 201 or cc or EC 202 or cc) F/S
AFRE 360, Environmental Economics (p: AFRE 265; AFRE 203) S
ANS 407, Food and Animal Toxicology (p: BS 161) S
CSS 210, Fundamentals of Soil Science (Recc: CEM 151) F/S
CSUS 465, Environmental and Natural Resource Law (p: CSUS 200 or EEM 255) F

*Note: Completion of CHE 472 or CHE 481 is a program requirement. Therefore, CHE 472 or CHE 481 taken alone cannot count as both a technical elective and a program requirement.

*Note: Completion of CEM 483 or CEM 484 is a program requirement. Therefore, CEM 483 or CEM 484 taken alone cannot count as both a technical elective and a program requirement.
\[ \text{EGR 440}, \text{ Engineering Entrepreneurship F} \]
\[ \text{ENE 280}, \text{ Principles of Environmental Engineering and Science (p: CEM 151; MTH 132 or cc) F/S} \]
\[ \text{ENE 481}, \text{ Environmental Chemistry: Equilibrium Concepts (p: CEM 151; CEM 152; ENE 280 or BE 230 or GLG 201 or GLG 301 or approval of dept.) F} \]
\[ \text{ENE 483}, \text{ Water and Wastewater Engineering (p: ENE 280 or BE 230; CHE 311) F} \]
\[ \text{ENE 487}, \text{ Microbiology for Environmental Science and Engineering (p: ENE 280) S} \]
\[ \text{ENE 489}, \text{ Air Pollution: Science and Engineering (p: CEM 151; MTH 133; ENE 280 or BE 230; CHE 311) S} \]
\[ \text{IBIO 446}, \text{ Environmental Issues and Public Policy F} \]

**FOOD PROCESSING**

\[ \text{BE 477}, \text{ Food Engineering: Fluids (p: BE 350; BE 351; BE 360) F * Override granted to senior CHE students.} \]
\[ \text{BE 478}, \text{ Food Engineering: Solids (p: BE 350; BE 351; BE 360) S} \]
\[ \text{CEM 482}, \text{ Science and Technology of Wine Production (p: CEM 351; must be 21 yrs; override required) F} \]
\[ \text{CHE 483}, \text{ Brewing and Distilled Beverage Technology (p: CHE 311; must be 21 yrs; override required) F or S} \]
\[ \text{FSC 211}, \text{ Principles of Food Science F/Su} \]
\[ \text{FSC 325}, \text{ Food Processing: Unit Operations (p: FSC 211 or ANS 201 or approval of dept.) S} \]
\[ \text{FSC 342}, \text{ Food Safety and Hazard Analysis Critical Control Point Program (p: FSC 211 or cc or HNF 150 or cc or course in MMG, CEM, or BS) F} \]
\[ \text{FSC 401}, \text{ Food Chemistry (p: CEM 352 or BMB 401 or cc) S} \]
\[ \text{FSC 421}, \text{ Food Laws and Regulations (p: HNF 150 or FSC 211 or ABM 100) S of ODD yrs./Su of EVEN yrs.} \]
\[ \text{FSC 430}, \text{ Food Processing: Fruits and Vegetables (p: FSC 211; FSC 325 or BE 350) F} \]
\[ \text{FSC 431}, \text{ Food Processing: Cereals (p: FSC 211; FSC 325 or BE 350) S} \]
\[ \text{FSC 432}, \text{ Food Processing: Dairy Foods (p: FSC 211; FSC 325 or BE 350) F} \]
\[ \text{FSC 433}, \text{ Food Processing: Muscle Foods (p: FSC 211; FSC 325 or BE 350) S} \]
\[ \text{FSC 440}, \text{ Food Microbiology (p: MMG 201 or MMG 301; WRA) F} \]
\[ \text{FSC 455}, \text{ Food and Nutrition Laboratory (p: BMB 401 or cc or BMB 461 or cc; WRA) F} \]
\[ \text{FSC 480}, \text{ Food Production Development, (p: FSC 401; FSC 310; FSC 440) S} \]
\[ \text{FSC 481}, \text{ Fermented Beverages, (p: must be 21 yrs.; override required) F} \]
\[ \text{MMG 301}, \text{ Introductory Microbiology (p: BS 161; CEM 351 or cc) F/S} \]

**MATERIALS ENGINEERING**

\[ \text{CE 221}, \text{ Statics (p: PHY 183; MTH 234 or cc) F/S/Su} \]
\[ \text{CHE 472}, \text{ Composite Materials Processing (p: CHE 311) F} \]
\[ \text{EGR 440}, \text{ Engineering Entrepreneurship F} \]
\[ \text{ME 222}, \text{ Mechanics of Deformable Solids (p: CE 221; MTH 234) F/S/Su} \]
\[ \text{ME 361}, \text{ Dynamics (p: CE 221; MTH 235) F/S} \]
\[ \text{ME 413}, \text{ Cryogenic-Thermal Systems (p: approval of department) S} \]
\[ \text{ME 414}, \text{ Mechanical Design of Cryogenic Systems (p: approval of department) F} \]
\[ \text{ME 495}, \text{ Tissue Mechanics (p: ME 222) S} \]
\[ \text{MSE 250}, \text{ Materials Science and Engineering (p: CEM 151) F/S/Su} \]
\[ \text{MSE 260}, \text{ Electronic, Magnetic, Thermal and Optical Properties of Materials (p: MSE 250; PHY 184 or cc) S} \]
\[ \text{MSE 370}, \text{ Synthesis and Processing of Materials (p: MSE 250; CHE 321) S} \]
\[ \text{MSE 425}, \text{ Biomaterials and Biocompatibility (p: MSE 250 or approval of dept.) F} \]
\[ \text{PKG 221}, \text{ Packaging with Glass and Metal (p: CEM 151; PHY 183; PKG 102 or cc or approval of dept.) F/S} \]
\[ \text{PKG 323}, \text{ Packaging with Plastics (p: CEM 351; STT 351 or STT 200 or STT 201 or STT 315; MTH 133; PKG 101; PKG 221 or cc or approval of dept.) F/S} \]

*Note: Completion of CHE 472 or CHE 481 is a program requirement. Therefore, CHE 472 or CHE 481 taken alone cannot count as both a technical elective and a program requirement.*

**MATHEMATICS, STATISTICS, AND COMPUTING**

*Updated 2/2022*
MTH 309, Linear Algebra I (p: MTH 133; WRA; MTH 299 or approval of dept.) F/S/Su
MTH 314, Matrix Algebra with Applications (p: MTH 133) F/S/Su
MTH 320, Analysis I (p: MTH 133; MTH 299 or approval of dept.) F/S/Su
MTH 414, Linear Algebra II (p: MTH 309) F
e MTH 415, Applied Linear Algebra (p: MTH 235; MTH 309 or MTH 314) F/S/Su
e MTH 421, Analysis II (p: MTH 320; MTH 234) F/S
e MTH 451, Numerical Analysis I (p: CSE 231; MTH 235) F
e STT 351, Probability and Statistics for Engineering (p: MTH 234) F/S/Su
e CSE 231, Programming I (Python) (p: MTH 132 or cc) F/S/Su
e CSE 232, Programming II (C++) (p: CSE 231; MTH 132) F/S/Su
e CSE 260, Discrete Structures in Computer Science (p: MTH 133) F/S/Su