

Chemical Engineering Technical Electives

Technical Electives: Students must complete at least **6 credits** of technically-oriented subject-related courses approved by his or her advisor. Acceptable subjects include, but are not limited to the following: composites processing or 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 group** 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 subscript “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.

BIOLOGICAL SCIENCES AND ENGINEERING

ANTR 350, Human Gross Anatomy and Structural Biology (p: BS 161) F/S/US

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

^e **CHE 882**, Advance Biochemical Engineering (p: CHE 481) S of EVEN yrs.

^e **CHE 883**, Multidisciplinary Bioprocessing Lab (p: CHE 481) S of ODD yrs.

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

^e **FSC 211**, Principles of Food Science F/S

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

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

^e **ME 494**, Biofluid Mechanics and Heat Transfer (p: ME 410 or cc) or (CHE 311 or cc) or (BE 350 or cc) F

^e **ME 495**, Tissue Mechanics (p: ME 222) S

MMG 301, Intro. Microbiology (p: BS 161; CEM 251 or cc or 351 or cc or CEM 143 or cc) F/S

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

MMG 425, Microbial Microbiology (RB: MMG 301) S

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

^e **MSE 425**, Biomaterials and Biocompatibility (p: MSE 250) S

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

PSL 250, Introductory Physiology (p: none) F/S/Su

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

PSL 431, Human Physiology I (p: BS 161; CEM 142 or 152) F

PSL 432, Human Physiology II (p: PSL 431; BS 161; CEM 142 or 152) S

ZOL 341, Fundamental Genetics (BS 161) F/S/Su

**Note:*

Completion of CHE 472 or CHE 481 is a program requirement. Therefore, CHE 472 or CHE 481 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)

^e **CHE 468**, Biomass Conversion Engineering (p: BE 351 or CHE 321) and (BE 360 or CHE 431) F

^e **BE 469**, Sustainable Bioenergy Systems (p: BE 230 or CHE 201) S

^e ***CHE 472**, Composite Materials Processing (p: CHE 311) S

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

^e **CHE 490**, Independent Study

- ° **CHE 483**, Brewing & Distilled Beverage Technology (p: CHE 311 or BE 350 or ME 410 or FSC 325 or cc or BE/FSC 429 or cc; must be 21 yrs.) S
- ° **CHE 883**, Multidisciplinary Bioprocessing Lab (p: CHE 481) S of ODD yrs.
- ° **CHE 882**, Advance Biochemical Engineering (p: CHE 481) S of EVEN yrs.
- ° **CSS 467**, BioEnergy Feedstock Production (p: MTH 103 or higher) F
- MMG 409**, Eukaryotic Cell Biology (p: BS 161; BMB 401 or cc or BMB 462 or cc) S
- MMG 421**, Prokaryotic Cell Physiology (p: MMG 301 and (BMB 461 or concurrently)) or (MMG 301 and (BMB 401 or concurrently)) F
- MMG 431**, Microbial Genetics (p: BMB 461 or concurrently) or (BMB 401 or concurrently) F

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

ADVANCED CHEMISTRY AND PHYSICS

- CEM 411**, Inorganic Chemistry (p: CEM 311 or CEM 384 or CEM483) S
- ° **CEM 444**, Chemical Safety (p: CEM 142; CEM 252; override needed) F, I credit
- ***CEM 483**, Quantum Chemistry (p: MTH 235; PHY 184; CEM 142 or 152) F
- ° ***CEM 484**, Molecular Thermodynamics (p: MTH 235 and CEM 142 or 152) S
- CEM 485**, Modern Nuclear Chemistry (p: CEM 142 or CEM 152; PHY 184) S of even yrs.
- PHY 215**, Thermodynamics and Modern Physics (p: PHY 184 or cc; MTH 234 or cc) F/S
- PHY 321**, Classical Mechanics I (p: PHY 184, MTH 234 or cc) S/Su
- PHY 422**, Classical Mechanics II (p: PHY 321) F
- ° **PHY 480**, Computational Physics (RB: CSE 131 or CSE 231) S

**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.*

ELECTRICAL ENGINEERING

- ° **ECE 201**, Circuits and Systems I (p: CSE 131 or cc or CSE 231 or cc or EGR 102 or cc or CSE 220 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 131 or 231 or or CSE 220 or EGR 102) F/S
- ° **ECE 280**, Electrical Engineering Analysis (p: MTH 234; ECE 201 or cc) F/S
- ° **ECE 345**, Electronic Instrumentation and Systems (p: MTH 235, PHY 184; WRA) F/S
- ° **CSE 231**, Programming I (Python) (p: MTH 132 or cc) F/S
- ° **CSE 232**, Programming II (Python) (p: CSE 231; MTH 132) F/S
- ° **CSE 260**, Discrete Structures in Computer Science (p: MTH 133) F/S

ENVIRONMENTAL ENGINEERING

- ANS 407**, Food and Animal Toxicology (p: BS 161) F
- CSS 210**, Fundamentals of Soil Science F
- CSUS 465**, Environmental and Natural Resource Law (p: CSUS (ESA) 200 or EEP 255) F
- ° **ENE 280**, Principles of Environmental Engineering and Science (p: CEM 141 or CEM 151; MTH 132 or cc) F/S
- ° **ENE 481**, Environmental Chemistry; Equilibrium Concepts (p: CEM 151 and 152; ENE 280 or Be 230 or GLG201 or GLG 301 or approval of dept.) F
- ° **ENE 483**, Water & Wastewater in Environmental Engineering (p: ENE 280 and CE 312) F
- ° **ENE 487**, Microbiology for Environmental Science and Engineering (p: ENE 280) S
- ° **ENE 489**, Air Pollution Science Engineering (p: (CEM 141 or CEM 151 or LB 171) and (MTH 133 or MTH 153H or LB 119) and (ENE 280 or BE 230) and (CE 321 or CHE 311) S
- EEP 255**, Ecological Economics F/S
- EEP 320**, Environmental Economics (p: EEP 255 and EC 201) S
- EEP 405**, Corporate Environmental Mgt. (p: EEP 255 or ABM 332 or MGT 315 or MGT 325) S
- ZOL 446**, Environmental Issues and Public Policy F

FOOD PROCESSING

- ° **BE 477**, Food Engineering: Fluids (p: BE 350; BE 351; BE 360) F *Override granted to senior CHE students.
- ° **BE 478**, Food Engineering: Solids (p: BE 350 and BE 351 and BE 360) S
- CEM 482**, Science & Tech. of Wine Production (p: CEM 143 or CEM 251 or CEM 351; must be 21 yrs.) F
- ° **CHE 483**, Fermented Beverage Technology (p: CHE 311 or BE 350 or ME 410 or FSC 325 or cc or BE/FSC 429 or cc; must be 21 yrs.) S
- ° **FSC 211**, Principles of Food Science F/S
- FSC 325**, Food Processing: Unit Operations (p: FSC 211 or ANS 201) S
- ° **FSC 342**, Food Safety and Hazard Analysis Critical Control Point Program (p: FSC 211 or HNF 150 or cc or HNF 160 or cc or cc in MMG, CEM, or BS) F
- ° **FSC 401**, Food Chemistry (p: CEM 352 or BMB 401 or cc) S
- FSC 421**, Food Laws and Regulations (p: HNF 150 or FSC 211 or HNF 260 or ABM 100) S
- ° **FSC 430**, Food Processing: Fruits and Vegetables (p: FS 211) F
- ° **FSC 431**, Food Processing: Cereals (p: FSC 211) S
- ° **FSC 432**, Food Processing: Dairy Foods (p: FSC 211 or ANS 201) S
- ° **FSC 433**, Food Processing: Muscle Foods (p: FSC 211 or ANS 201) S
- ° **FSC 440**, Food Microbiology (p: MMG 201 or MMG 301: WRA) F
- FSC 455**, Food and Nutrition Laboratory (p: ((BMB 200 or concurrently) or (BMB 401 or concurrently) or (BMB 461 or concurrently)) and completion of Tier I writing requirement) F
- ° **FSC 470**, Food Prod. Development, (p:(FSC 401 and FSC 410) and (FSC 440 or concurrently) S
- MMG 301**, Intro. Microbiology (p: BS 161; CEM 251 or cc or 351 or cc or CEM 143 or cc) F/S

MATERIALS ENGINEERING

- ° **CHE 472**, Composite Materials Processing (p: CHE 311 or ME 332 or CE 321) F
- ° **CE 221**, Statics (p: PHY 183, MTH 234, or cc) F/S/Su
- ° **ME 222**, Mechanics of Deformable Solids (p: CE 221; MTH 234) F/S/Su
- ° **ME 361**, Dynamics (p: CE 221; MTH 235) F/S
- ° **ME 495**, Tissue Mechanics (p: ME 222) S
- ° **MSE 250**, Introduction to Materials Science (p: CEM 141 or CEM 151) F/S/Su
- ° **MSE 260**, Electronic Structure and Properties of Materials (p: MSE 250, PHY 184 or cc; CEM 141 or CEM 151) S
- ° **MSE 370**, Physical Processing of Materials (p: MSE 250 and CHE 321 or ME 201 or PHY 215 or MSE 410) S
- ° **MSE 425**, Biomaterials and Biocompatibility (p: MSE 250) S
- ° **PKG 221**, Packaging with Glass & Metal (p: CEM 141 or 151; PHY 183 or PHY231; PKG 101 or cc) F/S
- ° **PKG 323**, Packaging with Plastics (p: PKG 101; PKG 221 or cc; CEM 351 or CEM 251 or CEM 143; STT 351 or STT 200 or STT 201; MTH 132 or MTH 124) F/S

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

MATHEMATICS, STATISTICS, AND COMPUTING

- MTH 309**, Linear Algebra I (p: MTH133 and (MTH 299 or approval of dept.; WRA) F/S/Su
- MTH 314**, Matrix Algebra with Applications (p: MTH133) F/S/Su
- MTH 320**, Analysis I (p: MTH133 and (MTH 299 or approval of dept.) F/S/Su
- MTH 414**, Linear Algebra II (p: MTH 309) F
- ° **MTH 415**, Applied Linear Algebra (p: MTH 235; MTH 309 or MTH 314) F/S/Su
- ° **MTH 421**, Analysis II (p: MTH 320 and MTH 234) F/S/Su
- ° **MTH 451**, Numerical Analysis I (p: CSE 131 or CSE 231; MTH 309 or 314 or 415; MTH 235) F
- ° **STT 351**, Probability and Statistics for Engineering (p: MTH 234) F/S/Su
- ° **CSE 231**, Programming I (Python) (p: MTH 124 or cc or MTH 132 or cc) F/S/Su
- ° **CSE 232**, Programming II (Python) (p: CSE 231; MTH 124 or cc or MTH 132) F/S/Su
- ° **CSE 260**, Discrete Structures in Computer Science (p: MTH 133) F/S