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, 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 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 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 for Pre-Health Professionals (p: BS 161) F/S/Su
- BE 444, Biosensors for Medical Diagnostics (p: BS 161; CEM 151; ECE 345) 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) S
- CHE 468, Biomass Conversion Engineering (p: CHE 321; CHE 431) F
- *CHE 472, Composite Materials Processing (p: CHE 311) F*

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*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) 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

*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.*

**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

*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**

*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

*EGR 440*, Engineering Entrepreneurship F

**ENVIRONMENTAL ENGINEERING**

*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

*EEM 255*, Ecological Economics (p: EC 201 or cc) F/S

*EEM 320*, Environmental Economics (p: EEM 255; EC 201; ABM 203 or approval of dept.) S

*EGR 440*, Engineering Entrepreneurship F

*ENE 280*, Principles of Environmental Engineering and Science (p: CEM 151; MTH 132 or cc) F/S

*ENE 481*, 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

*ENE 483*, Water and Wastewater Engineering (p: ENE 280 or BE 230; CHE 311) F

*ENE 487*, Microbiology for Environmental Science and Engineering (p: ENE 280) S

*ENE 489*, Air Pollution: Science and Engineering (p: CEM 151; MTH 133; ENE 280 or BE 230; CHE 311) S

*IBIO 446*, Environmental Issues and Public Policy F

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**FOOD PROCESSING**

- **BE 477**, Food Engineering: Fluids (p: BE 350; BE 351; BE 360) F
- **BE 478**, Food Engineering: Solids (p: BE 350; BE 351; BE 360) S
- **CEM 482**, Science and Technology of Wine Production (p: CEM 351; must be 21 yrs.; override required) F
- **CHE 483**, Brewing and Distilled Beverage Technology (p: CHE 311; must be 21 yrs.; override required) 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 CEM 351 or HNF 150 or course in MMG, CEM, or BS) F
- **FSC 340**, Food Chemistry (p: CEM 352 or BMB 401 or course in MMG, CEM, or BS) S
- **FSC 421**, Food Laws and Regulations (p: HNF 150 or FSC 211 or ABM 100) S of ODD yrs/Su of EVEN yrs.
- **FSC 430**, Food Processing: Fruits and Vegetables (p: FSC 211; FSC 325 or BE 350) F
- **FSC 431**, Food Processing: Cereals (p: FSC 211; FSC 325 or BE 350) S
- **FSC 432**, Food Processing: Dairy Foods (p: FSC 211; FSC 325 or BE 350) F
- **FSC 433**, Food Processing: Muscle Foods (p: FSC 211; FSC 325 or BE 350) S
- **FSC 440**, Food Microbiology (p: MMG 201 or MMG 301; WRA) F
- **FSC 470**, Food Production Development, (p: FSC 401; FSC 310; FSC 440) F
- **FSC 481**, Fermented Beverages, (p: must be 21 yrs.; override required) F
- **MMG 301**, Introductory Microbiology (p: BS 161; CEM 351 or course in MMG, CEM, or BS) F/S

**MATERIALS ENGINEERING**

- **CE 221**, Statics (p: PHY 183; MTH 234 or course in MMG, CEM, or BS) F/S/Su
- **CHE 472**, Composite Materials Processing (p: CHE 311) F
- **EGR 440**, Engineering Entrepreneurship F
- **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**, Materials Science and Engineering (p: CEM 151) F/S/Su
- **MSE 260**, Electronic, Magnetic, Thermal and Optical Properties of Materials (p: MSE 250; PHY 184 or course in MMG, CEM, or BS) F/S
- **MSE 370**, Synthesis and Processing of Materials (p: MSE 250; CHE 321) S
- **MSE 425**, Biomaterials and Biocompatibility (p: MSE 250 or approval of dept.) F
- **PKG 221**, Packaging with Glass and Metal (p: CEM 151; PHY 183; PKG 102 or course in MMG, CEM, or BS) F/S
- **PKG 323**, Packaging with Plastics (p: CEM 351; STT 351 or STT 200 or STT 201 or STT 315; MTH 133; PKG 101; PKG 221 or course in MMG, CEM, or BS) 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**

- **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
- **MTH 415**, Applied Linear Algebra (p: MTH 235; MTH 309 or MTH 314) F/S/Su
- **MTH 421**, Analysis II (p: MTH 320; MTH 234) F/S
- **MTH 451**, Numerical Analysis I (p: CSE 231; MTH 235) F
- **STT 351**, Probability and Statistics for Engineering (p: MTH 234) F/S/Su
- **CSE 231**, Programming I (Python) (p: MTH 132 or course in MMG, CEM, or BS) 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

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