

## Chemical Engineering Technical Electives

**Technical Electives:** Students must complete at least **6 credits** of technically oriented subject-related courses.

Students may replace one technical elective with 3 credits of EGR X (internship/co-op course).

### BEVERAGE SCIENCE

**CEM 482**, Science and Technology of Wine Production (p: CEM 351; must be 21 yrs; override required) F  
**CHE 483**, Brewing & Distilled Beverage Technology (p: CHE 311; must be 21 yrs; override required) F or S  
**FSC 481**, Fermented Beverages, (p: must be 21 yrs.; override required) F

### 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/Su  
**BE 444**, Biosensors for Medical Diagnostics (p: BS 161; CEM 151; ECE 345 or approval of dept.) S  
**BMB 462**, Advanced Biochemistry II (p: BMB 461 or BMB 401; BS 161; BS 162 or cc; CEM 352) F/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  
**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 421**, Prokaryotic Cell Physiology (p: MMG 301; BMB 461 or cc or BMB 401 or cc) F  
**MMG 425**, Microbial Ecology (Recc: MMG 301) S  
**MMG 431**, Microbial Genetics (p: BMB 461 or cc or BMB 401 or cc) F  
**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.**

### CHEMICAL ENGINEERING

**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.

**\*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.**

## **MECHANICAL ENGINEERING**

**CE 221**, Statics (p: PHY 183; MTH 234 or cc) F/S/Su

**ME 413**, Cryogenic-Thermal Systems (p: approval of department) S

**ME 414**, Mechanical Design of Cryogenic Systems (p: approval of department) 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

## **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**

**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

## **ENGINEERING ENTREPRENEURSHIP**

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

**EGR 440**, Engineering Entrepreneurship F

## **COMPUTER SCIENCE AND 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

## **ENERGY**

**BE 469**, Sustainable Bioenergy Systems (p: CHE 201; CHE 321) S

**CHE 468**, Biomass Conversion Engineering (p: CHE 321; CHE 431) F

**CSS 467**, BioEnergy Feedstock Production (p: MTH 103 or higher) F

**MSE 410**, Material Foundations for Energy Applications (p: MSE 310 or ME 201 or CHE 321) 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

**AFRE 829**, Economics of Environmental Resources (p: undergraduate intermediate microeconomics, calculus and statistics) 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

**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

## **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; 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) F or S  
**FSC 211**, Principles of Food Science F/Su  
**FSC 325**, Food Processing: Unit Operations (p: FSC 211 or ANS 201 or approval of dept.) S  
**FSC 342**, 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  
**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 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 455**, Food and Nutrition Laboratory (p: BMB 401 or cc or BMB 461 or cc; WRA) F  
**FSC 470**, Food Production Development, (p: FSC 401; FSC 310; FSC 440) S  
**FSC 481**, Fermented Beverages, (p: must be 21 yrs.; override required) F

## **MATERIALS ENGINEERING**

**CHE 472**, Composite Materials Processing (p: CHE 311) F  
**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 cc) S  
**MSE 370**, Synthesis and Processing of Materials (p: MSE 250; CHE 321) S  
**MSE 410**, Material Foundations for Energy Applications (p: MSE 310 or ME 201 or CHE 321) F  
**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 cc or approval of dept.) 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 cc or approval of dept.) F/S

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## **MATHEMATICS AND STATISTICS**

**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