

CONCENTRATIONS WITHIN THE BSEChE PROGRAM

August 2018

All concentrations consist of 12 credits, and must include at least one 300 or 400 level course. Only engineering and general electives can be used as part of a concentration. Up to three research credits in a related area can count toward a concentration with Dr. Montgomery's approval. Contact her for approval of any other courses. Courses taken for a concentration cannot be taken Pass/Fail. Concentrations are not available to students pursuing dual degrees or SUGS masters in the same area. Student must earn a C- or better in all courses counting towards a concentration, and must earn a 2.0 or above overall concentration GPA.

Conc. in BioPharmaceutical Engineering

12 credits total, including at least 1 course each from categories A, B, & C:

Category A: BioPharm Science and Engineering

ChE 517/ PharmSci 717 Biopharm engineering (3 cr.)
 ChE/Pharm 519 Modern pharmaceutical engr (3 cr.)
 PIBS 601 Principles of pharmacology (3 cr.)
 ChE 496 Solids handling (3 cr.)
 ChE 496/696 Introduction to Synthetic Biology (3 cr.)
 ChE 574 Engr principles in drug delivery and targeting (3 cr.)
 Biochem 415/515 Introductory biochemistry (3 cr.), or Chem 351 (4 cr.), MCDB 310 (3 cr.)
 BME 410 Design & applictns of biomaterials (3 cr.)
 Pharm Sci 608 Pharmacokinetic concepts & appl's (4 cr.)
 PIBS 621 Translational pharmacology (2 cr.)

Category B: Applied Statistics and Math

ChE 431 Engineering stats & problem solving (3 cr.)
 Stat 412 Intro to probability and statistics (3 cr.)
 Stat 470 Intro to design of experiments (4 cr. w/ Instructor permission)
 Stat 570 Design of experiments (3 cr.)
 Math 419 Linear spaces and matrix theory (3 cr.)
 IOE 460 Decision analysis (3 cr.)

Category C: Regulatory Science

BUSABRD 319 Global Immersion: Intell prop law (3 cr.)
 ChE/Pharm 597 Regulatory sci. for sci and engrs (2 cr.)
 BME/ChE 588 Globl qual syst & regulatory innovat (2 cr.)
 BL 319 Intellectual property law (3 cr.)

Other Relevant Courses

BME 500 BME Seminar (1 cr.)
 ChE 496/696 Chem Process Safety Risk Manag. (3 cr.)
 IOE 436 Human Factors (3 cr.)
 IOE 813 Provid. better hlthcre thru syst engr (2 cr.)
 Psych 449 Decision processes (3 cr.)

Conc. in Electrical Engr – Electronic Devices

NOTE: EECS students are given priority in enrollments.

Required Courses – 8 credits:

EECS 215 Introduction to electronic circuits (4 cr.) or
 EECS 314 Electrical circuits, systems, & appl'ns (4 cr.)
 EECS 320 Intro to semiconductor devices (4 cr.)

Technical Electives - 4 credits. Select from:

EECS 414 Introduction to MEMS (4 cr.)
 EECS 421 Properties of transistors (4 cr., req. EECS 320)
 EECS 423 Solid-state device laboratory (4 cr.)
 EECS 429 Semiconductor optoelectronic devices (4 cr.)

Concentration in Energy Systems Engineering

Technical Electives - 9 credits. Select from:

AERO 533/ Combustion processes
 ENSCEN 533 (3 cr., requires AEROSP 225)
 CEE 567/ Energy infrastructure systems (3 cr.)
 ESEng 567
 CHE 496 Hydrogen tech: prod'n & storage (3 cr.)
 CHE 496 Fuel processors & fuel cells (3 cr.)
 ChE 496/696 Chem Proc. Safety Risk Manag. (3 cr.)
 ME 432 Combustion (3 cr., req's ME 336, 320)
 ME 433/ Adv. energy solutions (3 cr., req. ME 235)
 AUTO 533
 ME 438 Internal combustion engines (4 cr.)
 ME 538 Advanced IC Engines (3 cr.)
 ME 539 Heat transfer physics (3 cr., req. ME BL 235 and ME 335)
 ME 571/ Energy generation & storage using
 ESENG 505 modern materials (3 cr.)
 NERS 250/ Fundamentals of nuclear energy &
 ENSCEN 211 Radiological sciences (4 cr.)

Policy/law course – 3 credits. Select from:

ESENG 501 Seminars on energy systems, tech, and policy (3 cr.)
 NRE 475 / Environ law (3 cr.)
 EHS 588/ Environ 475
 NRE/ BE 527 Energy markets and politics (3 cr.)

PubPol 250

PubPol 481

Soc. systems, energy, & pub policy (3cr.)

Science, tech, & pub policy (3 cr.)

Concentration in Environmental Engineering

Technical electives - 9 credits. Select from:

(sustainability-focused courses are underlined)

ChE 496/696 Chem Proc. Risk Safety Manag. (3 cr.)
CEE 265 Sustainable engineering principles (3 cr.)
 CEE 365 Enviro engr principles (4 cr.)
 CEE 366 Enviro engr lab (2 cr. reqs CEE 270 and 365)
 CEE 428 Groundwater hydrology (3 cr., requires CEE 265 and CEE 325 or equivalent)
 CEE 465 Enviro process engr (3 cr., requires CEE 325 and CEE 365)
 CEE 480 Design of enviro. engr systems (3 cr.)
 CEE 481 Aquatic chemistry (3 cr.)
 CEE 482 Enviro microbiology (3 cr., requires CEE 325 and 365)
 CEE 501-7 Wind energy development, engr, & construction
 CEE 501-14 Greenhouse gas control (3 cr.)
 CEE 526 Design of hydraulic systems (3 cr., requires CEE 325 or equivalent)
 CEE 563 Air quality engineering fundamentals (3 cr.)
CEE 586 Industrial ecology (3 - 4 cr., sr, std.)
 CEE 589/ Risk and benefit analysis in
 NRE 595 enviro engr (3 cr., sr. std.)
CEE 686 Case studies in environ sustainability (2-3 cr., sr std)
 CEE 686-001 Enviro finance (3 cr.)
 CLIMATE 350 Atmospheric thermodynamics (3 cr.)
 CLIMATE 410 Earth system modeling (4 cr.)
 CLIMATE 467/ Biogeochemical cycles (3 cr.)
 CHEM 467
 CLIMATE 475 Earth system interactions (4 cr., sr std)
 Earth 305 Earth's surface and sediment (4 cr.)
 Earth 313 Geobiology (4 cr.)
 Earth 325 Environ geochemistry (3 cr.)
 Earth 477 Hydrogeology (4 cr.)

Earth 478 Geochemistry of natural waters
 ME 589 Sustainable design of technology systems
 (3 cr., sr, std.)
 SPACE 370 Solar terrestrial relations (4 cr.)

Policy/law/economics course - 3 credits. Select from:

BE 562 Growth & Stabilization in the Macro Econ
 (2.25 cr.)
 CEE 587 Water resource policy (3 cr., sr, std.)
 CEE 589 Risk & benefit analysis in environ-
 mental engineering (3 cr. sr. std.)
 Earth 380 Mineral resources, economics, & the envi-
 ronment (4 cr.)
 Econ 370/
 Environ 375 Environ & resource econ (3 cr.)
 Environ 235 Natural Resources & Environ Econ (3 cr.)
 Environ 312/
 Polsci 380 Envirol politics and policy (3 cr.)
 Environ 365 International environmental law (3 cr.)
 Environ 412/
 PubPol 412 Environ values in public policy (3 cr.)
 NRE 475/
 EHS 588/
 Environ 475 Environmental law (3 cr.)
 NRE/BE 527 Energy markets and energy politics (3cr)
 PubPol 481 Science, tech, and public policy (3 cr.)

Concentration in the Life Sciences

Required Course:

MCDB 310 Intro biochem (3 cr.), (or Chem 351
 (4 cr.) or Biolchem 415/515 (3 cr.)

Technical Electives - 8 or 9 credits, for 12 credits total:

Biology 205 Developmental biology (3 cr.)
 Biology 207 Intro microbiology (4 cr.)
 Biology 208 Embryology (3 cr.)
 Biology 222 Introduction to neurobiology (3 cr.)
 Biology 225 Principles of animal physiology (3 cr.)
 Biology 305 Genetics (3 cr.)
 BME 418 Quantitative cell biology (3 cr.)
 BME 419 Quantitative physiology (4 cr.)
 BME 476 Biofluid mechanics (4 cr.)
 BME 479/
 Biotransport (4 cr.)
 CDB 580 Developmental biology (3 cr.)
 CEE 482 Environmental microbiology (3 cr.,
 requires CEE 325 and 365)
 ChE 517 Biopharm engineering (3 cr.)
 ChE 519 Pharmaceutical eng.. (3 cr., sr. std.)
 ChE 574 Engineering principles in drug delivery &
 targeting (3 cr.)
 ChE 584 Tissue Engineering (3 cr.)
 ChE 696 Tech innovation, law, & regulation (3 cr.)
 MCDB 411 Protein structure function (3 cr.)
 MCDB 436 Introductory immunology (3 cr.)
 MedAdm 403 The human anatomy (5 cr.)

Micrbiol 301 Intro. microbiology (3 cr.)
 Micrbiol 405 Medical microbiology & infectious
 diseases (3 cr.)
 Micrbiol 440 Human Immunology (3 cr.)
 Micrbiol 460 Eukaryotic Microbiology (3 cr.)
 Physiol 201 Intro to human physiology (4 cr.)
 Physiol 502 Human physiology (4 cr.)
 Stats 449 Topics in biostatistics (3 cr.)

Conc. in Materials Science and Engineering

Technical Electives - 12 credits. Select from:

MSE 242 Physics of materials (4 cr.)
 MSE 335 Kinetics & transport in MSE (4 cr.)
 MSE 350 Structures of materials (4 cr.)
 MSE 400 Electronic, Magnetic and Optical Materials
 for Modern Device Technology (3 cr.)
 MSE 410 Design & apps of biomaterials (3 cr.)
 MSE 412 Polymeric materials (3 cr.)
 MSE 420 Mechanical behavior of materials (3 cr.
 requires ME 211)
 MSE 440 Ceramic materials (3 cr.)
 MSE 465 Structural & chemical characterization of
 materials (3 cr., requires MSE 242, 360)
 MSE 470 Physical metallurgy (3 cr.)
 MSE 511/
 Rheology of Polymeric Materials (3 cr.)
 ChE 511/
 MacroSE 511
 MSE 514 Composite materials (3 cr.)
 MSE 558/9 Foundations of nanotechnology (3 cr.)

Concentration in Mechanical Engineering

Required Courses:

ME 211 Intro. to solid mechanics (4 cr.)
 ME 240 Intro. to dynamics and vibrations (4 cr.)

Technical Electives - 4 credits. Select from:

ME 311 Strength of materials (3 cr.)
 ME 350 Design and manufacturing II (4 cr. requires
 ME 211, 240 and 250)
 ME 382 Mechanical Behavior of Materials (4 cr. -
 requires ME 211)
 ME 400 Mechanical engr analysis (3 cr.)
 ME 401 Statistical quality control & design (3 cr.)
 ME 420 Fluid mechanics II (3 cr., requires ME 320)
 ME 432 Combustion (3 cr., reqs ME 336 & 320)
 ME 440 Intermediate dynamics & vibrations (4 cr.)
 ME 476 Biofluid Mechanics (4 cr. requires ME 320)

Concentration in Nuclear Engineering

Required Courses:

NERS 250 Fundamentals of NERS (4 cr.)
 NERS 311 Elements of NERS I (3 cr.)
 NERS 312 Elements of NERS II (3 cr.)

At least 2 additional credits, which require the above 3 courses. Choose from:

NERS 421 Nuclear engineering materials (3 cr.)
 NERS 425 Applications of radiation (4 cr.)
 NERS 441 Nuclear reactor theory I (4 cr. reqs NERS
 312 and Math 454)
 NERS 471 Introduction to plasmas (3 cr.)
 NERS 481 Engr principles of radiation imaging (2 cr.)
 NERS 484 Radiological health engr fund (4 cr.)

Conc. in Petroleum and Gas Exploration

To include 4 lecture courses, composed of at least 3 credits of 300 level or higher EARTH courses and 3 credits of 300 level or higher CEE courses. Only one of Earth 116 or Earth 119 can count toward the concentration

Earth 116/
 Introductory geology (5 cr.)
 Earth 118 Introductory geology laboratory (1 cr.)
 Earth 119 Introductory geology lecture (4 cr.)
 Earth 284 Environmental geology (4 cr.)
 Earth 305 Earth's surface & sediments (4 cr., requires
 intro geology course)
 Earth 310 Geochemistry of the solid earth (4 cr.
 requires intro geology course)
 Earth 314 Global & applied geophysics (4 cr.)
 Earth 351 Earth structure (4 cr.)
 Earth 380 Mineral resources, econ, & the
 environment (4 cr.)
 Earth 422 Principles of geochemistry (3 cr., requires
 intro geology course)
 Earth 467 Stratigraphy & basis analysis (4 cr.
 requires introductory geology course)
 Earth 477 Hydrogeology (4 cr.)
 CEE 345 Geotechnical engineering (4 cr.)
 CEE 428/
 Groundwater hydrology (3 cr.)
 Ensccn 428
 CEE 446 Engr geology & site characterization
 (3 cr., requires CEE 345)
 CEE 522 Sediment transport (3 cr.)
 CEE 527 Coastal hydraulics (3 cr.)
 CEE 528/
 Flow and transport in porous media (3 cr.,
 Ensccn 528 requires CEE 428 or equivalent)
 CEE 535 Excavation and tunneling (3 cr.)

Check web for updates at:

www.engin.umich.edu/che/undergraduate/program