CONCENTRATIONS WITHIN THE BSEChE PROGRAM
February 2017

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
At least one course from each category:

Category A: BioPharm Science and Engineering
- ChE 517 Biochemical engineering (3 cr.)
- ChE/Pharm 519 Modern pharmaceutical eng (3 cr.)
- PIBS 601 Principles of pharmacology (3 cr.)
- ChE 496 Solids handling (3 cr.)
- ChE 496/696 Industrial & therapeutic biomolecular engineering (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 & appilcns of biomaterials (3 cr.)
- Pharm Sci 608 Pharmacokinetic concepts & apps (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 436 Human factors (3 cr.)
- IOE 460 Decision analysis (3 cr.)

Category C: Regulatory Science
- ChE/Pharm 597 Regulatory sci. for sci. and engrs (2 cr.)
- BME/ChE 588 Global quality systems and regulatory innovation (2 cr.)
- ChE/BME 587 Tech innovation, law & regulation (2 cr.)
- Psych 449 Decision processes (3 cr.)
- LHC 319 Intellectual property law (2.25 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 216 (3 cr.)
- EECS 314 Electrical circuits, systems, & applns (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 220)
- EECS 423 Solid-state device laboratory (4 cr.)
- EECS 429 Semicon ductor optoelectronic devices (4 cr.)

Concentration in Energy Systems Engineering

Technical Electives - 9 credits. Select from:

- AERO 533/ 534 Combustion processes
- ENSCEN 533/ 534 (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 and fuel cells (3 cr.)
- ME 342 Combustion (3 cr., req’s ME 336, 320)
- ME 433/ Advanced energy solutions (3 cr.,
- AUTO 533 requires ME 235)
- ME 438 Internal combustion engines (4 cr.)
- ME 538 Advanced IC Engines (3 cr.)
- ME 539 Heat transfer physics (3 cr., requires ME 235 and 335)
- ME 571/ Energy generation and storage using
- ESENG 505 modern materials (3 cr.)
- NERS 250/ Fundamentals of nuclear energy and
- ENSCEN 211 Radiological sciences (4 cr.)

Policy/law course – 3 credits. Select from:
- ESENG 501 Seminars on energy systems, technology, and policy (3 cr.)
- NRE 475/ Environmental law (3 cr.)
- EHS 588/ Environmental law 475
- NRE/BE 527 Energy markets and politics (3 cr.)
- PubPol 250 Social systems, energy, and public policy (3 cr.)
- PubPol 481 Science, tech, and public policy (3 cr.)

Concentration in Environmental Engineering

Technical electives - 9 credits. Select from:
(sustainability-focused courses are underlined)

- AOS 350 Atmospheric thermodynamics (4 cr.)
- AOS 370 Solar terrestrial relations (4 cr.)
- AOS 410 Earth system modeling (4 cr.)
- CLIMATE 467/ Biogeochemical cycles (3 cr.)
- CLIMATE 475 Earth system interactions (4 cr., sr std)
- CEE 265 Sustainable engineering principles (3 cr.)
- CEE 365 Environmental engr principles (4 cr.)
- CEE 366 Environmental 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 Environmental process engr (3 cr., requires CEE 325 and CEE 365)
- CEE 480 Design of environ. engr systems (3 cr.)
- CEE 481 Aquatic chemistry (3 cr.)
- CEE 482 Environmental microbiology
- CEE 501-7 Wind energy development, engr, and construction
- CEE 501-14 Greenhouse gas control (3 cr.)
- CEE 526 Design of hydraulic systems
- CEE 563 Air quality engineering fundamentals (3 cr.)
- CEE 586 Industrial ecology (-3 cr., sr std.)
- CEE 589/ Risk and benefit analysis in
- NRE 595 environmental engr (3 cr., sr std.)
- CEE 686 Case studies in environmental
sustainability (2-3 cr., sr std.)
Concentration in the Life Sciences

Required Course:

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

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

- Biology 205 Developmental biology (3 cr.)
- Biology 207 Introductory 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/ CDB 580 Biotransport / Developmental biology (3 cr.)
- CEE 482 Environmental microbiology (3 cr., requires CEE 325 and 365)
- ChE 517 Biochemical 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 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.)

Concentration in Materials Science and Engineering

Required Course:

- MSE 350 Structures of materials (4 cr.)

Technical Electives - 8 credits. Select from:

- MSE 242 Physics of materials (4 cr.)
- MSE 335 Kinetics & transport in MSE (4 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 and chemical characterization of materials (3 cr., requires MSE 242, 360)
- MSE 470 Physical metallurgy (3 cr.)
- 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 400 Mechanical engineering 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 and 320)
- ME 440 Intermediate dynamics & vibrations (4 cr.)

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.)

Concentration 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 Geochimistry 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, and the environment (4 cr.)
- Earth 422 Principles of geochemistry (3 cr., requires intro geology course)
- Earth 467 Stratigraphy and basin analysis (4 cr. requires introductory geology course)
- Earth 477 Hydrogeology (4 cr.)
- CEE 345 Geotechnical engineering (4 cr.)
- CEE 428/ Groundwater hydrology (3 cr.)
- Enscen 428
- CEE 446 Engineering 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., Enscen 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