

**College of Engineering Minor in Interdisciplinary Engineering and Science (IES)  
For Students Entering Under Undergraduate Catalog 2022-23**

To obtain a minor in Interdisciplinary Engineering and Science (Scieneering), a student must complete at least 18 credit hours on an A/F basis, as indicated below. A student must receive a grade of C or better for each course on this checksheet. A minimum minor GPA of 2.0 in all courses taken to fulfill the minor is required.

1. Required common courses (6 credits):

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|---|---|----------|
| { | ENGR/COS 2164/Introduction to Scieneering   | (1)_____ |
| { | ENGR 2464/Engineering Fundamentals for Scientists (for Life Science <sup>i</sup> majors)<br>-or-<br>BIOL 2124/Cell and Molecular Biology for Engineers (for Physical Science <sup>ii</sup> or Engineering majors) | (2)_____ |
| { | ENGR/COS 4064                  Scieneering Capstone   | (3)_____ |

2. Complete 9 credit hours of approved in-discipline elective courses based on a student's major:

**A. LIFE SCIENCES<sup>i</sup> MAJORS (all courses are 3 credit hours unless otherwise noted):**

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|---|--|
| ALS 3104, Animal Breeding and Genetics (2)<br>ALS 3304, Physiology of Reproduction<br>ALS/BIOL 4554, Neurochemical Regulation<br>ALS/NR 4614, Watershed Assessment, Management, and Policy (2)  | BIOL 4874, Cancer Biology<br>BIOL 4884, Cell Biology   |
| BCHM 3114iii, Biochemistry for Biotechnology and the Life Sciences<br>BCHM 4115, General Biochemistry (4)<br>BCHM 4116, General Biochemistry<br>BCHM/BIOL 4784, Applications in Molecular Life Science  | CSES/ENSC 3634, Physics of Pollution<br>CSES/ ENSC/BIOL 4164, Environmental Microbiology<br>CSES/ENSC 4444, Managed Ecosystems, Ecosystem Services, and Sustainability<br>CSES 4644, Land-Based Systems for Waste Treatment<br>CSES/CHEM/ENSC 4734, Environmental Soil Chemistry<br>CSES/ENSC 4774, Reclamation of Drastically Disturbed Lands<br>CSES/ENSC 4854, Wetland Soils and Mitigation   |
| BIOL 3124, Cell Physiology<br>BIOL 3404, Introductory Animal Physiology<br>BIOL 3774, Molecular Biology<br>BIOL 4014, Environmental Toxicology (2)<br>BIOL 4104, Developmental Biology<br>BIOL 4114, Global Change Ecology<br>BIOL 4564, Infectious Disease Ecology<br>BIOL 4624, Microbial Genetics<br>BIOL 4664, Virology<br>BIOL 4674, Pathogenic Bacteriology<br>BIOL 4704, Immunology<br>BIOL 4734, Inflammation Biology<br>BIOL 4824, Bioinformatics Methods<br>BIOL 4844, Proteomics and Biological Mass Spectrometry<br>BIOL 4854, Cytogenetics | NANO 1015-1016, Introduction to Nanoscience<br>FST 4504, Food Chemistry<br>FST 4634, Epidemiology Foodborne Disease<br>HNFE 3025, Metabolic Nutrition<br>HNFE 3026, Metabolic Nutrition<br>HNFE 3804, Exercise Physiology<br>HNFE 4844, Exercise and Neuromuscular Performance<br>PPWS 4114, Microbe Forensics/Biosecurity<br>PSYC 3024 Human Behaviors and Natural Environments<br>PSYC 4074, Sensation and Perception<br>PSYC 4114, Cognitive Psychology |
| BIOL 4824, Bioinformatics Methods<br>BIOL 4844, Proteomics and Biological Mass Spectrometry<br>BIOL 4854, Cytogenetics  | SYSB 3035, Systems Biology of Genes and Proteins (4)<br>SYSB 3115; Network Dynamics and Cell Physiology (4)<br>SYSB 3116; Network Dynamics and Cell Physiology (4)   |

**B. ENGINEERING/PHYSICAL SCIENCES<sup>ii</sup> MAJORS (all courses are 3 credit hours unless otherwise noted):**

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|---|--|
| BSE 3154, Thermodynamics of Biological Systems                                  | GEOS 3404, Elements of Structural Geology                            |
| BSE 3504, Transport Processes in Biological Systems                             | GEOS 3504/MSE 3104, Mineralogy (with lab)                            |
| BSE 3524, Unit Operations in Biological Systems Engineering                     | GEOS 3604, Paleontology (with lab)                                   |
| BSE 4524, Biological Process Plant Design                                       | GEOS 3614/CSSES 3114/ENSC 3114, Soils (with lab)                     |
| BSE 4544/CHE 4544, Protein Separation Engineering                               | GEOS/GEOG 4084, Modeling with Geographic Information Systems         |
| BSE 4604, Food Process Engineering  | GEOS 4634, Environmental Geochemistry                                |
| CEE 3104, Introduction to Environmental Engineering                             | GEOS 4804, Groundwater Hydrology                                     |
| CEE 3684, Civil Engineering Materials   | ISE 3614, Introduction to Human Factors Engineering                  |
| CEE 4104, Water and Wastewater Treatment Design                                 | ISE 3624, Industrial Ergonomics                                      |
| CEE 4114, Fundamentals of Public Health Engineering                             | ISE 4015, Management Systems Theory, Applications, and Design        |
| CEE 4174, Solid and Hazardous Waste Management                                  | ISE 4304, Global Issues  |
| CEE 4614, Advanced Civil Engineering Materials                                  | ISE 4624, Work Physiology  |
| CHE 3134, Separation Processes  | ISE 4644, Occupational Safety and Hazard Control                     |
| CHE 3144, Mass Transfer   | MATH 4564, Operational Methods for Engineers                         |
| CHE 4014, Chemical Engineering Laboratory (5)                                   | MINE 3534, Mineral Processing (2)                                    |
| CHE 4104, Process Materials   | MINE 3554, Resource Recovery (2)                                     |
| CHE 4134, Chemical Process Modeling (2)   | MINE 4544, Mine Reclamation and Environmental Management             |
| CHE 4185, Process and Plant Design (4)  | MSE 2044, Fundamentals of Materials Engineering (4)                  |
| CHE 4186, Process and Plant Design (4)  | MSE 2054, Fundamentals of Materials Science                          |
| CHE 4214, Introduction to Polymer Materials                                     | MSE 3104/GEOS 3504, Mineralogy                                       |
| CHE 4334, Introduction to Colloidal and Interfacial Science                     | MSE 3134, Crystallography and Crystal Structures                     |
| CHE/BSE 4544, Protein Separation Engineering                                    | MSE 3204, Fundamentals of Electronic Materials                       |
| CHEM 4514, Green Chemistry  | MSE 3304, Physical Metallurgy  |
| CHEM 4534, Organic Chemistry of Polymers  | MSE 4164, Principles of Materials Corrosion                          |
| CHEM 4554, Drug Chemistry   | MSE 4304, Metals and Alloys  |
| CSSES 4644, Land-Based Systems for Waste Treatment                              | MSE 4414, Physical Ceramics  |
| ECE 2164/AOE 2664, Exploration of the Space Environment                         | MSE 4574, Biomaterials   |
| ECE 4154, Introduction to Space Weather   | MSE 4584, Biomimetic Materials                                       |
| ECE 4164, Introduction to Global Positioning System (GPS) Theory and Design (4) | NANO 1015-1016, Introduction to Nanoscience                          |
| ECE 4364, Alternate Energy Systems  | NANO 3015 Nanoscale Synthesis, Fabrication, and Characterization (4) |
| ECON 4014, Environmental Economics  | NANO 3016 Nanoscale Synthesis, Fabrication, and Characterization (4) |
| ENGR 3124, Introduction to Green Engineering                                    | NANO 4124 Advanced Nanomaterials and Devices                         |
| ENGR 4134, Environmental Life Cycle Assessment                                  | NEUR 3044, Cellular and Molecular Neuroscience                       |
| ENSC 3604, Fundamentals of Environmental Science                                | NEUR 3084, Cognitive Neuroscience                                    |
| ENSC/CSSES 3634, Physics of Pollution   | NEUR 3144 Mechanisms of Learning and Memory                          |
| ENSC/CSSES 3644, Plant Materials for Environmental Restoration                  | NEUR 3554, Neuroscience Research and Practical Experience            |
| ENSC/CSSES/CEE/BIOL 4164, Environmental Microbiology                            | NEUR 3914, Neuroscience of Drug Addiction                            |
| ENSC/CSSES 4444, Managed Ecosystems, Ecosystem Services, and Sustainability     | NEUR 4034, Diseases of the Nervous System                            |
| ENSC/CHEM/CSSES 4734, Environmental Soil Chemistry                              | NEUR 4084, Developmental Cognitive Neuroscience                      |
| ENSC/CSSES 4774, Reclamation of Drastically Disturbed Lands                     | NEUR/ECON/PSYC 4454, Neuroeconomics                                  |
| ENSC/CSSES 4854, Wetland Soils and Mitigation                                   | NEUR 4544, Synaptic Structure and Function                           |
| ESM 4105, Engineering Analysis of Physiologic Systems                           | NEUR 4814, Nutritional Neuroscience                                  |
| ESM 4106, Engineering Analysis of Physiologic Systems                           | PHYS 4574, Nanotechnology  |
| ESM 4204 <sup>iii</sup> , Musculoskeletal Biomechanics                          | PHYS 4714, Introduction to Biophysics                                |
| ESM 4224, Biodynamics and Control   | SBIO 3004 Sustainable Nature-based Enterprise                        |
| ESM 4234, Mechanics of Biological Materials and Structures                      | SBIO 3444 Sustainable Biomaterials and Bioenergy                     |
| ESM 4304, Hemodynamics  | SBIO 3454 Society, Sustainable Biomaterials and Energy               |
| GEOS 3014, Environmental Geosciences  | SBIO 3554 Sustainable Biomaterials Enterprises                       |
| GEOS 3034, Oceanography   |  |
| GEOS 3104, Elementary Geophysics  |  |

3. Complete 3 credit hours of approved out-of-discipline elective courses based on a student's major: pre-requisites and non-major enrollment restrictions apply and may limit courses for non-majors.

**A. LIFE SCIENCES<sup>i</sup> MAJORS (all courses are 3 credit hours unless otherwise noted):**

BIOL 4824, Bioinformatics Methods  
 BSE 3154, Thermodynamics of Biological Systems  
 CS 1044, Introduction to Programming in C  
 CS 1054, Introduction to Programming in Java  
 CS 1124, Introduction to Media Computation  
 ECE 2164/AOE 2664, Exploration of the Space Environment  
 ENGE 1354, Introduction to Spatial Visualization (1)  
 ENGE 2514, Introduction to Engineering Computation and Control with LABVIEW (2)  
 ENGR 1814, Energy, Resource Development and the Environment

ISE 2404, Deterministic Operations Research  
 MATH 1114<sup>iv</sup>, Elementary Linear Algebra (2)  
 MATH 2214<sup>v</sup>, Introduction to Differential Equations  
 MATH 2224, Multivariable Calculus  
 MATH 3214, Calculus of Several Variables  
 MSE 2034<sup>v</sup>, Elements of Material Engineering  
 STAT 3615, Biological Statistics  
 STAT 3616, Biological Statistics  
 STAT 4204, Experimental Designs  
 STAT 4214, Methods of Regression Analysis

**B. ENGINEERING/PHYSICAL SCIENCES<sup>ii</sup> MAJORS (all courses are 3 credit hours unless otherwise noted):**

ALS 2304, Comparative Animal Physiology and Anatomy (4)  
 ALS/BIOL 2404, Biotechnology in a Global Society  
 BCHM 2024, Concepts of Biochemistry  
 BCHM 3114, Biochemistry for Biotechnology and the Life Sciences  
 BIOL 2004, Genetics  
 BIOL/HORT 2304, Plant Biology  
 BIOL 2504, General Zoology  
 BIOL 2604, General Microbiology  
 BIOL 2804, Ecology  
 NANO 1015-1016, Introduction to Nanoscience  
 CSES 4644, Land-Based Systems for Waste Treatment  
 ECON 4014, Environmental Economics

ENSC 3604, Fundamentals of Environmental Science  
 GEOS 3014, Environmental Geosciences  
 GEOS 3034, Oceanography  
 GEOS 3104, Elementary Geophysics  
 GEOS 3404, Elements of Structural Geology  
 GEOS 3614/ CSES/ ENSC 3114, Soils (with lab)  
 GEOS/GEOG 4084, Modeling with Geographic Information Systems  
 GEOS 4634, Environmental Geochemistry  
 GEOS 4804, Groundwater Hydrology  
 HNFE 3804, Exercise Physiology  
 PHYS 4574, Nanotechnology  
 PHYS 4714, Introduction to Biophysics  
 PPWS 2104, Plants, Genes, and People

4. Students completing the minor must obey all pre-requisite rules. Some courses above may have additional pre-requisites not required for minor.
5. Students may "double count" up to 9 credit hours in the minor with those required for graduation in their major, provided the major has no restrictions to the contrary. Out-of-discipline elective courses chosen for the minor cannot be required courses in the student's major course of study.

<sup>i</sup> Life Science majors include all CALS and CNRE majors not listed in (ii), as well as the COS majors of Biochemistry, Biological Sciences, Psychology, and Systems Biology.

<sup>ii</sup> Physical Sciences include Chemistry, Economics, Environmental Sciences, Geosciences, Mathematics, Nanoscience, Neuroscience, Physics, and Statistics and Sustainable Biomaterials.

<sup>iii</sup> Course restricted to ESM majors/minors.

<sup>iv</sup> Will not count towards the IES minor for students majoring in Chemistry, Geological Sciences, Mathematics, Physics or Statistics.