

**College of Engineering Minor in Interdisciplinary Engineering and Science (IES)
For Students Entering under Undergraduate Catalog 2023_2024**

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 ⁱ majors) | (2)_____ |
| | -or-
BIOL 2124/Cell and Molecular Biology for Engineers (for Physical Science ⁱⁱ or Engineering majors) | |
| { | 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 SCIENCESⁱ MAJORS (all courses are 3 credit hours unless otherwise noted):

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

B. ENGINEERING/PHYSICAL SCIENCESⁱⁱ MAJORS (all courses are 3 credit hours unless otherwise noted):

BSE 3154, Thermodynamics of Biological Systems
 BSE 3504, Transport Processes in Biological Systems
 BSE 3524, Unit Operations in Biological Systems Engineering
 BSE 4524, Biological Process Plant Design
 BSE 4544/CHE 4544, Protein Separation Engineering
 BSE 4604, Food Process Engineering

CEE 3104, Introduction to Environmental Engineering
 CEE 3684, Civil Engineering Materials
 CEE 4104, Water and Wastewater Treatment Design
 CEE 4114, Fundamentals of Public Health Engineering
 CEE 4174, Solid and Hazardous Waste Management
 CEE 4614, Advanced Civil Engineering Materials

CHE 3134, Separation Processes
 CHE 3144, Mass Transfer
 CHE 4014, Chemical Engineering Laboratory (5)
 CHE 4104, Process Materials
 CHE 4134, Chemical Process Modeling (2)
 CHE 4185, Process and Plant Design (4)
 CHE 4186, Process and Plant Design (4)
 CHE 4214, Introduction to Polymer Materials
 CHE 4334, Introduction to Colloidal and Interfacial Science
 CHE/BSE 4544, Protein Separation Engineering

CHEM 4514, Green Chemistry
 CHEM 4534, Organic Chemistry of Polymers
 CHEM 4554, Drug Chemistry
 CSES 4644, Land-Based Systems for Waste Treatment

ECE 2164/AOE 2664, Exploration of the Space Environment
 ECE 4154, Introduction to Space Weather
 ECE 4164, Introduction to Global Positioning System (GPS)
 Theory and Design (4)
 ECE 4364, Alternate Energy Systems

ECON 4014, Environmental Economics

ENGR 3124, Introduction to Green Engineering
 ENGR 4134, Environmental Life Cycle Assessment

ENSC 3604, Fundamentals of Environmental Science
 ENSC/CSES 3634, Physics of Pollution
 ENSC/CSES 3644, Plant Materials for Environmental
 Restoration

ENSC/CSES/CEE/BIOL 4164, Environmental Microbiology
 ENSC/CSES 4444, Managed Ecosystems, Ecosystem Services,
 and Sustainability

ENSC/CHEM/CSES 4734, Environmental Soil Chemistry
 ENSC/CSES 4774, Reclamation of Drastically Disturbed Lands
 ENSC/CSES 4854, Wetland Soils and Mitigation

ESM 4105, Engineering Analysis of Physiologic Systems
 ESM 4106, Engineering Analysis of Physiologic Systems
 ESM 4204ⁱⁱⁱ, Musculoskeletal Biomechanics
 ESM 4224, Biodynamics and Control
 ESM 4234, Mechanics of Biological Materials and Structures
 ESM 4304, Hemodynamics

GEOS 3014, Environmental Geosciences
 GEOS 3034, Oceanography
 GEOS 3104, Elementary Geophysics

GEOS 3404, Elements of Structural Geology
 GEOS 3504/MSE 3104, Mineralogy (with lab)
 GEOS 3604, Paleontology (with lab)
 GEOS 3614/CSES 3114/ENSC 3114, Soils (with lab)
 GEOS/GEOG 4084, Modeling with Geographic Information Systems
 GEOS 4634, Environmental Geochemistry
 GEOS 4804, Groundwater Hydrology

ISE 3614, Introduction to Human Factors Engineering
 ISE 3624, Industrial Ergonomics
 ISE 4015, Management Systems Theory, Applications, and Design
 ISE 4304, Global Issues
 ISE 4624, Work Physiology
 ISE 4644, Occupational Safety and Hazard Control

MATH 4564, Operational Methods for Engineers

MINE 3534, Mineral Processing (2)
 MINE 3554, Resource Recovery (2)
 MINE 4544, Mine Reclamation and Environmental Management

MSE 2044, Fundamentals of Materials Engineering (4)
 MSE 2054, Fundamentals of Materials Science
 MSE 3104/GEOS 3504, Mineralogy
 MSE 3134, Crystallography and Crystal Structures
 MSE 3204, Fundamentals of Electronic Materials
 MSE 3304, Physical Metallurgy
 MSE 4164, Principles of Materials Corrosion
 MSE 4304, Metals and Alloys
 MSE 4414, Physical Ceramics
 MSE 4574, Biomaterials
 MSE 4584, Biomimetic Materials

NANO 1015-1016, Introduction to Nanoscience
 NANO 3015 Nanoscale Synthesis, Fabrication, and Characterization (4)
 NANO 3016 Nanoscale Synthesis, Fabrication, and Characterization (4)
 NANO 4124 Advanced Nanomaterials and Devices

NEUR 3044, Cellular and Molecular Neuroscience
 NEUR 3084, Cognitive Neuroscience
 NEUR 3144 Mechanisms of Learning and Memory
 NEUR 3554, Neuroscience Research and Practical Experience
 NEUR 3914, Neuroscience of Drug Addiction
 NEUR 4034, Diseases of the Nervous System
 NEUR 4084, Developmental Cognitive Neuroscience
 NEUR/ECON/PSYC 4454, Neuroeconomics
 NEUR 4544, Synaptic Structure and Function
 NEUR 4814, Nutritional Neuroscience

PHYS 4574, Nanotechnology
 PHYS 4714, Introduction to Biophysics

SBIO 3004 Sustainable Nature-based Enterprise
 SBIO 3444 Sustainable Biomaterials and Bioenergy
 SBIO 3454 Society, Sustainable Biomaterials and Energy
 SBIO 3554 Sustainable Biomaterials Enterprises

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 SCIENCESⁱ 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^{iv}, Elementary Linear Algebra (2)

MATH 2214^v, Introduction to Differential Equations

MATH 2224, Multivariable Calculus

MATH 3214, Calculus of Several Variables

MSE 2034^w, 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 SCIENCESⁱⁱ 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.

ⁱ 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.

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

ⁱⁱⁱ Course restricted to ESM majors/minors.

^{iv} Will not count towards the IES minor for students majoring in Chemistry, Geological Sciences, Mathematics, Physics or Statistics.