

**College of Engineering Minor in Interdisciplinary Engineering and Science (IES)
For Students Entering Under Undergraduate Catalog 2021-2022**

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

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