

**College of Engineering Minor in Interdisciplinary Engineering and Science (IES)
For Students Graduating in Calendar Year 2020**

To obtain a minor in Interdisciplinary Engineering and Science (Sciengineering), 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. Complete the following courses:

ENGR/COS 2164	Introduction to Sciengineering	(1) _____
ENGR/COS 4064	Sciengineering Capstone	(3) _____

Students in a Life Scienceⁱ major must complete

ENGR 2464	Engineering Fundamentals for Scientists	(2) _____
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Students in a Physical Scienceⁱⁱ or Engineering major must complete

BIOL 2124	Cell and Molecular Biology for Engineers	(2) _____
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2. Complete 9 credit hours of approved in-discipline elective courses based on a student's major:

A. FOR STUDENTS MAJORING IN A LIFE SCIENCESⁱ DISCIPLINE (all courses are 3 credit hours unless otherwise noted):

ALS/BIOL 4554, Neurochemical Regulation

ALS/NR 4614, Watershed Assessment, Management, and Policy (2)

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

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

BIOL 4874, Cancer Biology

BIOL 4884, Cell Biology

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

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

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. FOR STUDENTS MAJORING IN AN ENGINEERING/PHYSICAL SCIENCESⁱⁱ MAJOR (all courses are 3 credit hours unless otherwise noted):

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

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. FOR STUDENTS MAJORING IN A LIFE SCIENCESⁱ DISCIPLINE (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. FOR STUDENTS MAJORING IN AN ENGINEERING/PHYSICAL SCIENCESⁱⁱ MAJOR (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 (i), 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.

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.