College of Engineering Minor in Interdisciplinary Engineering and Science (IES)
For Students Graduating in Calendar Year 2021

To obtain a minor in Interdisciplinary Engineering and Science (Scienceering), 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 Scienceering
   Engr/COS 4064  Scienceering Capstone

   Students in a Life Science major must complete
   ENGR 2464  Engineering Fundamentals for Scientists

   Students in a Physical Science or Engineering major must complete
   BIOL 2124  Cell and Molecular Biology for Engineers

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

   A. FOR STUDENTS MAJORING IN A LIFE SCIENCES 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/CHM/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 SCIENCES MAJOR (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 3584, 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
ENG 3124, Introduction to Green Engineering
ENG 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/BIOL 4264, 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
ENSM 4105, Engineering Analysis of Physiologic Systems
ENSM 4106, Engineering Analysis of Physiologic Systems
ENSM 4204, Musculoskeletal Biomechanics
ENSM 4224, Biodynamics and Control
ENSM 4234, Mechanics of Biological Materials and Structures
ENSM 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/ECN/PSY 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: prerequisites and non-major enrollment restrictions apply and may limit courses for non-majors.

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>BIOL 4824</td>
<td>Bioinformatics Methods</td>
</tr>
<tr>
<td>BSE 3154</td>
<td>Thermodynamics of Biological Systems</td>
</tr>
<tr>
<td>CS 1044</td>
<td>Introduction to Programming in C</td>
</tr>
<tr>
<td>CS 1054</td>
<td>Introduction to Programming in Java</td>
</tr>
<tr>
<td>CS 1124</td>
<td>Introduction to Media Computation</td>
</tr>
<tr>
<td>ECE 2164/AOE 2664</td>
<td>Exploration of the Space Environment</td>
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<tr>
<td>ENGE 1354</td>
<td>Introduction to Spatial Visualization (1)</td>
</tr>
<tr>
<td>ENGE 2514</td>
<td>Introduction to Engineering Computation and Control with LABVIEW (2)</td>
</tr>
<tr>
<td>ENGR 1814</td>
<td>Energy, Resource Development and the Environment</td>
</tr>
<tr>
<td>ISE 2404</td>
<td>Deterministic Operations Research</td>
</tr>
<tr>
<td>MATH 1114*</td>
<td>Elementary Linear Algebra (2)</td>
</tr>
<tr>
<td>MATH 2214*</td>
<td>Introduction to Differential Equations</td>
</tr>
<tr>
<td>MATH 2224</td>
<td>Multivariable Calculus</td>
</tr>
<tr>
<td>MATH 3214</td>
<td>Calculus of Several Variables</td>
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<tr>
<td>MSE 2034*</td>
<td>Elements of Material Engineering</td>
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<tr>
<td>STAT 3615</td>
<td>Biological Statistics</td>
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<tr>
<td>STAT 3616</td>
<td>Biological Statistics</td>
</tr>
<tr>
<td>STAT 4204</td>
<td>Experimental Designs</td>
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<tr>
<td>STAT 4214</td>
<td>Methods of Regression Analysis</td>
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B. FOR STUDENTS MAJORING IN AN ENGINEERING/PHYSICAL SCIENCES' MAJOR (all courses are 3 credit hours unless otherwise noted):

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<tr>
<td>ALS 2304</td>
<td>Comparative Animal Physiology and Anatomy (4)</td>
</tr>
<tr>
<td>ALS/BIOL 2404</td>
<td>Biotechnology in a Global Society</td>
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<tr>
<td>BCHM 2024</td>
<td>Concepts of Biochemistry</td>
</tr>
<tr>
<td>BCHM 3114</td>
<td>Biochemistry for Biotechnology and the Life Sciences</td>
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<tr>
<td>BIOL 2004</td>
<td>Genetics</td>
</tr>
<tr>
<td>BIOL/HORT 2304</td>
<td>Plant Biology</td>
</tr>
<tr>
<td>BIOL 2504</td>
<td>General Zoology</td>
</tr>
<tr>
<td>BIOL 2604</td>
<td>General Microbiology</td>
</tr>
<tr>
<td>BIOL 2804</td>
<td>Ecology</td>
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<td>GEOS 3614/ CSES/ ENSC 3114</td>
<td>Soils (with lab)</td>
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<td>HNFE 3804</td>
<td>Exercise Physiology</td>
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<td>PHYS 4574</td>
<td>Nanotechnology</td>
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<td>PHYS 4714</td>
<td>Introduction to Biophysics</td>
</tr>
<tr>
<td>PPWS 2104</td>
<td>Plants, Genes, and People</td>
</tr>
</tbody>
</table>

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.

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1. 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.

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

3. Course restricted to ESM majors/minors.

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