Plan of Study for the Environmental Science & Engineering AB Concentration  
Effective for Students Declaring the Concentration after August 1, 2020

NAME: ___________________________  CLASS: ___________________________

EMAIL: ___________________________  DATE: ___________________________

This Plan of Study Form is for a (Circle One): DECLARATION  REVISION

<table>
<thead>
<tr>
<th>REQUIRED COURSES</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics</strong> (2-5 courses)</td>
<td>(FA/SP Year)</td>
</tr>
<tr>
<td>Begin according to placement:</td>
<td></td>
</tr>
<tr>
<td>Math 1a – Introduction to Calculus I (or Math Ma &amp; Mb)</td>
<td>______</td>
</tr>
<tr>
<td>Math 1b – Calculus, Series, and Differential Equations</td>
<td>______</td>
</tr>
<tr>
<td>Math 21a – Multivariable Calculus</td>
<td>______</td>
</tr>
<tr>
<td>(or Math 22a or 23b, or Applied Math 21a or 22b)</td>
<td></td>
</tr>
<tr>
<td>Math 21b – Linear Algebra and Differential Equations</td>
<td>______</td>
</tr>
<tr>
<td>(or Math 22b or 23a, or Applied Math 21b or 22a)</td>
<td></td>
</tr>
</tbody>
</table>

| **Physics** (2 courses) | |
| AP 50a – Physics as a Foundation for Sci. & Eng. Part I | ______ |
| (or PS 12a or Physics 15a or 16) | |
| AP 50b – Physics as a Foundation for Sci. & Eng. Part II | ______ |
| (or PS 12b or Physics 15b) | |

| **Chemistry** (2 courses) | |
| Select two: | |
| **Recommended:** Physical Sciences 11 – Foundations and Frontiers of Modern Chemistry: A Molecular and Global Perspective | ______ |
| (or Physical Sciences 1 – Chemical Bonding, Energy, and Reactivity) | |
| Life Sciences 1a – An Integrated Introduction to the Life Sciences | ______ |
| (or Life & Physical Sciences A – Foundational Chemistry and Biology) | |
| Physical Sciences 10 – Quantum and Statistical Foundations of Chemistry | |
| Chemistry 17 – Principles of Organic Chemistry | |
| (or Chemistry 20 – Organic Chemistry) | |
| Chemistry 60 – Foundations of Physical Chemistry | |

| **Environmental Science & Engineering Introductory Course** (1 course) | |
| ESE 6 – Intro to Environmental Science & Engineering | ______ |
| (may substitute GENED 1085, 1094, or 1137, or other appropriate course by petition) | |

| **Sophomore Forum** | |
| Required, non-credit. | ______ |
### REQUIRED COURSES
(Circle or fill-in for courses planned in each category.)

<table>
<thead>
<tr>
<th>Semester (FA/SP Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breadth in Environmental Science &amp; Engineering (2 courses)</td>
</tr>
<tr>
<td><em>Strongly recommended to select one course on environmental physics and one course on environmental chemistry. With permission of the Director of Undergraduate Studies, students may substitute alternative ESE courses.</em></td>
</tr>
</tbody>
</table>

- **One course on environmental physics:** ESE 129, 131, 132, 162
- **One course on environmental chemistry:** ESE 133, 163, 164

### Approved Electives (5 courses)

Select five from the options below (course titles are listed on page 3). With permission of the Director of Undergraduate Studies, up to two courses may be substituted with a relevant upper-level course from other areas of the natural sciences and engineering. Courses marked with an * are approved for the required design experience (see below).

- ES 91r (one term), 96*, 112, 115*, 123, 181, 183
- EPS 53, 134, 187
- OEB 55, 120, 157

### Design Experience

*All students must take an approved course (see courses marked with an * above) with significant design experience as one of their ESE Breadth or Approved Electives. This requirement may also be satisfied with a design component within a senior thesis or independent research project (ES 91r).*

### Required Signatures:

Student _____________________________ Date ______

Associate Director of Undergraduate Studies _____________________________ Date ______

ADUS indicate if a petition is needed: Yes______ No______

Director of Undergraduate Studies _____________________________ Date ______
COURSE TITLES FOR APPROVED ELECTIVES:

ESE 101 – Global Warming Science 101
ESE 109 – Earth Resources and the Environment
ESE 122 – Designing Satellite Missions: Research Methods through Lens of Earth Observing Systems
ESE 129 – Climate and Atmospheric Physics Lab
ESE 130 – Biogeochemistry of Carbon Dioxide and Methane
ESE 131 – Introduction to Physical Oceanography and Climate
ESE 132 – Introduction to Meteorology and Climate
ESE 133 – Atmospheric Chemistry
ESE 136 – Climate and Climate Engineering
ESE 138 – Mysteries of Climate Dynamics
ESE 160 – Space Science and Engineering: Theory and Applications
ESE 161 – Applied Environmental Toxicology
ESE 162 – Hydrology
ESE 163 – Pollution Control in Aquatic Ecosystems
ESE 164 – Environmental Chemistry
ESE 166 – State-of-the-art Instrumentation in Environmental Sciences
ESE 168 – Human Environmental Data Science: Agriculture, Conflict and Health
ESE 169 – Seminar on Global Pollution Issues

ES 91r – Supervised Reading and Research
ES 96 – Engineering Problem Solving and Design Project
ES 112 – Thermodynamics by Case Study
ES 115 – Mathematical Modeling
ES 123 – Intro to Fluid Mechanics & Transport Processes
ES 181 – Engineering Thermodynamics
ES 183 – Introduction to Heat Transfer

EPS 53 – Marine Geochemistry
EPS 134 – Global Warming Debates: The Reading Course
EPS 187 – Low Temperature Geochemistry II: Modern and Ancient Biogeochemical Processes

OEB 55 – Ecology: Populations, Communities, and Ecosystems
OEB 120 – Plants and Climate
OEB 157 – Global Change Biology
### Prerequisite Planning Table for the Environmental Science & Engineering AB

<table>
<thead>
<tr>
<th>Typically Offered</th>
<th>Math</th>
<th>Chemistry</th>
<th>Physics</th>
<th>Other</th>
</tr>
</thead>
</table>

#### Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Semester</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESE 6</td>
<td>Spring</td>
<td></td>
</tr>
</tbody>
</table>

#### Selected Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Semester</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESE 101</td>
<td>Spring</td>
<td>21b</td>
</tr>
<tr>
<td>ESE 109</td>
<td>Spring (odd)</td>
<td></td>
</tr>
<tr>
<td>ES 112</td>
<td>Spring</td>
<td></td>
</tr>
<tr>
<td>ES 123</td>
<td>Spring</td>
<td>21a, b</td>
</tr>
<tr>
<td>ESE 129</td>
<td>Fall</td>
<td>21a</td>
</tr>
<tr>
<td>ESE 130</td>
<td>Bracketed</td>
<td>PS 11</td>
</tr>
<tr>
<td>ESE 131</td>
<td>Spring (even)</td>
<td>21a, b</td>
</tr>
<tr>
<td>ESE 132</td>
<td>Fall (even)</td>
<td>21a, b</td>
</tr>
<tr>
<td>ESE 133</td>
<td>Spring</td>
<td>1b</td>
</tr>
<tr>
<td>ESE 136</td>
<td>Spring</td>
<td>1a</td>
</tr>
<tr>
<td>ESE 138</td>
<td>Fall (odd)</td>
<td>21a, b</td>
</tr>
<tr>
<td>ESE 160</td>
<td>Fall (even)</td>
<td>21a, b</td>
</tr>
<tr>
<td>ESE 161</td>
<td>Fall (odd)</td>
<td>1b</td>
</tr>
<tr>
<td>ESE 162</td>
<td>Fall (even)</td>
<td>21a, b</td>
</tr>
<tr>
<td>ESE 163</td>
<td>Fall (odd)</td>
<td>21a</td>
</tr>
<tr>
<td>ESE 164</td>
<td>Fall</td>
<td>PS 11</td>
</tr>
<tr>
<td>ESE 166</td>
<td>Spring</td>
<td>1b</td>
</tr>
<tr>
<td>ESE 168</td>
<td>Fall</td>
<td></td>
</tr>
<tr>
<td>ESE 169</td>
<td>Spring (odd)</td>
<td>1b</td>
</tr>
</tbody>
</table>

1. Courses listed as Recommended Preparation, and not an enforced requirement.
2. Equivalent courses are accepted for prerequisites (e.g., Phys 15a, PS 12a, or AP50a all count for Physics A).