Plan of Study for the Environmental Science & Engineering AB Concentration

Effective for Students Declaring the Concentration after August 1, 2024

NAME: _____ CLASS: _____ EMAIL: _____ DATE: _____

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

In a few sentences, describe your main interest area within Environmental Science and Engineering:

Please list your selected concentration courses in the schedule below:

1st Fall	1st Spring	2nd Fall	2nd Spring	3rd Fall	3rd Spring	4th Fall	4th Spring

REQUIRED COURSES	**Selected Courses**
Mathematics (2-5 courses) *Begin according to placement:* Math 1a – Introduction to Calculus I (or Math Ma & Mb) Math 1b – Calculus, Series, and Differential Equations Math 21a – Multivariable Calculus (or Math 22a, 25a) Math 21b – Linear Algebra and Differential Equations (or Math 22b, 25b) *Note that Math 18/19 series do not count toward your concentration credit.	
Physics (2 courses) PS 12a – Electromagnetism and Quantum Physics (or AP 50a or Physics 15a or 16) PS 12b– Mechanics and Statistical Physics (or AP 50b or Physics 15b)	
Chemistry / Basic Sciences (2 courses) PS 11– Foundations and Frontiers of Modern Chemistry ***(Required)*** *Take one from the following or petition for more advanced courses:* LPS A – Foundational Chemistry and Biology (or LS 1a) CHEM 10 – Quantum and Statistical Foundations of Chemistry CHEM 17 – Principles of Organic Chemistry (or CHEM 20)	

REQUIRED COURSES	Selected Courses
Gateway Course (1 course) ESE 6 – Intro to Environmental Science & Engineering ***(strongly recommended)*** (With permission of the DUS, may be substituted by an advanced ESE course or ESE 50)	
Thematic Plan Electives (5 courses)**:** *Select a thematic plan and five courses*. **Courses in Bold** must be included. If not choosing a thematic plan, you must choose 7 courses from the approved electives list and include at least four courses from ESE (including graduate-level ES courses taught by ESE faculty).* ☐ Climate Change: ESE **101**, 129, 131, 133, 162, 168; ES 260, 268; OEB 120 ☐ Energy: ESE **109**; **ES 112 or 181**, 173, 183, 190, 231, 248; PHY 129 ☐ Ecosystem Science and Management: ESE 115, 133, 161, 162, 163, 164, 169; ES 123; OEB 55 ☐ Environmental Data Analytics and Modeling: ESE 101, 102, **168**, 169; ES 266; CS 109; AM 101, 115, 120; STAT 110 or 111; ES 123 ☐ Sustainable Design: ESE 161, 163, 164, 166; ES 50, 51, 183, 192, 291; SCI 6121 & 6122	
Approved Electives (2 courses; or 7 courses if not choosing a Thematic Plan) *Select two (or 7) from the options below*:* • ESE 101, 102, 109, 115, 129, 131, 132, 133, 138, 160, 161, 162, 163, 164, 166, 168, 169 • Data analytics, statistics, and scientific computing†: AM10, 101, 120; CS 32, 50, 109a, 109b; SCI 5; Stat 110 • Engineering Sciences: ES 91r (one term), 96, 112, 123, 181, 183, 260, 231, 248, 266, 268 • Earth and Planetary Sciences: EPS 53, 134, 187 • Organismic and Evolutionary Biology: OEB 55, 120, 157 • Physics: PHY 129 • Introductory Engineering Sciences Courses (no more than one): ES 50, 51, 53 • Upper-level Applied Math (no more than one): AM 105, 115 *† Students are strongly encouraged to acquire competency in this area before taking upper-level ESE courses with programming and data analysis components.*	

**With permission of the DUS, up to two elective courses may be substituted with a relevant upper-level course from other areas of the natural sciences and engineering. Students are allowed to develop their own thematic plan and petition for DUS approval.*

Required Signatures:

Student	Date
Assistant 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 102 – Data Analysis and Statistical Inference in the Earth and Environmental Sciences
ESE 109 – Earth Resources and the Environment
ESE 115 – Ecosystem Patterns and Processes: Parallels in Natural and Built Environments
ESE 129 – Climate and Atmospheric Physics Lab
ESE 131 – Introduction to Physical Oceanography and Climate
ESE 132 – Introduction to Meteorology and Climate
ESE 133 – Atmospheric Chemistry
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 – Field and Lab-based Seminar on Local Pollution Issues

ES 91r – Supervised Reading and Research
ES 96 – Engineering Problem Solving and Design Project
ES 112 – Thermodynamics
ES 123 – Intro to Fluid Mechanics & Transport Processes
ES 181 – Engineering Thermodynamics
ES 183 – Introduction to Heat Transfer
ES 231 – Energy Technology (Graduate level)
ES 248 – Electrochemistry (Graduate level)
ES 260 – Atmospheric Chemistry and Physics (Graduate level)
ES 266 – Environmental Modeling (Graduate level)
ES 268 – Physics of Climate (Graduate level)

EPS 53 – Marine Geochemistry
EPS 134 – Global Warming Debates: The Reading Course
EPS 187 – Biogeochemistry

OEB 55 – Ecology: Populations, Communities, and Ecosystems
OEB 120 – Plants and Climate
OEB 157 – Global Change Biology

AM 10 – Computing with Python for Scientists and Engineers
AM 101 – Statistical Inference for Scientists and Engineers
AM 105 – Ordinary and Partial Differential Equations
AM 115 – Mathematical Modeling
AM 120 – Applied Linear Algebra and Big Data

STAT 110 – Introduction to Probability
STAT 111 – Introduction to Statistical Inference

CS 32 – Computational Thinking and Problem Thinking
CS 50 – Introduction to Computer Science
CS 109A – Data Science 1: Introduction to Data Science
CS 109B – Data Science 2: Advanced Topics in Data Science

SCI 5 – An Introduction to Computation for Contemporary Science
SCI 6121/6122 – Environmental Systems (must take both; Graduate School of Design)

	Typically Offered	Math	Chem.	Physics	Other	Prog. Lang.
Gateway Course						
ESE 6	Fall	1b				R/Python
Selected Electives						
ESE 50	Spring					
ESE 101	Spring	*(1b)*				Python
ESE 102	Fall	*(21a,b)*				R / Python
ESE 109	Spring (odd)				*(ESE 6 or EPS 10)*	MATLAB
ESE 115	Spring	1b	*(PS 11)*		*(ESE 6)*	R / Python
ESE 129	Fall (even)	*(21a)*		*(A)*		Python
ESE 131	Spring (even)	21a,b		A		Python / MATLAB
ESE 132	Fall (even)	21a,b		A		
ESE 133	Spring	1b	PS 11			
ESE 138	Fall (odd)	21a,b		A		
ESE 160	Fall (odd)	21a,b		A,B		Python/MATLAB
ESE 161	Spring	1a or 1b	PS 11			
ESE 162	Fall (even)	21a,b		A		
ESE 163	Fall (even)	21a			*(ESE 6)*	
ESE 164	Fall		PS 11			
ESE 166	Spring	1b	PS 11	A,B		
ESE 168	Fall	*(1b)*	*(PS 11)*	*(A)*		Python / MATLAB
ESE 169	Fall	1a or 1b	PS 11			Python
ES 96	Fall/Spring				Preference given to SB students	
ES 112	Spring					
ES 123	Spring	21a		A		Python
ES 181	Fall			A		
ES 183	Spring	21a,b		A		MATLAB
AM 101	Spring	21a				MATLAB
AM 105	Spring	21a,b				MATLAB
AM 115	Fall/Spring	21a,b			*(AM 104,105,108; AM115; STAT 110)*	MATLAB
AM 120	Spring	21a,b			CS 32, 50; AM 10; SCI 5	Python / MATLAB
STAT 110	Fall/Spring	*(1b)*				R
STAT 111	Fall/Spring				STAT 110	R

[1]Courses listed as Recommended Preparation, and not enforced prerequisites, are shown in parentheses.

[2]Equivalent courses are accepted for prerequisites (e.g., Phys 15a, PS 12a, or AP50a all count for Physics A)

[3] Programming language indicates the default language used for instruction (not prerequisites).

[4] Please check out https://info.seas.harvard.edu/courses/four-year-plan each semester.