Plan of Study for the Environmental Science & Engineering Track
of the Engineering Sciences SB Concentration
Effective for Students Declaring the Concentration after August 1, 2023

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

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

The S.B. Program in Engineering Sciences must contain at least 20 courses: 4 courses in mathematics, 4 courses in basic sciences, and 12 courses in engineering topics. This Plan of Study is not final until this form has been signed, ensuring that the proposed plan meets the ABET distribution requirements.

Please describe your academic theme:

REQUIRED COURSES	Semester (FA/SP Year)	Selected Course
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 22b, 25a) Math 21b – Linear Algebra and Differential Equations 　　　　(or Math 22a, 25b)		
Probability & Statistics (1 course, if starting in Math 1b or higher) *Select one*: AM 101 – Statistical Inference for Scientists & Engineers ES 150 – Intro to Probability with Engineering Applications Statistics 110 – Introduction to Probability		
Applied Mathematics (1 course, if starting in Math 21a or equivalent) *Select one:* AM 104 – Series Expansions & Complex Analysis AM 105 – Ordinary & Partial Differential Equations AM 107 – Graph Theory & Combinatorics		
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/Life Sciences (2 courses) *Select two (PS 11 strongly recommended):* LPS A – Foundational Chemistry and Biology (or LS 1a – An Integrated Introduction to the Life Sciences) PS 11 – Foundations & Frontiers in Modern Chemistry CHEM 10 – Quantum, Statistical, and Computation Foundations of Chemistry CHEM 17 – Principles of Organic Chemistry 　　　　(or CHEM 20 – Organic Chemistry)		

REQUIRED COURSES	Semester (FA/SP Year)	Selected Course
Sophomore Forum *Required, non-credit.*		
Computer Science (1 course) *Select one:* AM 10 – Computing with Python for Scientists and Engineers CS 32 – Computational Thinking and Problem Solving CS 50 – Introduction to Computer Science I		
Environmental Science & Engineering Core (5 courses) Environmental Science and Engineering 6 *Select four courses from (course titles shown on p. 4):* Environmental Science and Engineering 109, 115, 131, 133, 160, 161, 162, 163, 164, 166, 168, 169 Engineering Sciences 112, 123		

Engineering Breadth (3 courses)
 	
Select one upper-level course (>100) from each area, see lists on pp. 4-5. (Note: ES50 may be used for the Electrical area.)
 	
Area: Mechanics & Materials
 	
  Course:
 	
Area: Engineering Physics & Chemistry
 	
  Course:
 	
Area: Electrical
 	
  Course:		

Approved Engineering Elective (1 course) *Select at least 1additional course on engineering topics** 1.		
Engineering Design (2 courses) Engineering Sciences 96 Engineering Sciences 100hf		

* Environmental Science and Engineering 6, Engineering Sciences 50, 51, and 53: No more than three of these courses may count towards concentration credit. Engineering Sciences 50 and 53 can only count as an Engineering Elective when taken during the freshman or sophomore year.
ES 91r may be included as an Engineering Elective in a Revised Plan of Study following the approval of a written petition and a signed certification that the project meets the ABET definition of an engineering topic.

For courses co-listed in another department, students must enroll in the Engineering Sciences offering.

Required Signatures:

_____   _____
Student   Date

_____   _____
Assistant/Director of Undergraduate Studies   Date

This plan *does* / *does not* meet the ABET distribution requirements.

_____   _____
Assistant Dean for Education   Date

Pre-approved Courses for the SB in Engineering Sciences

Engineering Courses
Sorted by Depth Area and requirements for ABET engineering topics. For courses co-listed in another department, students must enroll in the Engineering Sciences offering.

Environmental
ESE 6 – Introduction to Environmental Science & Engineering
ESE 109 – Earth Resources and the Environment
ES 112 – Thermodynamics by Case Study
ESE 115 – Ecosystem Patterns and Processes: Parallels in Natural and Built Environments
ES 123 – Intro to Fluid Mechanics & Transport Processes
ESE 131 – Introduction to Physical Oceanography and Climate
ESE 133 – Atmospheric Chemistry
ESE 136 – Climate and Climate Engineering
ESE 160 – Space Science: 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

Mechanics and Materials
ES 51 – Computer Aided Machine Design
ES 120 – Intro to the Mechanics of Solids
ES 123 – Intro to Fluid Mechanics & Transport Processes
ES 125 – Mechanical Systems
ES 128 – Computational Solid & Structural Mechanics
ES 181 – Engineering Thermodynamics
ES 183 – Introduction to Heat Transfer
ES 190 – Intro to Materials Science & Engineering
ES 192 – Material Selection and Design

Engineering Physics and Chemistry
ES 112 – Thermodynamics by Case Study
ES 170 – Engineering Quantum Mechanics
ES 173 – Introduction to Electronic and Photonic Devices
ES 181 – Engineering Thermodynamics
ES 190 – Intro to Materials Science & Engineering

Electrical
ES 50 – Intro to Electrical Engineering
ES 151 – Applied Electromagnetism
ES 152 – Circuits, Devices, and Transduction
ES 155 – Systems and Control
ES 157 – Biological Signal Processing
ES 158 – Introduction to Optimal Control and Estimation
ES 159 – Intro to Robotics
ES 173 – Introduction to Electronic and Photonic Devices
ES 176 – Introduction to Microelectromechanical System
ES 177– Microfabrication Laboratory
CS 141 – Computing Hardware

General Engineering Electives (Cannot be used for Depth or Breadth Areas)
ES 111 – Intro to Scientific Computing
ES 105hfr – Humanitarian Design Projects (two semesters)
ES 115 – Mathematical Modeling
ES 121 – Intro to Optimization: Models & Methods
CS 109a – Data Science 1: Introduction to Data Science
CS 120 – Introduction to Algorithms and their limitations
BE 110 – Physiological Systems Analysis
BE 129 – Introduction to Bioelectronics
BE 191 – Intro to Biomaterials

Prerequisite Planning Table for the ES SB - Environmental Science & Engineering Track

	Typically Offered	Math	Chemistry	Physics	Other	Prog. Lang.
Required Courses						
ESE 6	Spring					R
ES 96	Fall & Spring				**Junior year**	
ES 100HF	Fall-Spring				**ES 96**	
Selected Core and Breadth Course						
ESE 109	Spring (odd)				(ESE 6 or EPS 10)	MATLAB
ESE 115	Fall	1b	(PS 11)		(ESE 6)	R / Python
ESE 131	Spring (even)	21a,b		A	`	Python / MATLAB
ESE 132	Fall (even)	21a,b		A		
ESE 133	Spring	1b	PS 11			
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	Fall (even)	1b	PS 11	A,B		
ESE 168	Fall	(1b)	(PS 11)	(A)		Python / MATLAB
ESE 169	Fall	1a or 1b	PS 11			Python
ES 112	Spring					
ES 120	Spring	21a, b		A		
ES 123	Spring	21a		A		Python
ES 125	Fall	21a,b		A		Python
ES 150	Spring	21a (Co-req 21b)				Any language
ES 173	Fall	1b		A, B		
ES 181	Fall			A		
ES 183	Spring	21a,b		A		MATLAB
ES 190	Spring	(21a,b)				
ES 192	Fall	(21a,b)				
AM 101	Fall	21a				MATLAB
AM 105	Spring	21a,b				MATLAB

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

[2]Equivalent courses are accepted for prerequisites (e.g., Phys 15a, PS 12a, or AP50a allcount 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.