Form IIIa

Course Information

Course Name	Code	Semester	Theory (hours/week)	Application (hours/week)	Laboratory (hours/week)	National Credit	ECTS
Soil Science and Pollution	CEV427	FALL	3	0	0	3	5
Prerequisites	None.						
Course language	English						
Course type	Elective						
Mode of Delivery (face to face, distance learning)	Face to face						
Learning and teaching strategies	Lectures, project-based learning, problem solving, computer-based exercises, discussion						
Instructor (s)							
Course objective	This course introduces soil as a dynamic environmental system and examines how soil physical, chemical, and biological properties influence pollutant behavior, ecosystem health, and sustainable land management. The course integrates soil science with modern environmental monitoring approaches, including GIS, remote sensing, UAVs, and introductory data-driven modeling. Students will evaluate soil pollution problems, interpret spatial and environmental data, and develop a practical soil pollution management plan through a final project.						
Learning outcomes	1- Explain the major physical, chemical, and biological properties of soils and their importance for soil science and environmental engineering practice. 2- Analyze the types, sources, and effects of soil pollutants, including heavy metals, pesticides, and microplastics. 3- Interpret soil sampling strategies, soil quality indicators, and monitoring data for the assessment of soil degradation and pollution risk. 4- Apply statistical, geospatial, and introductory AI/machine learning approaches to visualize, analyze, and model soil quality and pollution-related data. 6-Evaluate soil remediation technologies and sustainable soil management practices for polluted and degraded soils. 7-Communicate a soil pollution assessment and management plan through a written project report and oral presentation.						
Course Content	The course focuses on soils as dynamic environmental systems and examines how soil degradation and pollution affect ecosystem functions, environmental quality, and sustainable land management. The content covers soil health, pollutant sources and behavior, risk pathways, remediation strategies, and sustainable management practices. It also introduces modern approaches for soil pollution assessment, including GIS-based mapping, UAV-supported field applications, emerging technologies, data processing, decision support, and introductory AI-based methods. Through theoretical knowledge, practical applications, field-oriented learning, and real-world case studies, students develop the skills needed to evaluate soil pollution problems and prepare integrated soil pollution assessment and management plans.						

References	• Brady, N.C., & Weil, R.R. (2016). *The Nature and Properties of Soils (15th ed.).* Pearson. • Montgomery, D.R. (2012). *Dirt: The Erosion of Civilizations (2nd ed.).* University of California Press. • Jensen, J.R. (2017). *Remote Sensing of the Environment: An Earth Resource Perspective* (2nd ed.). Pearson. • Kabacoff, R.I. (2015). *R in Action: Data Analysis and Graphics with R* (2nd ed.). Manning Publications. • Gates, A.J. (2021). *IoT and Edge Computing for Scientists and Engineers: Implementation, Analysis, and Action*. Springer. • Lantz, B. (2019). *Machine Learning with R: Expert Techniques for Predictive Modeling* (3rd ed.).

Form IVb: Course outline weekly

Weeks	Topics
1. Week	Introduction to Soil Science
2. Week	Physical and Chemical Soil Properties
3. Week	Biological and Ecological Soil Functions
4. Week	Soil Health, Ecosystem Services, and Degradation
5. Week	Pollutant Behavior and Risk Pathways in Soil (Assignment 1 Announcement)
6. Week	Soil Remediation Principles and Techniques
7. Week	Midterm Exam
8. Week	GIS-Based Mapping of Soil Pollution (Assignment 1 Submission Deadline)
9. Week	Selected Assignment 1 Discussion and Final Project Topic Selection
10. Week	Emerging Technologies for Soil Pollution Assessment (Assignment 2 Announcement)
11. Week	Field Trip: UAV Applications for Soil Pollution Monitoring
12. Week	Decision Support and AI-Based Soil Assessment
13. Week	Sustainable Management and Case Studies (Assignment 2 Submission Deadline)
14. Week	Integrated Soil Pollution Assessment and Remediation (Project Progress Discussion)
15. Week	Project Submission and Presentations
16. Week	Final Exam

Assesment methods

Course activities	Number	Percentage
Assignments	2	20%
Midterm Exam	1	15%
Project	1	15%
Presentation	1	10%
Final Exam	1	40%
Total		100%

WORKLOAD AND ECTS CALCULATION

Activities	Number	Duration (hour)	Total Work Load
Course Duration (14 weeks)	14	3	42
Study Hours Outside Class	14	2	28
Project	1	20	20
Presentation	1	10	10
Assignments	2	10	20
Midterm	1	10	10
Final Exam	1	20	20
Total Workload			150

Matrix of learning outcomes versus program outcomes

D.9. Program Outcomes	**Contribution Level ***				
	1	**2**	**3**	**4**	**5**
1. Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied knowledge in these areas in complex engineering problems.			**X**		
2. Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				**X**	
3. Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.		**X**			
4. Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively.			**X**		
5. Ability to design and conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.					**X**
6. Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7. Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentatio					**X**
8. Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9. Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in engineering practice.				**X**	
10. Knowledge about business life practices such as project management, risk management, and change management; awareness in entrepreneurship, innovation; knowledge about sustainable development.			**X**		
11. Knowledge about the global and social effects of engineering practices on health, environment, and safety, and contemporary issues of the century reflected into the field of engineering; awareness of the legal consequences of engineering solutions.					**X**

*1 Lowest, 2 Low, 3 Average, 4 High, 5 Highest