



**University of Kerala**

Discipline	CHEMISTRY				
Course Code	UK5DSECHE301				
Course Title	ENVIRONMENTAL CHEMISTRY IV				
Type of Course	DSE				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2	5
Pre-requisites	1. Basic Knowledge in soil chemistry 2. Fundamentals of analytical chemistry 3. UK3DSECHE200, UK4DSECHE200, UK5DSECHE300				
Course Summary	This course introduces the soil chemistry and environmental impact of soil chemistry. This course also gives information about the soil remediation Techniques				

**Detailed Syllabus:**

Module	Unit	Content	Hrs
		<b>ENVIRONMENTAL CHEMISTRY IV</b>	<b>75</b>
<b>I</b>		<b>INTRODUCTION AND IMPORTANCE OF SOIL CHEMISTRY</b>	<b>8</b>
	1.1	Introduction to soil Chemistry and soil profile	2
	1.2	Properties of soil: Physical (Porosity, Texture, Bulk Density and Particle size), Chemical (pH, CEC, Alkalinity, Conductivity and Organic carbon) and Biological properties -Basic idea only	2
	1.3	Chemical process in soil – Ion exchange & Redox reactions, soil pH.	2
	1.4	Soil colloids: Classification, Properties - charge, stability, zeta potential, flocculation and peptization (Brief idea only)	2
<b>II</b>		<b>SOIL POLLUTION – CAUSES, TYPES, EFFECTS AND CONSEQUENCES</b>	<b>15</b>
	2.1	Introduction to soil pollution – Major sources of soil pollution: Natural and man-made sources.	3
	2.2	Type of soil pollutants – Organic and inorganic contaminants, solid waste, nuclear waste, industrial pollutants, pollutants from agriculture, Heavy metal pollution in soils (Hg, Cd, Pb, As, Cu)	4
	2.3	Effects of soil pollution: Health hazards, Yield and quality depreciation in agricultural production, Desertification, Pollution of water resources due to soil pollution.	5
	2.4	Population displacement, Species extinction, Economic Impacts	3

<b>III</b>	<b>ANALYTICAL METHODS FOR MONITORING SOIL QUALITY</b>		<b>11</b>
	3.1	Soil sampling methods - Grid sampling and Zone sampling	2
	3.2	Physical Analysis of soil: Texture, Moisture, Bulk density	2
	3.3	Chemical analysis of soil: pH, Organic carbon, EC, CEC, nitrogen (Kjeldahl method)	4
	3.4	Bioindicators of soil pollution: Microbial, plant and Animal bioindicators	3
<b>IV</b>	<b>CONTROL MEASURES, POLICIES AND CASE STUDIES</b>		<b>11</b>
	4.1	Need to control soil pollution; Methods to prevent soil pollution– Biofertilizers, natural pesticides, Ecological farming	2
	4.2	Bioremediation of contaminated soil – processes like Biosparging, Bioventing, Bioaugmentation, mycoremediation and phytoremediation (Basic idea only)	2
	4.3	Soil erosion - factors affecting soil erosion; Methods of Conservation of soil fertility	2
	4.4	Government policies and legislation in India to control soil pollution: Environment Protection (Management of Contaminated Sites) Rules, 2025, Solid Waste Management Rules, 2016, Polluter Pays Principle.	2
	4.5	Case studies (Eloor edayar industrial belt soil pollution, love canal case and Ranipet chromium pollution); Role of an individual in the conservation of soil & Soil Fertility.	3
<b>V</b>	<b>SOIL ANALYSIS PRACTICALS II</b>		<b>30</b>
	1	Determination of Soil pH by pH meter -Minimum 5 Samples	
	2	Determination of Bulk density and moisture content by physical method - Minimum 5 Samples	
	3	Determination of organic matter and organic carbon content in soil by Titrimetric method-Minimum 5 samples	
	4	Determination of electrical conductivity of soil by conductivity method-Minimum 5 samples	
	5	Determination of specific gravity of soil samples-minimum 5 samples	

**Reference**

1. Balram Pani, *Text Book of Environmental Chemistry*, I.K International Publishing
2. S.M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi
3. Balram Pani, *Text Book of Environmental Chemistry*, I.K International Publishing House Pvt Ltd
4. Gray W. van Loon & Stephen J. Duffy, *Environmental Chemistry: A Global Perspective*, Oxford University Press
5. H. Kaur, *Environmental Chemistry*, Pragati Prakashan.
6. V.K Ahluwalia, *Environmental Chemistry*, Second Edition, Ane Books Pvt. Ltd.

**Course outcome**

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Analyze the physical, chemical, and biological properties of soil, soil chemical processes, and the behavior of soil colloids to interpret their influence on soil fertility, stability, and environmental quality.	An	1,3
CO2	Analyze the sources, types, and effects of soil pollutants, including heavy metals and agricultural and industrial contaminants, and evaluate their impact on human health, agriculture, water resources, biodiversity, population displacement, and the economy.	An	1,2,3
CO3	Evaluate soil quality and pollution status using soil sampling techniques, physical and chemical analysis, and bioindicators to assess soil health and environmental sustainability.	E	1,2,3
CO4	Design sustainable strategies for the prevention, remediation, and management of soil pollution by integrating eco-friendly practices, bioremediation techniques, soil conservation methods, environmental policies, and community participation.	C	1,3
CO5	Develop and implement soil analysis strategies using modern analytical techniques and instruments to assess soil properties, nutrient content, and overall soil quality.	C	1,3

**R-Remember, U-Understand Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: ENVIRONMENTAL CHEMISTRY IV**

**Credits: 3:0:1 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	CO1	1,3	An	C	L	
2	CO2	1,2,3	An	F, C	L	
3	CO3	1,2,3	E	C	L	
4	CO4	1,3	C	F, C	L	
5	CO5	1,3	C	F, C	L	

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs:**

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	1	-	1	-	-	1	1	-	-	-	-	-	-
CO 2	1	2	1	-	-	1	1	-	-	-	-	-	-
CO 3	1	1	1	-	-	1	1	-	-	-	-	-	-
CO 4	1	-	1	-	-	1	1	-	-	-	-	-	-
CO 5	1	-	1	-	-	1	1	-	-	-	-	-	-

**Correlation Levels:**

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

**Mapping of COs to Assessment Rubrics:**

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓			✓
CO 3	✓			✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	