

KU5DSECHE303: ENVIRONMENTAL CHEMISTRY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
V	DSE	300	KU5DSECHE303	4	60

Learning Approach (Hours/ Week)		Marks Distribution			Duration of ESE (Hours)
Lecture/ Tutorial	Practical/ Internship	CE	ESE	Total	
4	0	30	70	100	2

Course Description: This course in Environmental Chemistry provides a comprehensive understanding of the chemical principles and processes affecting the environment. It covers atmospheric structure and composition, water and soil chemistry, and pollution sources and control measures. Topics include toxicology, air and water pollution, soil contamination, and noise and radiation hazards. Students will explore environmental segments, chemical toxicology, greenhouse effects, eutrophication, and bioremediation, emphasizing pollution control and environmental management techniques. This knowledge prepares students for careers in environmental science, research, and policy-making.

Course Prerequisite: Basic idea about environmental pollutants

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand Environmental Segments: Describe lithosphere, hydrosphere, atmosphere, and biosphere, and their chemical compositions.	U
2	Analyze Air Pollution: Identify air pollutants, their effects, and scientific control methods including devices and regulations.	An

3	Assess Water Pollution: Evaluate sources, impacts, and control methods of water pollution, including sewage treatment and water standards.	An
4	Examine Soil Pollution: Investigate soil pollution causes, effects on plants, and scientific bioremediation techniques for soil management.	E
5	Understand Noise and Radiation Pollution: Explain sources, effects, and control measures of noise and radiation pollution, including case studies in scientific manner.	E

***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	3	3	3	3	3	0
CO 2	3	3	3	3	3	3	1
CO 3	3	3	3	3	3	3	0
CO 4	3	3	3	3	3	3	1
CO 5	3	3	3	3	3	3	0

Course Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	ENVIRONMENTAL SEGMENTS AND AIR POLLUTION		9
	1	Environmental segments: Lithosphere, Hydrosphere, Atmosphere and Biosphere- Atmospheric structure and composition - chemical composition of water in water bodies – (Ground water, river water and lake water, sea water wetlands)	
	2	Hydrological cycle- Chemical Toxicology–Toxic chemicals in environment –Sources, effects and treatment of heavy metal poisoning – Pb, As, Cd, Hg, Cr, Cu & Co- Mina Mata and Itai-Itai diseases.	

2	WATER POLLUTION		12
	1	Water resources- water pollution – sources – Industrial effluents – agriculture discharge oil spills – heavy metals – pesticides – detergents. Eutrophication – bio magnification and bioaccumulation – Experimental determination of Dissolved oxygen, BOD and COD	
	2	Thermal Pollution – Control of water pollution –ISI/BSI standards of drinking water- Hardness of water – causes and effects – methods of estimation – removal of hardness.	
	3	Domestic water treatment – Sewage – Sewage analysis -Sewage treatment	

3	SOIL POLLUTION		12
	1	Lithosphere – soil formation-Different types of weathering – components of soils – Acid Base and ion exchange reactions in soil	
	2	Soil pollution – soil acidification – effects on plants – liming of soil – Industrial and urban wastes – plastics, pesticides and heavy metals in soil – garbage –biomedical waste – E waste –Municipal Solid waste management. Bioremediation	

4	NOISE AND RADIATION POLLUTION		12
	1	Noise pollution and Radioactive Pollution: Human acoustics - Noise – general features - types of Noise – Measurement of noise – sound pressure and power levels – sources and effects of noise pollution – prevention of hearing loss in industry – control of noise pollution	
	2	Radiation chemistry – Manmade and natural radiations – biological effects of radiation - radiation hazards from reactors –Fukushima nuclear disaster- radioactive waste management	

5	TEACHER SPECIFIC MODULE -AIR POLLUTION		15
	<i>Directions: A module on Air Pollution or any other relevant topic to the course as per teacher's choice can be proposed</i>		
	1	Air pollutants –CO, NO _x , SO ₂ , H ₂ S, Hydrocarbons, particulate matter. Acid rain and its effects- Greenhouse effect and global warming	
	2	Climate change – ozone chemistry and ozone hole- chlorofluorocarbons, dioxins.	
	3	Photochemical smog (reactions), Bhopal gas tragedy.	
	4	Control of air pollution – control by devices – Stacks, filters, electrostatic precipitators, cyclone separators, scrubbers and catalytic converters.	

Essential Readings:

1. Baird, Colin, and Michael Cann, Environmental Chemistry, 5th edn., W.H. Freeman.
2. Manahan, Stanley E., Environmental Chemistry, 10th edn., CRC Press.
3. De, Anil Kumar, Environmental Chemistry, 8th edn., New Age International Publishers.
4. Sawyer, Clair N., Perry L. McCarty, and Gene F. Parkin, Chemistry for Environmental Engineering and Science, 5th edn., McGraw-Hill.
5. Masters, Gilbert M., Introduction to Environmental Engineering and Science, 3rd edn., Prentice Hall.
6. VanLoon, Gary W., and Stephen J. Duffy, Environmental Chemistry: A Global Perspective, 3rd edn., Oxford University Press.
7. Connell, Des W., Basic Concepts of Environmental Chemistry, 2nd edn., CRC Press.
8. Harrison, Roy M., Pollution: Causes, Effects and Control, 5th edn., Royal Society of Chemistry.

Web References:

1. Royal Society of Chemistry, Environmental Chemistry, www.rsc.org/learn-chemistry
2. Khan Academy, Chemistry of Life, www.khanacademy.org/science/chemistry
3. Environmental Protection Agency (EPA), Air Quality, www.epa.gov/air-quality
4. National Oceanic and Atmospheric Administration (NOAA), Water Pollution, www.noaa.gov/education/resource-collections/water-cycle/water-pollution

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		70
Continuous Evaluation		30
a)	Test Paper*	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		100

*Average mark of the best two written tests may be considered for internal mark.

Employability for the Course: This course prepares students for careers in environmental science, research, and policy. Graduates can work in environmental monitoring, pollution control, waste management, and regulatory agencies. They will have the skills to address environmental challenges, conduct analyses, and develop sustainable solutions for various environmental issues.