



University of Kerala

Discipline	ZOOLOGY				
Course Code	UK4DSEZOO203				
Course Title	Environmental Science II- Environmental Pollution				
Type of Course	DSE				
Semester	IV				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	Pass in Class XII				
Course Summary	<p>This course covers the comprehensive study of air, water, soil, noise, and light pollution, including their sources, impacts, and mitigation strategies. Students will explore the concepts, standards, and pollutants associated with each type of pollution, along with their effects on human health, wildlife, and ecosystems. Through case studies, students will analyse real-world scenarios, identifying successful management approaches and ongoing challenges. By examining the pathways of contamination and ecological consequences, students will gain insights into the long-term impacts of pollution on both natural and human environments. Additionally, the course highlights the importance of regulatory frameworks and guidelines in addressing pollution issues and promoting sustainable practices for environmental protection.</p>				

Detailed Syllabus

Module	Unit	Content	60 hrs
I	Air Pollution: Causes and Impacts		12
	1.1	Air Pollution: Concepts, Sources of air pollution- Natural and anthropogenic. Air quality standards, emission standards. Primary and secondary air pollutants. Atmospheric reactions are mechanisms of transformations and their relationship.	3
	1.2	Particulate matter: Sources, classification and composition, particulate dynamics, viable and nonviable particles.	2

	1.3	Effects of air pollution on human health, animals and vegetation.	2
	1.4	Pollution-related phenomena and their consequences: the greenhouse effect, global warming, temperature inversion, CFCs and ozone depletion, and photochemical smog. Related activity: <i>A quiz can be administered utilising the Mentimeter App for the learning experience.</i>	3
	1.5	Case studies on air pollution, threats and challenges. Examples: The Beijing Smog Crisis (2013) and The Delhi Air Pollution Crisis (ongoing). Related activity: <i>Poster presentation can be adapted for learning. Group activity, Maximum 5 students in a group.</i>	2
II	Water Pollution: Causes and Impacts		12
	2.1	Characteristics of natural water and aquatic environment. Sources of potable water. Water quality standards- WHO, EPA and BIS. Industrial water quality standards.	3
	2.2	Types of water pollution: Physical, chemical, biological, and physiological. Sources of water pollution, such as domestic and industrial wastewater, their compositions, discharge standards, and effects on receiving bodies.	2
	2.3	The fate of pollutants in water: Metals, heavy metals, non-metals, and their specifications. Pesticides, oils, greases, organic matter, biodegradation, and bioaccumulation and their effects on water bodies.	2
	2.4	Marine, thermal, and radioactive pollution in water and their consequences; transport of pollutants; pollutant cycle in the environment (land, air, and water). Bioaccumulation and Biomagnification. Related activity: <i>Quiz competition can be adapted for mode of learning, Group activity, Maximum 5 students in a quiz team.</i>	3
	2.5	Case studies on water pollution, threats and challenges. Examples: The Cuyahoga River Fire (1969), The Love Canal Disaster (1978) and The Flint Water Crisis (2014-2019). Related activity: <i>PowerPoint presentation can be adapted for learning experience, Group activity, Maximum 5 students in a group.</i>	2
III	Soil Pollution: Causes and Impacts		12
	3.1	Definition and types of soil pollution: chemical, biological, and physical contaminants. Sources of soil pollution: industrial activities, agricultural practices, mining operations, and urbanisation.	2
	3.2	Pathways of soil contamination: direct release, atmospheric deposition, leaching, and runoff. Introduction to soil quality indicators and standards	3

		for assessing contamination levels.	
	3.3	Overview of key pollutants: heavy metals, pesticides, petroleum hydrocarbons, and persistent organic pollutants (POPs).	2
	3.4	Ecological consequences of soil pollution: disruption of soil microbial communities, loss of biodiversity, and habitat degradation.	2
	3.5	Health risks associated with exposure to contaminated soils: Toxicological effects, food chain contamination, and respiratory diseases. Effects of soil contamination on ecosystem services.	2
	3.6	Case studies on long-term impacts of soil pollution on ecosystems and human populations. Example: Aral Sea Ecological Disaster, Agricultural Pesticide Pollution in Punjab, India and Mining Pollution in the Niger Delta, Nigeria. Related activity: PowerPoint presentation can be adapted for learning experience, Group activity, Maximum 5 students in a group.	1
IV	Noise Pollution: Causes and Impacts		12
	4.1	The definition and types of noise pollution are environmental, occupational, and transportation noise. Sources of noise pollution are industrial activities, transportation systems, construction sites, and recreational activities.	3
	4.2	Measure and assess noise levels: Decibel scale, sound monitoring equipment, and noise mapping techniques. Noise Pollution Standards and Legal Framework.	2
	4.3	The effects of noise pollution on human health include hearing loss, sleep disturbances, stress-related disorders, and cardiovascular diseases. (Discussion mode of learning can be adapted). Related activity: PowerPoint presentation can be adapted for learning experience, Group activity, Maximum 5 students in a group.	2
	4.4	The impact of noise pollution on wildlife behaviour, communication, and habitat disruption. Introduction to noise exposure limits and guidelines for protecting human health and wildlife.	3
	4.5	Case studies illustrating noise pollution's health and ecological consequences in different contexts. Examples: The Effects of Aircraft Noise on Heathrow Residents (London, UK) The Impact of Shipping Noise on Marine Life (Global Context) Urban Noise Pollution and its Effects on Songbirds (Urban Areas, Global Context). Related activity: PowerPoint presentation can be adapted for learning experience, Group activity, Maximum 5 students in a group.	2
V	Light Pollution: Causes, Ecological and Health Impacts		12

5.1	Definition and types of light pollution: skyglow, glare, light trespass, and clutter. Introduction to the concept of dark-sky preservation and its importance for ecosystems and human health.	3
5.2	Sources of light pollution and measurement: outdoor lighting fixtures, streetlights, advertising signage, and industrial facilities, as well as methods for quantifying its extent and intensity.	2
5.3	Artificial light at night (ALAN) affects wildlife behaviour, migration patterns, and ecosystems.	2
5.4	The impact of light pollution on nocturnal species is disruption of circadian rhythms, predation risk, and habitat fragmentation.	1
5.5	The health effects of light pollution on humans include sleep disturbances, hormonal imbalances, and an increased risk of chronic diseases.	2
5.6	Case studies illustrate light pollution's ecological and health consequences in different ecosystems and urban areas. The Impact of Artificial Light on Sea Turtle Hatchlings (Coastal Areas, Global Context), The Effects of Urban Light Pollution on Nocturnal Insects (Urban Areas, Global Context), The Health Effects of Blue Light Exposure from LED Streetlights (Urban Areas, Global Context). Related activity: <i>PowerPoint presentation can be adapted for learning experience, Group activity, Maximum 5 students in a group.</i>	2

References:

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3. Cunniff P.E., 1987. Environmental Noise Pollution. McGraw Hill, New York,.
4. De Nevers N 2000. Air Pollution Control Engineering, 2nd Edition. McGraw Hill, Singapore.
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7. Helmut Kohuke 1968. Soil physics. McGraw-Hill.
8. Krishnan Khannan, S. 1994. Fundamentals of Environmental Pollution, Chand Publication.
9. Kudesia, V.P and Ritu Kudesia (1992). Water Pollution, Pragati Prakashan Publication, Meerut.
10. Kumarasawmy, K., A. Alagappa Moses and M. Vasanthy (2004). Environmental Studies. Bharathidasan University Publications.
11. Malcom Cresser 1993. Soil Chemistry and its Application. Cambridge University Press.
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14. Nathansan, John 1986. Basic Environmental Technology - Wiley.
15. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
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20. Stanly Manahan 2011. Environmental Chemistry. CRC Press.
22. Tiwary A, Williams I, Colls J. (2019). Air Pollution: Measurement, Modelling and Mitigation. Fourth Edition.
23. Trivedi P.R. 1992. Environmental Agricultural pollution. Akashdeep Publishing House.

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand air pollution, encompassing its concepts, sources, and effects on human health, animals, and vegetation, alongside the ability to analyse Pollution-related phenomena and evaluate associated threats and challenges through case studies.	U, R, An	PSO-1, 2, 3, 7
CO-2	Acquire in-depth knowledge of water pollution, covering natural water characteristics, potable water sources, international and industrial water quality standards, classification of pollution types, pollutant fate assessment, and critical evaluation of case studies on management strategies and emerging challenges in pollution control.	U, R, An	PSO-1, 2, 3, 7
CO-3	Grasp in soil pollution, covering its causes, impacts, and key pollutants. This will enable them to proficiently identify pollution sources, contamination pathways, ecological and health risks, and analyse long-term implications through case studies to support informed decision-making in soil management and remediation efforts.	U, AP, An	PSO-1, 2, 3, 7
CO-4	Gain a thorough understanding of noise pollution, encompassing its causes, effects, and measurement techniques. This will allow them to evaluate its impact on human health and wildlife behaviour and critically assess noise pollution standards and legal frameworks.	U, AP, An	PSO-1, 2, 3, 7

CO-5	Understand light pollution, encompassing its origins, ecosystem effects, and human well-being. They will be proficient in identifying sources, measuring intensity, and assessing impacts on nocturnal species, empowering them to advocate for dark-sky preservation and sustainable lighting practices using case studies.	U, AP, An	PSO-1, 2, 3, 7
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R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Environmental Science II- Environmental Pollution

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	Understand air pollution, encompassing its concepts, sources, and effects on human health, animals, and vegetation, alongside the ability to analyse pollution-related phenomena and evaluate associated threats and challenges through case studies.	PO1,6,8/ PSO-1, 2, 3, 7	U, An	F, C, P	L	-
2	Acquire in-depth knowledge of water pollution, covering natural water characteristics, potable water sources, international and industrial water quality standards, classification of pollution types, pollutant fate assessment, and critical evaluation of case studies on management strategies and emerging challenges in pollution control.	PO1, 6, 8/ PSO- 1, 2, 3, 7	U, An	F, C	L	-
3	Grasp in soil pollution, covering its causes, impacts, and key pollutants. This will enable them to proficiently identify pollution sources, contamination pathways, ecological and health risks, and analyse long-term implications through case studies to support	PO1, 6, 8/ PSO- 1, 2, 3, 7	U, An	F, C	L	-

	informed decision-making in soil management and remediation efforts.					
4	Gain a thorough understanding of noise pollution, encompassing its causes, effects, and measurement techniques. This will allow them to evaluate its impact on human health and wildlife behaviour and critically assess noise pollution standards and legal frameworks.	PO1, 6, 8/ PSO-1, 2, 3, 7	U, Ap, An	F, C	L	-
5	Understand light pollution, encompassing its origins, ecosystem effects, and human well-being. They will be proficient in identifying sources, measuring intensity, and assessing impacts on nocturnal species, empowering them to advocate for dark-sky preservation and sustainable lighting practices using case studies.	PO1, 6, 8/ PSO-1, 2, 3, 7	U, Ap, An	F, C	L	-

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

Mapping of COs with PSOs and POs

	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	2	3	1	-	-	-	1	1	-	-	-	-	2	-	3
CO 2	1	3	1	-	-	-	2	2	-	-	-	-	1	-	3
CO 3	1	2	2	-	-	-	2	1	-	-	-	-	2	-	3
CO 4	1	2	3	-	-	-	1	1	-	-	-	-	2	-	3
CO 5	1	3	2	-	-	-	2	1	-	-	-	-	2	-	3

Correlation Levels:

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

Assessment Rubrics:**Suggested Assignments (Any two)**

1. Effects of air pollution on human health
2. The health effects of light pollution on humans
3. Effects of noise pollution on human health
4. Risks associated with exposure to contaminated soils
5. Overview of key pollutants
6. Sources of water pollution

Continuous Comprehensive Assessment

1. Assignments
2. Seminars
3. Industrial/Field Visit Reports
4. Submission of Activity Reports
5. Tests
6. Quiz/Debate
7. Poster preparation & presentation

End Semester Evaluation

1. Multiple Choice Questions
2. Very Short Answer Questions
3. Short Answer Questions
4. Essay Type Questions

Mapping of COs to Assessment Rubrics

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