Course-Plan

School: Science and Technology
Department: Environmental Science
Course Code: ES-555
Course Name: Environmental Chemistry

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1. **Abstract**:

The environmental chemistry is the study of the sources, reactions, transport, effects, and fates of chemical species in the air, soil, and water environments; and the effect of human activity on these. Environmental chemistry is an interdisciplinary science that includes atmospheric, aquatic and soil chemistry, as well as heavily relying on analytical chemistry and being related to environmental and other areas of science.

Environmental chemistry involves first understanding how the uncontaminated environment works, which chemicals in what concentrations are present naturally, and with what effects. Without this it would be impossible to accurately study the effects humans have on the environment through the release of chemicals.

Environmental chemists draw on a range of concepts from chemistry and various environmental sciences to assist in their study of what is happening to a chemical species in the environment. Important general concepts from chemistry include understanding chemical reactions and equations, solutions, units, sampling, and analytical techniques.

2. **Objectives:**

1. A primary objective in environmental chemistry is to forecast the concentrations of pollutants in the environments with respect to space and time variables.
2. Environmental chemistry is the scientific study of the chemical and biochemical phenomena that occur in natural places.

3. Prerequisites of the course:

Knowledge of chemistry like thermodynamics, chemical kinetics , chemical equilibrium etc.

4. **Course outline+ suggested reading:**

Introduction and scope of environmental chemistry and green chemistry, Stoichiometry
Chemical thermodynamics, Gibbs energy, chemical potential, Gibb's phase equilibria. Equilibrium of chemical reactions, Chemical kinetics, Simple reaction mechanism, order of reactions, law of mass action, Chemical composition of the earth, abundance of elements, Classification of elements, major and trace elements and their partitioning during mineral formation, Atmosphere: atmospheric chemistry , composition and reactions in the lower and upper atmosphere, Chemistry of air pollutants, photochemical reactions, oxygen and ozone chemistry , smog, Aquatic chemistry : structure and properties of water and their environmental significance, Acid-base reactions, solubility of gases in water, the carbonate system , Radionuclides, concept of BOD,COD,DO , organic matter and humic matter in water , redox potential, Marine water systems.

Text Books:

1. A.K.De, *Environmental Chemistry*, Willey Eastern Ltd.; 2010
2. D.W.Connel, *Basic Concept of Environmental Chemistry*, Lewis, 2000
3. P.K.Gupta, *Methods in Environmental Analysis –water, soil and air*, Agrobios,2000
4. S.K.Manahan, E*nvironmental Chemistry*, Lewis, 2000

Reference Books:

1. P.O.Neil, *Environmental Chemistry*, Champman & Hall , 1999
2. F.W.Fifield (edtr), *Environmental Analytical Chemistry*, Blackwell, 1999
3. L.S. Clesceri , *Standard methods for examination of water and waste water*, American Public health Association,28th Edition ,2000

5. (a) **Time-Plan for the course**

Lecture No.	Topics
1	Introduction and scope of environmental chemistry and green chemistry
2	Stoichiometry
3-5	Chemical thermodynamics, Gibbs energy, chemical potential
6-10	Gibb's phase equilibria. Equilibrium of chemical reactions
11-15	Chemical kinetics, Simple reaction mechanism, order of reactions, law of mass action
16	**Unit test**
17	Chemical composition of the earth, abundance of elements,
	Mid term test
18-19	Classification of elements, major and trace elements and their partitioning during mineral formation.
20-22	Atmosphere: atmospheric chemistry , composition and reactions in the lower and upper atmosphere,
23-24	Chemistry of air pollutants, photochemical reactions, oxygen and ozone chemistry , smog
25-26	Aquatic chemistry : structure and properties of water and their environmental significance
27-28	Acid-base reactions, solubility of gases in water, the carbonate system
29-30	Radionuclides, concept of BOD,COD,DO , organic matter and humic matter in water , redox potential
31-32	Marine water systems
33	Discussion
34	**Unit test**
	Mid-term test

(b) Evaluation plan

Performance of the student is evaluated on the basis of the following continuous assessment
Mid-term: 40 Marks
Practicals: 100 marks
End term: 60 marks
Term paper/ unit test: 25 marks

Total: 250 marks

6. Pedagogy: Lecture method, Group discussion, Group presentation, assignment, etc.

7. Expected outcome: Towards the end of the course the student would be able to apply the knowledge of the sources, reactions, transport, effects, and fates of chemical species in the various air, soil, and water environments.