CH-335 Environmental Chemistry

Credit Hours: 2-1

Pre-requisite: Nil,

Course Objectives

1. By the end of this course, students should be able to understand the structure, components, and dynamic interactions among Earth's environmental segments — lithosphere, hydrosphere, biosphere, atmosphere, and anthrosphere. Explain the principles of atmospheric chemistry, including chemical composition, behavior of gases, ozone chemistry, and the impact of pollutants on atmospheric balance. Identify and analyze different types of environmental pollution, their anthropogenic sources, chemical behavior, biomagnification, and strategies for pollutant removal and control. Apply the principles of green chemistry and explore sustainable technologies for minimizing environmental impact. Evaluate renewable and alternative energy technologies, their chemical basis, and their role in sustainable environmental management. Develop laboratory and field skills relevant to environmental chemical analysis and pollution monitoring.

Detailed Contents

2. Introduction to Environment. Basic environmental segments. Lithosphere, hydrosphere, biosphere, atmosphere (troposphere, stratosphere, mesosphere, thermosphere, exosphere etc), and anthrosphere.
3. Atmospheric Chemistry. Atmospheric chemistry, mixture types, concentration expressions, mixing ratio, number density, mass concentration, atmospheric pressure, and barometric law. The Ozone Layer; the ozone hole, ozone protection, biological consequences of ozone depletion. Chapman mechanism of ozone depletion.
4. Pollution and Pollutants: Pollution, its types, sources, biomarkers and impacts. Anthropogenic sources, health and environmental hazards, removal methods for various heavy metals (Cd, Pb, Hg, As and Cr etc.) Bioconcentration and biomagnification of pollutants.
5. Green Technologies: Principle of green chemistry, natural and green insecticides. Integrated pest management. Energy Production and Environment. liquid and gaseous fuel, hydrogen economy. Renewable Energies including hydroelectric power energy, wind energy, geothermal energy, tidal energy, solar thermal energy, solar photovoltaic

cell and dye sensitized solar cell.

Course Outcomes

6. On successful completion of the course the student will be able to:
7. Demonstrate knowledge of chemical principles of various fundamental environmental phenomena and processes in air land and water.
8. Apply the basic concepts of Chemistry (e.g chemical thermodynamics, kinetics, and photochemistry) to analyze chemical processes involved in different environmental issues.
9. Critically discuss local and global environmental issues based on scientific principles.

Relevant Experiments

1. Determination of Ferrous (Fe++) ions contents in the given sample of water in terms of molarity, w/w% and ppm.
2. Determination of chloride (Cl-) ions contents in the given sample of water by Mohr's method in terms of molarity, w/w% and ppm.
3. Determination of the total hardness in the given sample of water using EDTA titration method in terms ppm of CaCO3.
4. Determination of the temporary and permanent hardness in the given sample of water in terms ppm of CaCO3.
5. Determination of the P and M-alkalinity in the given sample of water.
6. Determination of acidity in the given sample of water.
7. Determination of TDS of the given sample of water.
8. Determination of Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) of the given water sample.
9. Determination of nitrogen contents in the given wastewater/soil samples.
10. Determination of phosphorus contents in the given wastewater/soil samples.
11. Determination of sulfur contents in the given wastewater sample.
12. Determination of the grease and oil contents in the given wastewater sample.
13. Determination of soil pH.
14. Determination of organic matter in the given soil sample.
15. Determination of organic carbon in the given soil sample via colorimetric method
16. Determination of the bulk density, specific gravity and water holding capacity of given soil sample.

Recommended Books

1. [Jac]. D. J. Jacob, " Introduction to Environmental Chemistry , Princeton University Press, 1999.
2. [Man] S. E. Manahan, "ENVIRONMENTAL SCIENCE, TECHNOLOGY, AND CHEMISTRY" *Environmental Chemistry,* Taylor & Francis Inc. CRC Press LLC, 2009.
3. Collin Baird, Environmental Chemistry, W. H. Freeman and company, New York, 1995.
4. Peter O. Neill, Environmental Chemistry, Chapman and Hall, London, 1993.
5. Derek M. Elsom, Atmospheric Pollution, Blackwell Publishers, Oxford, 1992.
6. Environmental Chemistry by S. E. Manahan, 11th Edition, Taylor & Francis Inc. CRC Press LLC, 2022.
7. 2. Environmental and Pollution Science by Ian Pepper, Charles Gerba, and Mark Brusseau, 3rd Edition, Academic Press (Elsevier), 2019.
8. 3. Chemistry for Environmental and Earth Sciences by Glenn Roy and Anne Marie Shaker, 3rd Edition, Taylor & Francis Inc. CRC Press LLC, 2021.
9. 4. Environmental Chemistry: A Laboratory Manual by G. S. Sodhi, 2nd Edition, Narosa Publishing House, 2019.
10. 5. Experimental methods for General and Environmental Chemistry by Dr. Anita Rajor, 1st edition, Standard Publisher Distributors, 2006.