

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

1. **Name of the Academic Unit: Chemistry**
2. **Subject Name: Chemical Thermodynamics and Kinetics L-T-P: 2-0-0**
Credits: 2
3. **Pre-requisites: Nil**
4. **Syllabus and reference books:**

Syllabus:

Module-1: Chemistry of Atmosphere:

Origin, composition and structure of atmosphere-particles, ions and radicals in the atmosphere, Greenhouse effect - Causes, consequences and abatement of Greenhouse effect. Ozone depletion - Causes, consequences and abatement of ozone depletion, Photochemical smog – Chemistry of formation of toxic gases products, effects and control.

Module-2: Air pollution - monitoring and control:

Air sampling techniques -Sources and effects, of oxides of sulphur, oxides of nitrogen, oxides of carbon. Monitoring of air pollutants by instrumental methods, Monitoring and control of particulate pollution. Control of air pollution by raw material change, process modification, and incineration/ combustion methods. Catalytic reactors for automobiles.

Module-3: Water pollutants and waste water treatment:

Unique characteristics of water; Water and the living ecosystem and non-living environment, Types of Pollutants; Chemical, physical and biological pollutants. Water Pollution indicators - dissolved oxygen (DO); biological oxygen demand (BOD); chemical oxygen demand (COD), Waste-water: composition – Organic matter, inorganic constituents or microorganisms. Salinity and hardness of water. Water Quality Parameters and water treatment methods - primary, secondary, tertiary treatment. Water quality standards for portable water and recent developments in water purifiers.

Module-4: Soil chemistry:

Nature and composition of soil, Acid base and ion exchange reactions in soil, macronutrients in soil, Micronutrients in soil, Nitrogen, phosphorous and potassium in soil. Impact of fertilizers and herbicides on soil. Microbial treatment of soil and challenges due to non-degradable pollutants in soil. Important methods for testing agricultural soil.

Module-5: Miscellaneous topics:

Solid Waste Management - classification, methods of disposal and management. Hazardous materials/chemicals– Classification, symbols, safety aspects and handling/transformation approaches in India and abroad. Environmental Impact Assessment processes in India – Important environmental acts and rules practiced worldwide.

Reference Books:

1. Environmental Chemistry, Fourth Edition, C Baird, M. Cann, H. Freeman & Co Ltd (ISBN13: 978-1429201469).
2. Environmental Chemistry, Eleventh Edition, Stanley E. Manahan, CRC Publishers 2022.

5. Lecture-wise break-up:

Sl. No.	Topic	No. of lectures
1.	Chemistry of Atmosphere	4
2.	Air pollution - monitoring and control:	4
3.	Water pollutants and waste water treatment:	8
4.	Soil chemistry:	4
5.	Miscellaneous topics:	4
Total number of hours		24