

20CY204 ENVIRONMENTAL AND SUSTAINABLE CHEMISTRY

Hours per Week :

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Course Description and Objectives:

This elective course is designed to give the students a comprehensive approach towards the knowledge regarding basic environmental concerns of this planet with special emphasis on industrial waste management and remediation technologies in accordance with the principles of sustainability. This course is aimed to provide the students with a better understanding regarding waste handling and management especially in industries and as well as lay a foundation to develop newer technologies and strategies towards mitigation of wastewater, solid wastes and hazardous wastes.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
1.	Identify the different environmental problems and their solutions.
2.	Apply the knowledge of chemistry to analyze various environmental parameters.
3.	Explain the different aspects of waste management.
4.	Discuss the existing approaches towards waste management and mitigation of hazardous wastes.
5.	Design new technologies and management strategies for waste remediation.

UNIT - I :**Environment and Sustainable Development**

Concept of environment and its problems (emphasis on industrial pollution), Sustainable Development, Sustainability and Sustainability Indices (SD), Ecological footprint, Environment Conservation Strategies, Environmental Laws and Acts, Environmental Audit (EA), Environmental Impact Assessment (EIA).

UNIT - II :**Environmental Chemistry**

Components of environmental chemistry (equilibrium, redox, etc.) Biogeochemical cycles; Environmental aspects of air-chemistry: Air pollutants and their reactions in atmosphere (Photochemical smog; Oxygen and Ozone chemistry). Environmental aspects of water-chemistry, Concept of DO, BOD, COD, Total hardness, Carbonate system. Environmental aspects of soil-chemistry: Inorganic and Organic components of soil, Nitrogen pathways in soil; NPK in soils.

UNIT - III :**Wastewater Management and Treatment Technologies.**

Water resources, Contaminants from industrial sources, Primary treatment, Secondary treatment (Precipitation, Coagulation, aerobic process, activated sludge system, trickling filters, anaerobic process), Tertiary treatments, Advanced wastewater treatments (Ion-exchange, Adsorption, Electrodialysis etc.) and reuse of wastewater, Industrial effluent treatment systems, Reactors and bioreactors for water treatment.

UNIT - IV :**Solid Waste Management and Treatment Technologies :**

Types of Solid wastes (Municipal solid waste, Industrial solid waste etc.), Determination of composition of solid wastes, Integrated solid waste management - Planning for integrated waste management, Operation of solid waste management system, landfills, pyrolysis, composting, bio-fertilizers, Plastic wastes, Recycling technologies and Biodegradability.

UNIT - V :**Hazardous Waste Management and Treatment Technologies:**

Definition and classification of hazardous waste, Sources of hazardous wastes Storage, collection and disposal/treatment of hazardous wastes, Heavy metal waste, its impact and remediation, Nuclear Wastes, Characteristics and management of nuclear wastes, Biomedical and Chemical Wastes Biomedical waste, Types, management and handling, control of biomedical wastes, E-wastes. Hazardous wastes from industries and their management.

Text Books:

1. Environmental Science, Botkin and Keller, Wiley publications
2. Environmental Chemistry, Stanley E. Manahan, CRC Press
3. Water and Wastewater Technology, Mark J. Hammer and Mark J. Hammer Jr., PHI learning Pvt. Ltd
4. Solid and Hazardous Waste Management, S. C. Bhatia, Atlantic Publishers and Distributers (P) Ltd

Reference Books:

5. Essential Environment: The science behind the stories, Withgott and Laposata, Pearson publishers.
6. Environmental Chemistry: Green Chemistry and Pollutants in Environment, Lichtfouse, Eric, Schwarzbauer, Jan, Robert, Didier (Eds.), Springer-Verlag Berlin Heidelberg
7. Water and Waste water Engineering: Design principles and practice Mackenzie L. Davis. Mcgraw Hill publication.
8. Wastewater Engineering: Treatment and Reuse Metcalf and Eddy, Tata Mcgraw Hill publication
9. Sustainable Solid Waste Management: A Systems Engineering Approach, Chang and Pires, Wiley.