



ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

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TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr' 2022

PRE-REQUISITES : Basic chemistry - Class XII

INTENDED AUDIENCE : Masters degree students of any of the Civil Engineering, Chemical Engineering Environmental Engineering, Mining Engineering, Geology and Geophysics, and Bioengineering/Biotechnology

INDUSTRIES APPLICABLE TO : Environmental consulting firms, Coal India, Thermal power plants

COURSE OUTLINE :

The objective of the course is to provide students with basic concepts from environmental chemistry and microbiology for understanding and solving environmental problems. Major topics that will be covered in environmental chemistry are: review of basic concepts in chemistry, concept of chemical equilibria, equilibrium constants and activity, reaction kinetics, acid and basis, polyprotic acids and bases, acidity, alkalinity, carbonate system, pH-Ct, buffers, and solubility reactions, nuclear chemistry, nitrogen chemistry and chlorination. Major topics that will be covered in environmental microbiology are: Introduction, the bacteria, the fungi, the algae, protozoa and other higher forms, viruses, pathogens and disease, microbial growth and enumeration, control of microorganisms, microbial diversity and metabolic pathways for remediating contaminated water, solid and hazardous waste, and soil.

ABOUT INSTRUCTOR :

Prof. Anjali Pal did her M.Sc & PhD from Calcutta University in Chemistry and at present teaching as a full professor in the Department of Civil Engineering, Indian Institute of Technology, Kharagpur. Prof. Pal is actively engaged in teaching and research in the field of Environmental Engineering and Science. She has published more than 215 research papers and received International Hall of Fame award (USA), R & D 100 award (USA) for her contribution in the field of pollution monitoring. Her Convention Award from the Indian Chemical Society is for her independent contribution to organic chemistry. Her research interest includes adsorption, advanced oxidation processes (AOPs), catalysis and spectroscopy. She has developed a number of new methods for trace detection / determination of pollutants. She has visited many countries like USA, UK, Japan, France, Taiwan etc. as a visiting professor.

Prof. Sudha Goel did her B.E. (1990) in Environmental Engineering from L.D. College of Engineering, Gujarat University, Ahmedabad and M.S.E. (1992) and Ph.D. (1997) in Environmental Engineering from The Johns Hopkins University (JHU), Baltimore, US. She is currently Associate Professor, Department of Civil Engineering and School of Environmental Science and Engineering, IIT Kharagpur. She has been teaching Environmental Microbiology and some aspects of Environmental chemistry regularly since 2004. Her research interests include Water quality and treatment, and Solid and Hazardous Waste Management. She developed a web-based course 'Water and Wastewater Engineering' and wrote a textbook of the same name. She has several publications, taught several courses, and guided students at all levels in their research work.

COURSE PLAN :

Week 1: Concepts of acids, bases and salts, strengths of acids and bases, buffers, acid-base indicators, choice of indicators

Week 2: Concept of chemical equilibrium, solubility and solubility product, activity, Le Chatelier principle

Week 3: Reaction kinetics, rate and order of a reaction, determination of order

Week 4: Reaction mechanism, rate determining step, catalysts, activation energy

Week 5: Radioactivity and nuclear chemistry

Week 6: Nitrogen chemistry and chlorination

Week 7: Introduction and overview of environmental applications; major groups of microbes: bacteria, fungi, algae, protozoa and virus.

Week 8: Cell chemistry, biology and microscopy

Week 9: Microbial Metabolism

Week 10: Microbial Growth and Control

Week 11: Pathogens and diseases, metabolic diversity-1

Week 12: Metabolic Diversity-2 and Biogeochemical Cycles