

PAPER: CHEM 1008E

Environmental and Green Chemistry

Total Marks: 50 (Theory 35 + Internal Assessment 15)

Credits: 02

Unit – I: Environmental Chemistry (Credit – 01)

Concept and scope of environmental chemistry, Environmental terminology and nomenclatures, Environmental segments, Ozone depletion, The green-house effect and Global warming, El-Nino phenomenon. Micro-organism in aquatic chemical reactions, Eutrophication, Re-cycle of waste-water in process industry, Treatment of sewage and reuse of water in industry and agriculture, microbiologically mediated redox reactions and Nitrogen transformation by bacteria. Water pollutants: Water-quality parameters and standards: physical and chemical parameters (colour, odour, taste and turbidity, DO, BOD, COD etc.); industrial and waste-water treatment; Chemical hazards, chemical disasters, pollution of environment-man made, industrial, natural disasters, environmental biochemistry, toxicological chemistry; analysis of water and waste water, solid wastes and air pollution-Photochemical smog, Auto exhausts, Acid-rains, Air-quality standards. Toxic chemicals in the environments, Impact of toxic chemicals on enzymes, Biochemical effects of arsenic, cadmium, lead, mercury, carbon monoxide, nitrogen oxides, sulphur oxides, ozone, PAN, cyanide, pesticides, insecticides and carcinogens.

Unit – II: Green Chemistry (Credit – 01)

Definition, Concepts and basic principles of green chemistry, need of green chemistry, green chemistry as an alternative tool for reducing pollution, atom economy, less hazardous chemical syntheses, atom economy in rearrangements, addition and pericyclic reactions, less hazardous chemical syntheses, designing safer chemicals, safer solvents and auxiliaries, design for energy efficiency, Green synthesis, clean routes, supercritical solvents, ionic liquids, green catalyst, auto-exhaust catalyst and clean technology. Development of new methods for organic synthesis such as Green Synthesis: use of sonochemistry, use of ionic liquids, use of microwaves, biocatalysis. Selection of solvent: i) Aqueous phase reactions ii) Reactions in ionic liquids iii) Solid supported synthesis iv) Solvent free reactions, Green catalysts: i) Phase transfer catalysts (PTC) and ii) Biocatalysts. Microwave and Ultrasound assisted green synthesis: Aldol condensation, Cannizzaro reaction, Diels-Alder reactions, Strecker synthesis, Williamson synthesis and Dieckmann condensation.

Book Suggested:

1. *Handbook of Environmental chemistry*, Springer-Verlag, O. Hutzinger.
2. M. Bernhard, F.E. Brinckman & P.J. Sadler, *The Importance of Chemical Speciation in Environmental Processes*, Springer-Verlag,
3. L.J. Frishten, & L.W. Gay, *Environmental Instrumentation*, Springer-Verlag,.
4. Real World Cases in *Green Chemistry*, ACS, M.C. Cann & M.E. Connelly.
5. P.T. Anastas and T.C. Williamson, *Green Chemistry: Designing Chemistry for Environment*, ACS,
6. *Green separation processes, methods and application*, Fonso, National Scientific Book Agency, Delhi-110053.
7. G.W. Vanloon, S.J. Duffer, *Environmental Chemistry - A Global Perspective*, (2000) Oxford University Press.
8. F.W. Fifield and W.P.J. Hairens, *Environmental Analytical Chemistry*, 2nd Edition (2000), Black Well Science Ltd.
9. Colin Baird, *Environmental Chemistry*, (1995) W.H. Freeman and Company, New York.
10. A.K. De, *Environmental Chemistry*, 4th Edition (2000), New Age International Private Ltd., New Delhi.
11. Peter O. Warner, *Analysis of Air Pollutants*, 1st Edition (1996), John Wiley, New York.
12. S.M. Khopkar, *Environmental Pollution Analysis*, 1st Edition (1993), Wiley Eastern Ltd., New Delhi.
13. S.K. Banerji, *Environmental Chemistry*, 1st Edition (1993), Prentice-Hall of India, New

PAPER: CHEM 1006E
Environmental and Green Chemistry
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Unit – II: Green Chemistry (Credit – 01)

Definition, Concepts and basic principles of green chemistry, need of green chemistry, green chemistry as an alternative tool for reducing pollution, atom economy, less hazardous chemical syntheses, atom economy in rearrangements, addition and pericyclic reactions, less hazardous chemical syntheses, designing safer chemicals, safer solvents and auxiliaries, design for energy efficiency, Green synthesis, clean routes, supercritical solvents, ionic liquids, green catalyst, auto-exhaust catalyst and clean technology. Development of new methods for organic synthesis such as Green Synthesis: use of sonochemistry, use of ionic liquids, use of microwaves, bio-catalysis. Selection of solvent: i) Aqueous phase reactions ii) Reactions in ionic liquids iii) Solid supported synthesis iv) Solvent free reactions, Green catalysts: i) Phase transfer catalysts (PTC) and ii) Biocatalysts. Microwave and Ultrasound assisted green synthesis: Aldol condensation, Cannizzaro reaction, Diels-Alder reactions, Strecker synthesis, Williamson synthesis and Dieckmann condensation.

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