Bachelors with Chemistry as Major/Minor
5th Semester

Title of the course: Environmental &Green Chemistry

Course Code:CHM522J/N1 **Credits:**Theory-3, Lab-1

Theory (3 credits: 45 Hours) **Max. Marks**: 75, **Min Marks:**27

Course Objectives:

To impart understanding of Chemistry in Environment and green chemistry principles and applications.

Learning outcomes:

- The students will acquire knowledge of:
  1. Principles of green chemistry.
- 2. Alternative reaction conditions and their applications.
- 3. Designing greener processes.
- 4. Chemistry of environmental segments.
- 5. Chemistry, monitoring and control of environmental contaminants.
- 6. Chemistry behind treatment applications.

UNIT I: Environmental Chemistry **(15 hours)**

Segments of Environment; Biogeochemical cycles (C, N and P); Macro and Micronutrients in Soil. Acid--Base and Ion exchange reactions in Soil.Factors determining composition of water bodies (thermal stratification, acid-base, pE concept). Water quality parameters: Dissolved oxygen, Metals, Content of Chloride, Phosphate and Nitrate.Vertical profile of atmosphere, Chemical and Photochemical Reactions in Atmosphere, Photochemical Smog formation, Green House Effect; Acid Rain: chemistry and control.

UNIT-II Green Chemistry **(15 hours)**

Need for Green Chemistry and the role of chemists. Principles of Green Chemistry. E-Factor. Tools of Green Chemistry: Selection of starting materials, Catalysts, Alternative Solvents: Supercritical fluids, ScO_2, H_2O, Ionic Liquids, Appropriate reagents, atom economy.

Alternative energy sources: Microwaves, Sonication, Mechanical and Visible light. Chemicals from Renewable Raw Materials: Ethanol, Biodiesel, Ethylene glycol, andGlycerol.

Unit-III Applied Environmental and Green Chemistry **(15 hours)**

Analytical Methods for determining BOD, COD, and metals (As, Cd, Hg, Pb & Se), Continuous monitoring methods for determination of gaseous contaminants(SOx, NOx and Hydrocarbons). Water treatment and Purification methods (Chlorination, Ozonation, UV radiation)

Comparative account of reactions carried under normal and green conditions: Aldol condensation, Baeyer-Villiger Oxidation, Diel-Alder and Benzoin Condensation reaction.

Books recommended

1. Green Chemistry and Catalysis; Roger Arthur Sheldon, Isabel Arends, Wiley-VCH, **2007.**
2. Green Chemistry- An Introductory Text; IIndEdn.; Mike Lancaster; RSC; **2010.**
3. Green Chemistry- Theory and Practice; P. T. Anastas and J. C. Warner; oxford; **2000**.
4. Green Chemistry –Environmentally Benign Reactions; V.K.Ahluwalia, 2nd Edition, **2012**
5. Green Chemistry, RashmiSanghi and M MSrivastava; **2003** 1st Edition.
6. Environmental Chemistry; Nigel.J.Bunce; Wurez Publishers; 1991.
7. Environmental Chemistry; 2nd edn; Colin Baird; Freeman &Co; 1991.
8. Environmental Chemistry; A.K.De; Wiley Eastern;1995.
9 Environmental Chemistry; S.E.Manahan (6th /7th /8th/9thEdns); LewisPublishers

Practical (1 credits: 30 Hours) Max. Marks: 25, Min Marks:9

1. Aldol condensation using water as a green solvent and comparison of yield and time with the reaction using conventional solvent.
2. Claisen-Schmidt condensation using grinding technique under solvent free conditions.
3. Photochemical cycloaddition reaction of Anthracene and Maleic anhydride.
4. Determine the Chemical Oxygen demand of a water sample.

Books recommended

1. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
2. Comprehensive Practical Organic Chemistry: Qualitative analysis Ahluwalia, V.K. &Sunita Dhingra; Universities Press, India, 2004.
3. Advanced Practical Organic Chemistry; N. K. Vishnoi; 3rd Edn; Vikas Publishing, 2009.
4. Green Chemistry and Catalysis; Roger Arthur Sheldon, Isabel Arends, Wiley-VCH, **2007.**
5. Green Chemistry- An Introductory Text; IIndEdn.; Mike Lancaster; RSC; **2010.**
6. Green Chemistry –Environmentally Benign Reactions; V.K.Ahluwalia, 2nd Edition, **2012**