BACHELORS WITH CHEMISTRY AS MAJOR

5th SEMESTER

CHM522J1: CHEMISTRY _ ENVIRONMENTAL & GREEN CHEMISTRY

CREDITS: THEORY-3, LAB-1

THEORY (3 CREDITS: 45 HOURS)

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, and Glycerol.

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)

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; 3rdEdn; 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**