Course Title: Green Chemistry

Course Code: CH-820

Credit Hours: 3-0

Prerequisite: Nil

Course Objectives

To improve comprehension of students about Green Chemistry so they are able to

- Evaluate chemical feedstocks, reagents, reaction conditions and design syntheses of target molecules to reduce toxicity and environmental impact according to the principles of green chemistry
- Calculate atom economy of a chemical reaction and compare it with the chemical yield
- Assess the replacement of volatile organic solvents with green alternative solvents
- Describe applications for supercritical fluids, solventless processes, solid supported reagents and aqueous solvent systems
- Propose suitable catalysts for oxidations using oxygen or hydrogen peroxide and zeolites for acid-catalysis.

Course Outcomes

After successful completion of this course students will be able to

- Explain how to design safer chemicals and processes
- Recognize how to reduce environmental persistence

Course Contents

Introduction: Twelve Principles of Green Chemistry along with their applications for Sustainable Development. **Green Solvents:** Solvent-free Systems, Supercritical Fluids, Ionic Liquids and Other green solvents. **Green Catalysis:** Types of green catalyst, Greener Lewis Acids. **Green Synthesis:** Atom Economic Reactions, Atom Un-economic Reactions. **Measuring Green Performance:** Life Cycle Assessment, Green Process Metrics, Synthetic Efficiency and Overall Process Quality. **Green Chemical Products:** Eco-Friendly chemical Products and Green energy chemical Resources. **Green Techniques in Chemistry:** Microwave-assisted Reaction, Sonication-assisted reaction, Electrochemical Synthesis. **Industrial Case Studies:** A greener anthrosphere through Industrial ecology, Greening of various Industries.

Recommended Books

1. Green Chemistry Fundamentals and Applications by Suresh C. Ameta and

Rakshit Ameta, CRC Press Taylor & Francis Group, 2013, ISBN 13:978-1-4665-7826-5

2. Green Chemistry: An Introductory Text by Mike Lancaster, Royal Society of Chemistry, 2002, ISBN 0-85404-620-8
3. Green Chemistry Metrics A Guide to Determining and Evaluating Process Greenness by Andrew P. Dicks and Andrei Hent, Springer Publisher, 2015, ISBN 978-3-319-10500-0
4. Handbook of Green Chemistry and Technology by James Clark and Duncan Macquarrie Blackwell Science Ltd, 2002, ISBN 0-632-05715-7
5. Problem-Solving Exercises in Green and Sustainable Chemistry by Albert S. Matlack and Andrew P. Dicks, CRC Press Taylor & Francis Group, 2016, ISBN 13: 978-1-4822-5258-3