

BS Chemistry Semester-III					
Programme	BS Chemistry	Course Code	Chem-291L	Credit Hours	1
Course Title	Green Chemistry Laboratory		Course Type	Major Elective	
Course Introduction					
<p>Green Chemistry Laboratory course is designed to teach students the tools and strategies to improve the chemical reaction and process using the principles of green chemistry. Students will conduct experiments that emphasize sustainable practices, such as reducing waste, using safer solvents and reagents, and improving process efficiency. The laboratory sessions will also focus on evaluating the environmental impact of various chemical processes and developing innovative solutions.</p> <p>The course contents are provided below.</p> <p>Overview of laboratory safety and green chemistry principles. Solvent free green synthesis of coumarin (Knoevenagel/Pechmann/ suitable condensation reaction). Synthesis of quaternary ammonium salts. Recycling of renewable waste (use of hair/feather waste for keratin extraction or any suitable recycling experiment). Green synthesis of metal or metal oxide nanoparticles of Ag/Cu/Zn. Reduction of dyes using green reducing agents. Heterogeneous catalysis for oxime formation.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ol style="list-style-type: none">1. Identify the tools and strategies to improve the chemical reaction and process using the principles of green chemistry.2. Explain how the practice of green chemistry enhances competitiveness, innovation and faster time to market, while addressing critical ethical and sustainability issues.3. Students will be aware of the social, ecological and economic dimensions with responsibility of the profession of chemist.					
Course Content			Assignments/Readings		
Week 1	Overview of laboratory safety and green chemistry principles		Related reading		
Week 2	Solvent free green synthesis of coumarin (Knoevenagel/Pechmann/ suitable condensation reaction)		Related reading		
Week 3	Solvent free green synthesis of coumarin (Knoevenagel/Pechmann/ suitable condensation reaction)		Related reading		
Week 4	Synthesis of quaternary ammonium salts		Related reading		
Week 5	Synthesis of quaternary ammonium salts		Related reading		
Week 6	Recycling of renewable waste (use of hair/feather waste for keratin extraction or any suitable recycling experiment)		Related reading		
Week 7	Recycling of renewable waste (use of hair/feather waste for keratin extraction or any suitable recycling experiment)		Related reading		
Week 8	Mid-term Examination				
Week 9	Green synthesis of metal or metal oxide		Related reading		

	nanoparticles of Ag/Cu/Zn	
Week 10	Green synthesis of metal or metal oxide nanoparticles of Ag/Cu/Zn	Related reading
Week 11	Green synthesis of metal or metal oxide nanoparticles of Ag/Cu/Zn	Related reading
Week 12	Reduction of dyes using green reducing agents	Related reading
Week 13	Reduction of dyes using green reducing agents	Related reading
Week 14	Heterogeneous catalysis for oxime formation	Related reading
Week 15	Heterogeneous catalysis for oxime formation	Related reading
Week 16	Final term Examination	

Textbooks and Reading Material

1. Sally A. Henrie, (2015), *Green Chemistry-Laboratory Manual for General Chemistry*, Taylor & Francis CRC Press.
2. Syed Kazim Moosvi, Waseem Gulzar Naqash, Mohd. Hanief Najar, (2021), *Green Chemistry Principles and Designing of Green Synthesis*, De Gruyter publishers.
3. P. Anastas and P. Trevorrow, (2013), *Handbook of Green Chemistry, Green Processes, Designing Safer Chemicals*, Wiley Publishers.
4. A. Lapkin and D. Constable, (2008), *Green Chemistry Metrics: Measuring and Monitoring Sustainable Processes*, Wiley Publishers.
5. Anastas, Paul T, and John C Warner (2000), *Green Chemistry: Theory and Practice*, Oxford Academic Press.

Teaching Learning Strategies

Class lecture method, which includes seminars, discussions, assignments and projects. Audio-visual tools will be used where necessary

Assignments: Types and Number with Calendar

1. Written Task
2. Presentation
3. Tutorials
4. Solving related exercises

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.