

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM

PART-A: Introduction			
Program: Bachelor in Science <i>(Certificate / Diploma / Degree)</i>		Semester - II/IV/V/VI	Session: 2024-2025
1	Course Code	CHSEC	
2	Course Title	GREEN CHEMISTRY	
3	Course Type	SEC	
4	Pre-requisite(if, any)	<i>As per Program</i>	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ <i>Understand needs, goals, and obstacles in green chemistry.</i> ➤ <i>Understand and application of twelve principles of chemistry.</i> ➤ <i>Design green solvents and green reactions.</i> ➤ <i>To interpret and execute case study, survey, and projects on Green Chemistry.</i> 	
6	Credit Value	2 Credits (1C + 1C)	<i>Credit = 15 Hours –Theoretical learning and = 30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max.Marks:50	Min Passing Marks:20
PART -B: Content of the Course			
Total No.of Teaching–learning Periods: Theory–15 Periods (15 Hrs.) and Lab. or Field learning/Training 30Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Theory Contents	<p>Introduction to Green Chemistry: What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry.</p> <p>Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following:</p> <ul style="list-style-type: none"> • Designing a Green Synthesis using these principles; Prevention of Waste/ by products; maximum incorporation of the materials used in the process into the final products, Atom Economy, addition, substitution, and elimination reactions. • Prevention/ minimization of hazardous/ toxic products reducing toxicity, and risks (hazard × exposure); waste or pollution prevention hierarchy. • Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents. <p>Future Trends in Green Chemistry: Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; Green chemistry in sustainable development.</p>		15
Lab./Field Training Contents	<ul style="list-style-type: none"> • Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis). • Microwave assisted reactions in water: Hofmann elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction. • Right fit pigment: synthetic azo pigments to replace toxic organic and inorganic pigments. • An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn. 		30

	Case study/Project Case study/Project on Green chemistry, Role of green chemistry in lab safety, and implications of green chemistry.	
Keywords	<i>Green chemistry, Green synthesis, Green solvents, Green reactions, principles of Green chemistry, Hofmann elimination, Diels-Alder reaction, oxidation, and reduction.</i>	

Signature of Convener & Members (CBoS):

PART-C: Learning Resources

Text Books, Reference Books and Others

Textbooks Recommended-

1. Ahluwalia, V.K. (2013). *Green chemistry: A textbook.* Alpha Science International.
2. Shukla, S., Gulati, S., & Batra, S.K. (2020). *A textbook of green chemistry: benign by design.* Shree kala Prakashan.
3. Kumar, V. (2013). *An introduction to green chemistry.* Vishal publishing Co.
4. Lancaster, M. (2020). *Green chemistry: an introductory text.* Royal society of chemistry.

Reference books Recommended:

1. Perosa, A., & Zecchini, F. (2007). *Methods and reagents for green chemistry: an introduction.* John Wiley & Sons.
2. Clark, J. H., & Macquarrie, D. J. (Eds.). (2008). *Handbook of green chemistry and technology.* John Wiley & Sons.
3. Ameta, S. C., & Ameta, R. (Eds.). (2023). *Green Chemistry: Fundamentals and Applications.* CRC press.
4. Anastas, P. T. (Ed.). (2013). *Handbook of green chemistry (Vol. 1).* Wiley-VCH.

Online Resources- e-Resources / e-books and e-learning portals

- https://www.mygreenlab.org/uploads/2/1/9/4/21945752/gc_-_green_chem_guide-beyond_benign_my_green_lab.pdf
- <https://www.organic-chemistry.org/topics/green-chemistry.shtm>
- <https://royalsocietypublishing.org/doi/10.1098/rsos.191378>
- <https://www.gvsu.edu/labsafety/green-chemistry-99.htm>

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment(CIA):15 Marks

End Semester Exam(ESE): 35Marks

Continuous Internal Assessment(CIA): (By Course Coordinator)	Internal Test / Quiz-(2): 10 & 10	Better marks out of the two Test / Quiz +obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance- 05 Total Marks -15	
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment	
	A. Performed the Task based on learned skill - 20 Marks	Managed by Coordinator as per skilling
	B. Spotting based on tools (written) - 10 Marks	
C. Viva-voce (based on principle/technology) - 05 Marks		

Name and Signature of Convener & Members of CBoS:

Indira, K. L., A. K., K. S., A. S., S. S., S. S.