Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Science College
Semester-5 (B.Sc)

Subject: Green Chemistry- BSCCM15317

Type of course: Minor

Prerequisite: Basic understanding of Green chemistry principles, sustainable design

Rationale: This course covers Green chemistry, organic chemistry, and biochemistry, focusing on understanding chemical processes in the environment and living organisms. Students learn to identify, address pollution, sustainability issues and introduced to green chemistry principles for environmentally friendly practices.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				SEE		CCE			
CI	T	P	C	Theory	Practical	MSE	LWA/V	ALA	
4	0	0	4	100	00	30	00	70	200

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; MSE- Mid Semester Examination; LWA - Lab Work Assessment; V – Viva voce; CCE-Continuous and Comprehensive Evaluation; ALA- Active Learning Activities.

4 Credits * 25 Marks = 100 Marks (each credit carries 25 Marks) Theory
SEE 100 Marks will be converted in to 50 Marks
CCE 100 Marks will be converted in to 50 Marks

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Course Content:

Unit No	Course Content	Hrs	% Weightage
1	**Basics of Green Chemistry:** What is Green Chemistry?, Goals of Green Chemistry, Limitations/Obstacles of Green Chemistry, Definition and concepts of green chemistry, sustainable consumption of resources, small-scale composting pits for biodegradable waste.	15	25%
2	**Principles of Green Chemistry:** Twelve principles of Green Chemistry with their explanations and examples, Designing a Green Synthesis using these principles, Selection of Starting Materials , Use of Protecting Groups, Use of Catalyst, Products Designed Should be Biodegradable, Designing of manufacturing Plants, Strengthening of Analytical Techniques	15	25%
3	**Applications of Green Catalysts:** Green catalysts-acid catalyst, basic catalyst, oxidation catalysts, polymer supported catalysts, photocatalyst, green synthesis-phase transfer catalyst, green synthesis of polycarbonates, paracetamol, ibuprofen, citral, urethane, adipic acid and styrene	15	25%
4	**Prevention of Hazardous Chemicals:** Prevention of Waste/By-Products, Atom-economy: Rearrangement Reactions ,Addition Reactions , Substitution Reactions , Elimination Reactions ,Minimization of Hazardous Products ,Designing Safer Chemicals ,Energy Requirements for Synthesis , Selection of Appropriate Solvent ,Selection of Starting Materials ,Use of Protecting Groups ,Use of Catalyst , Products Designed Should be Biodegradable	15	25%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Green Chemistry in Daily Life** Ask students to research and present examples of green chemistry in household products, like cleaning agents or biodegradable plastics. Students will prepare a report and upload it on GMIU Web Portal.	10

2	**Green Chemistry Poster Presentation** Students will create a poster presenting one of the 12 principles of Green Chemistry with examples and real-life applications. They will Prepare their poster and upload on GMIU Web Portal.	10
3	**Life cycle Analysis (LCA):** Faculty will introduce the concept of life cycle Analysis on a common product like a plastic bottle, electric car battery or a cleaning product. Students will evaluate green chemistry alternatives and prepare a script and upload on GMIU Portal	10
4	**Case Study on Green Chemistry in Industry** Assign students a case study on a company or industry that has successfully implemented Green Chemistry. Students will prepare a review paper and upload on GMIU Web Portal.	10
5	**Chemical Process Analysis** Divide students into small groups and assign each group a real-world case study of a chemical process that was improved using green chemistry principles. Analyze them and upload notes on GMIU Portal.	10
6	**Green Chemistry Debate** Organize a debate where students argue for or against a particular green chemistry concept. Prepare summary and upload them on GMIU portal.	10
7	**Attendance**	10
Total		70

Suggested Specification table with Marks (Theory):75

Distribution of Theory Marks **(Revised Bloom's Taxonomy)**						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	30%	40%	30%	00	00	00

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Understand basics of green chemistry.
CO2	Grasp the core concepts of green chemistry, including the 12 principles.
CO3	Gain an awareness of the impact of chemistry on the environment, society, development, and the role of green chemistry in addressing environmental challenges.
CO4	Develop the importance of sustainability and how green chemistry can contribute to a more sustainable future.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
From the content 10% topics are suggested for flipped mode instruction.
Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory
The internal evaluation will be done on the basis of Active Learning Assignment
Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] New Trends in Green Chemistry by V.K. Ahluwalia, M. Kidwai Second Edition, 2004.
[2] "Green Chemistry" theory and practice, P. T. Anastas and J. C. Warner, New York Oxford university press, 1998
[3] J .A. Hyatt, Liquid and Supercooled Carbon Dioxide as Organic Solvents, J. Am. Chern.
[4] V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry.