

ELECTIVE PAPER-C: GREEN CHEMISTRY

Semester	Subject Code	Category	Instruction Hours						Credits
			Lecture		Theory		Practical		
			Per Week	Per Semester	Per Week	Per Semester	Per Week	Per Semester	
I	21CPCH1Db	Elective	3	45	3	45	0	0	3

COURSE OBJECTIVES

- ❖ To understand the green chemistry strategies for designing the chemical synthesis.
- ❖ To make the students knowledgeable about solvent - free synthesis, ultrasound and microwave assisted green synthesis

COURSE OUTCOME

- On completion of the course, the student should be able to:

CO Number	CO statement	Knowledge level
CO1	Gain knowledge about the basic principles and designing of safer chemicals to produce biodegradable products	K2 & K3
CO2	Get clear idea about the solvent - free green synthesis, ultrasound and microwave assisted green synthesis	K3 & K4
CO3	Understand polymer supported catalytic reactions and ionic liquids as green solvents in synthesizing various products	K3 & K4
CO4	Acquire knowledge about the phase transfer catalysis in green synthesis	K2 & K3
CO5	Gain clear knowledge about industrial case studies such as reverse tanning, vegetable tanning and chrome tanning	K3 & K4

* CO-Course Outcomes

Knowledge level K1-Remember; K2-Understand; K3-Apply; K4-Analyze

MAPPING WITH PROGRAM OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	M	M
CO2	S	S	M	M	S	M
CO3	M	S	S	M	S	M
CO4	M	S	S	M	S	M
CO5	M	M	S	S	S	S

UNIT- I: BASIC PRINCIPLES OF GREEN CHEMISTRY**9 hours**

Basic principles - prevention of waste/by-products, maximum incorporation of the reactants (starting materials and reagents) into the final product, prevention or 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 and products designed should be biodegradable.

UNIT- II: ULTRASOUND AND MICROWAVE ASSISTED GREEN SYNTHESIS**9 Hours**

Ultrasound: Introduction, instrumentation, the phenomenon of cavitation - Sonochemical esterification, substitution, addition, alkylation, oxidation, reduction and coupling reactions - Microwaves: Introduction, concept, reaction vessel/ medium, specific effects, atom efficiency (% atom utilization), advantages and limitations - N-alkylation and alkylation of active methylene compounds and Diels –Alder reactions. Reactions in water and reaction in organic solvents - Solvent - free reactions and deprotection of esters.

UNIT- III: IONIC-LIQUIDS AS GREEN SOLVENTS**9 hours**

Introduction - structure, synthesis and applications of some important ionic liquids in organic synthesis - Polymer supported reagents in green synthesis - Introduction - properties and advantages of polymer supported reagents and choice of polymers - Substrate covalently bound to the support - Synthesis of oligosaccharides - intramolecular cyclisation - Selective chemical reactions on one aldehyde group of symmetrical aldehydes - Asymmetric synthesis - Reagent linked to a polymeric material - Preparation of sulfonazide polymer and application in diazotransfer reaction - Synthesis of polymer bound per acid and its applications - synthesis of polystyrene tin dichloride resin and its applications - Polymer supported catalytic reactions - Preparation of polymer supported AlCl_3 and applications - polymer supported photosensitizers.

UNIT- IV: PHASE TRANSFER CATALYSIS IN GREEN SYNTHESIS**9 hours**

Introduction - mechanism of phase transfer catalyst reaction - types and advantages of phase transfer catalyst - types and applications of phase transfer reaction - Nitriles from alkyl or acyl halides, alkyl fluorides, alcohols, azides from alkyl halides - generation of dichlorocarbenes

- addition to olefins - elimination reaction - alkylation reactions - Williamson synthesis - Benzoin condensation - Darzen reaction - Michael reaction - Wittig reaction - oxidation under PTC condition and reduction.

UNIT-V: INDUSTRIAL CASE STUDIES

9 hours

Methyl Methacrylate (MMA) - Greening of Acetic acid manufacture - Vitamin-C - Leather manufacture -Types of Leather- Difference between Hide and Skin - Tanning – Reverse tanning - Vegetable tanning - Chrome tanning - Fat liquoring – Dyeing – Application - Polyethylene-Ziegler Natta Catalysis - Metallocene Catalysis - Ecofriendly Pesticides and Insecticides.

Distribution of marks : Theory -100%

TEXT BOOKS

S.No	Authors	Title	Publishers	Year of publication
1.	V.K.Ahluwalia and M. Kidwai	New Trends in Green Chemistry	II Edn., Anamaya publishers New Delhi	2007
2.	Mike Lancaster	Green Chemistry and Introductory text	II Edition	2002
3.	V. K. Ahluwalia and R. Aggarwal, Narosa	Organic Synthesis, Special Techniques	New Delhi	2003
4.	Mike Lancaster	Green Chemistry – an introduction text	Royal Society of Chemistry, UK	2002
5.	W. B. Weber, G. W. Gokel, Springer, Berlin,.	Phase Transfer Catalysis in Organic Synthesis	Springer	1977

REFERENCES BOOKS

S.No	Authors	Title	Publishers	Year of publication
1.	R. Sanghi and M. Srivastava	Green Chemistry - Environment Friendly Alternatives	New Delhi	2003
2.	P. T. Anastas and J. C. Warner	Green Chemistry - Theory and Practice	Oxford University press. Oxford	1988
3.	N. K. Mathur, C. K. Narang and R. E. Williams	Polymers as Aids in Organic Synthesis	Academic Press, NY	1980
4.	E. V. Dehmlov, S. S. Dehmlov	Phase Transfer Catalysis	2 nd Edn., Verlagchemie, Wienhein	1983

TEACHING METHODOLOGY:

- Board and chalk
- PowerPoint presentation
- Models
- Group discussion
- Seminar and Assignments
- Animated videos

SYLLABUS DESIGNERS:

1. Dr. T. Gomathi, Assistant Professor, Department of Chemistry
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