

GUJARAT TECHNOLOGICAL UNIVERSITY

B.Pharm
SEMESTER: VII

Subject Name: Green Chemistry

Subject Code: 2270012

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	Theory		Practical	
				External	Internal	External	Internal
3	0	0	3	80	20	0	0

Sr No	Course Contents	Total Hrs
1.	Introduction to Green Chemistry: • Definition. • Need for Green Chemistry & eco efficiency. • Goals of Green Chemistry. • Limitations/Obstacles in the pursuit of the goals of Green Chemistry. • Twelve principles of Green Chemistry with their explanations and examples. • Inception of Green Chemistry. • Designing a green synthesis – Prevention of waste / byproducts – Atom economy. • Awards for Green Chemistry & international organizations promoting green chemistry	10
2.	Designing Green Synthesis • Designing and choice of starting materials/solvents/reagents • Bio catalysts • Polymer Supported Catalysts • Green solvents, solvent less processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy • Avoidance of unnecessary derivatization • Careful use of blocking/protecting groups & use of catalytic reagents • Microwave-assisted organic synthesis (MAOS)	15
3.	Green Reactions: • Green Synthesis of the following compounds: adipic acid, catechol, BHT, 4-aminodiphenylamine, benzyl bromide, acetaldehyde, citral, ibuprofen, paracetamol, • Microwave assisted reactions in water: ○ Hofmann Elimination, ○ Hydrolysis (of benzyl chloride, benzamide, n-phenyl benzamide) ○ Oxidation (of toluene, alcohols). ○ Fries rearrangement, ○ Claisen Rearrangement, ○ Diels Alder Reaction, ○ Decarboxylation. ○ Microwave assisted solid state reactions: Deacetylation, Saponification of esters ○ Reductions:, synthesis of nitriles from aldehydes; anhydrides from dicarboxylic	15

	acid • Ultrasound assisted reactions: Esterification, saponification, substitution reactions, Alkylations, oxidation, reduction, coupling reaction, Cannizaro reaction, Strecker synthesis, Reformatsky reaction.	
4.	Future Trends in Green Chemistry • Oxidation reagents and catalysts; Biomimetic, multifunctional reagents. • Combinatorial Green Chemistry. • Proliferation of solventless reactions. • Noncovalent Derivatization & Green Chemistry Applications. • Green chemistry in sustainable development	5

Reference Books:

1. M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).
2. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
3. P.T. Anastas & J.K. Warner: Oxford Green Chemistry- Theory and Practical, University Press (1998).
4. A.S. Matlack: Introduction to Green Chemistry, Marcel Deckkar, (2001).
5. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).