



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Branch: Green Technology and Sustainability Engineering

Course/Subject Code: 3174407

Course/Subject Name: Green Product Design

W. E. F. Academic Year:	2024-25
Semester:	VII th
Category of the Course:	Professional Elective

Prerequisite:	Basic Science
Rationale:	The objective of this course is to study the importance and the underlying principles of green and sustainable technology towards green product design by considering environmental conditions. Also, the concept of hazardous waste utilization, under rule-9, is included to understand the need of green product development by utilizing hazardous waste and thereby reducing the environmental pollution load.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Understand the principles of green chemistry in green product design
02	Understand green product design and environmentally acceptable
03	Understand the life cycle analysis of product
04	Understand the applications of green product design for various domains
05	Understand hazardous waste handling under rule-9 and green laws compliance

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/ Practical		
				ESE (E)	PA/ CA (M)	PA/CA (I)	ESE (V)	
3	0	0	3	70	30	0	0	100

Course Content:

Unit No.	Content	No. of Hours	%of Weightage
1.	Concept of green chemistry and product design for sustainability The twelve principles of green chemistry and green engineering, safe	08	18

	product and process design, design for degradation, real-time analysis for pollution prevention, inherently safer chemistry for accident prevention.		
2.	Understanding green product design and environmentally acceptable Green product design definition, product strategy, material selection, resource use, production requirements and planning for the final disposition (recycling, reuse, or disposal) of a product, environmental load of product, environmentally compatible materials, design of unit operations for pollution prevention, economics of pollution prevention, sustainable process and product design.	09	20
3.	Approach to life cycle analysis of product Life cycle analysis, life cycle inventory, general issues in inventory analysis, issues applicable to specific life cycle stages, raw material acquisition stage, manufacturing stage, use/reuse/maintenance stage, recycle/waste management stage.	09	20
4.	Applications of green product design in various domains Applications of green product design in chemical industries, medical and pharmaceutical industries, food and beverages industries, consumer products industries, cosmetics, packaging, computers, automobiles and electronics industries.	10	22
5.	Hazardous waste handling under rule-9 and green laws compliance Understanding of rule-9 for utilization of hazardous waste, SOP preparation for utilization of hazardous waste under rule-9, case studies of products/processes design to utilize hazardous waste under rule-9, International laws on product take-back and its impact, ISO 14000.	09	20
Total		45	100

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	15	15	10

Where R: Remember, U: Understanding, A: Application, N: Analyze, E: Evaluate, C: Create (as per Revised Bloom's Taxonomy)

Reference Books:

1. Green Chemistry – An introductory text - M. Lancaster, RSC
2. Green chemistry metrics, Alexi Lapkin and David Constable (Eds) , Wiley publications
3. Environmental chemistry, Stanley E Manahan, Lewis Publishers
4. Handbook on life cycle assessment : Operational guide to the ISO standards, Kluwer Academic Publishers
5. Ciambrone , D.F., Environmental life cycle analysis, CRC Press
6. Fiksel, Joseph, ed. Design for Environment: Creating eco-efficient products and processes. New York: McGraw- Hill
7. Green technology and design for the environment Billatos, Samir B. and Nadia A. Basaly.

8. Unit operations and processes in environmental engineering- Tom D Reynolds – PWS Publishing
9. Introduction to environmental engineering - P. Arne Veslind- Cengage learning
10. Environmental engineering - Joseph A. Salvato–wiley.

List Learning Resources Required:

Students can refer to video lectures available on the websites including NPTEL

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