GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: Under Graduate
Branch: Plastics Engineering
Subject Code: BE03053021
Subject Name: Biodegradable & Compostable Polymers

w. e. f. Academic Year:	2024-25
Semester:	3
Category of the Course:	PCC

Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes
01	Understand the theory behind Bio Polymers
02	Understand the importance and applications of Bio Polymers

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	TH		ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	0	30	45	120	04	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Introduction:** Chemistry and biochemistry of polymer degradation – Enzymes chemical degradation initiates biodegradation – Hydrolysis of synthetic biodegradable polymers. Starch filled plastic – thermoplastic starch – starch based materials in the market – other additives for biodegradation.	07	15
2.	**Photo-biodegradable plastics** – need for degradable polymers – technical requirements of degradable polymers – Agricultural plastics – Packaging plastics – Control of biodegradation by means of antioxidants	07	15
3.	**Test methods and standards for bio-degradable plastics** – Criteria used in evaluation of biodegradable plastics – Description of current test methods – Scanning test for ready biodegradability – Test for inherent biodegradability – Test for simulation studies – Other methods for assessing polymer biodegradability	09	15
4.	**Recycling technology for biodegradable plastics** – Conventional recycling – Degradable complicate recycling – reprocessing polyethylene	06	15

	starch/film scrap – Economics in inplant recycling		
5.	**Compostable polymer materials** – definitions, Composting, Anaerobic digestion (AD), Soil biodegradation, structures and methods of preparation, Properties and applications, Thermal and thermooxidative degradation, Composting methods and legislation, Biodegradation, Biodegradable vs compostable	07	20
6.	**Biodegradability testing** of compostable polymer materials under laboratory conditions, Biodegradation of compostable polymer materials under real conditions, Biodegradation of compostable polymers in various environments, Environmental impact of compostable polymer materials	09	20
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	20	25	20	15	05

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

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.

References/Suggested Learning Resources:

(a) Books:

1. G.J.L. Griffin, Chemistry and Technology of Biodegradable Polymers, Blackie Academic Professional, 1994
2. Gerald Scott & Dan Gilad, Degradable Polymers-Principles & Applications, Chapman & Hall, 1995
3. Handbook of Biodegradable polymers – Abraham J. Domb, Joseph Kost & David M. Wiseman
4. Polymer Photodegradation – Mechanism and experimental methods – Jain F. Rabek
5. Compostable Polymeric Materials book by Ewa Rudnik, 2019
6. Compostable Polymers and Nanocomposites — A Big Chance for Planet Earth by Gity Mir Mohamad Sadeghi and Sayaf Mahsa

(b) Open source software and website:

Suggested Course Practical List: If any
Practical based on above topics.

1. To synthesize Bio Polymer from Soyabean oil
2. Preparation of Starch based plastic materials in laboratory
3. Processing of Bio Plastics
4. Processing of Bio Composites
5. To carry out tests for measuring biodegradation in Polymers.
6. To Carry out the DSC test for Bio Plastics
7. Surface Analysis of Bio Plastics and Composites using SEM.
8. Surface Analysis using TEM
9. FTIR Test for Bio Plastics
10. Manufacture of Bio Degradabale Plastic Films

Design based Problems (DP)/Open Ended Problem:

1. To Manufacture artificial Heart Valves in BIOPLASTICS
2. To manufacture artificial organsin Bio Plastics
3. To design and build knee replacements in Bio plastics

- **List of suggested activities for Problem Based Learning:**

S.N.	Self Learning Activity
1	MOOCS courses
2	College Library
3	Digital Library
4	National Digital Library of India
5	Society of Plastic Engineering (SPE) Digital Library
6	One Nation One Subscription (ONOS) for Journal Papers

- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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