GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3162316
Semester – VI
Subject Name: Bioplastics

Type of course: Open Elective

Prerequisite:

Rationale:.Now-a-days there is a problem of disposal of waste plastics. It makes make compulsion to think about increase use of bio plastic. At the end of this course the students will able to know the most relevant bio plastics from renewable and non-renewable origin. They will be able to understand the biodegradation behaviour and apply the principle ecotoxicological aspects in the biodegradation process of polymers. It also takes into consideration aspects related to the biodegradation of bio plastics in different environments and the related standards and showingtheir use in helping to solve specific solid waste problems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction Definition of biopolymers, biodegradable polymers, Classification of biodegradable polymers, biobased plastics, Advantages of biopolymers.	3
2	**Degradation of polymers – Mechanisms and Evaluation Methods** Introduction, Defining Biodegradability,Mechanisms of Polymer Degradation-Non-biological Degradation of Polymers and its types like Thermal degradation, Mechanical Degradation, Degradation by Ultrasonic Waves, Photo degradation, Degradation by High-Energy Radiation, Oxidative Degradation and Hydrolytic Degradation. Biological Degradation of Polymers-Enzymic Hydrolysis, Enzymic Oxidation. Measuring Biodegradation of Polymers- Enzyme assays, Plate test, Respiratory test, Natural environment, Field trial, Gas evolution test, Factors Affecting Biodegradability:	8
3	Types of Biodegradable Polymers Bio based polymers, Starch based polymers, Cellulose based polymers, Chitin and Chitosan, Bacterial Polyesters, Synthetic Biodegradable Polymers, Polymers from Bio-Based Monomers	7
4	**Biodegradation Behaviour of Polymers in Liquid Environments** Introduction**,** Degradation in Real Liquid Environments,Degradation in Laboratory Tests	8

	Simulating Real Aquatic Environments,Degradation in Laboratory Tests with Optimised and Defined Liquid Media,Standard Tests for Biodegradable Polymers Using Liquid Media,	
5	**Biodegradation Behaviour of Polymers in the Soil** Introduction,How Polymers Reach Soil,The Soil Environment-Surface factors, Underground factors,Degradability of Polymers in Soil, Effects of Biodegradable Polymers on Soil Living Organisms	6
6	**Ecotoxicological Aspects in the Biodegradation Process of Polymers** Need of Ecotoxicity Analysis for Biodegradable Materials, Introduction to Ecotoxicology, Recommendations and Standard Procedures for Biotests, Special prerequisites to Be Considered When Applying Bioassays for Biodegradable Polymers,	5
7	**General Characteristics, Processability, Industrial Applications and Market Evolution of Biodegradable Polymers** General Characteristics:Polymer Biodegradation Mechanisms,Polymer Molecular Size, Structure and Chemical Composition etc Processability:Extrusion,Film Blowing and casting,Moulding,Fibre spinning Industrial Applications:Loose-Fill Packaging,Compost Bags,other application Market Evolution	5

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**25**	**15**	**10**	**3**	**2**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (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.

Reference Books:

1. Handbook of Biodegradable Polymers :CatiaBastioli

2. Biopolymers and biomaterials:Padinjakkara, Aneesa Souza, Fernando Gomes Thankappan,

3. Introduction to Bioplastics Engineering :Ashter, Syed Ali (z-lib.org)

4. Plastic Materials: J. A. Brydson

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Course Outcomes:

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the basic characteristic and advantages of bio plastics.	10
CO-2	Compare the degradation Mechanisms and Evaluation Methods of polymers.	20
CO-3	Identify various bioplastics and its applications.	25
CO-4	Acquire knowledge about Biodegradation Behaviors of Polymers.	25
CO-5	Apply the knowledge of processing of bioplastics for manufacturing various products.	20

List of Experiments: - As per the syllabus topics

Major Equipment:

List of Open Source Software/learning website:

i. https://www.nptel.com