

# GUJARAT TECHNOLOGICAL UNIVERSITY

## PLASTIC TECHNOLOGY (24)

BIOPOLYMERS

SUBJECT CODE: 2722412

SEMESTER: II

**Type of course:** Elective

**Prerequisite:**

**Rationale:**

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

### Content:

Sr. No.	Content	Total Hrs	% Weightage
<b>1</b>	<b>Unit I</b> Biopolymers- Definition, Importance, Classification, Biodegradable & Compostable polymers Polymers derived from renewable resources, Oils and fats of plant and animal origin, Hydroxylation (ring opening) of vegetable oil, vegetable oil as feedstock for Polyurethane polymers, properties and applications of botanically derived polymers.	<b>5</b>	10
<b>2</b>	<b>Unit II</b> Polynucleotides [DNA, RNA]; Polypeptides [Collagen, Keratin, elastin etc.]; Structural hierarchy and its importance Present scenario of Biopolymer based industries in India and Abroad Cellulose: Wood and other cellulose sources, Cellulose isolation, Use of native Cellulose, Cellulose properties, Dissolution of Cellulose, Use of regenerated Cellulose Hemicelluloses: Sources and different chemical structures of hemicelluloses, Chemical derivatives of hemicelluloses, Properties and use of hemicelluloses and their derivatives,	<b>10</b>	30
<b>3</b>	<b>Unit III:</b> Actual market importance and future chances Chitin & Chitosan: Chemical structure, Sources and extraction of chitin, Extraction and characterization, Physico-chemical properties, Chemical modifications, Functional properties and applications- Film & coating applications Production, Chemistry & Properties of Polylactides, Production methods for Polylactides, Polycondensation of Lactic acid, solvent assisted polycondensation, chain extension of lactic acid based polymers, ring opening polymerisation, Properties & applications of PLA blends	<b>10</b>	20
<b>4</b>	<b>Unit IV:</b>		

	Production, Chemistry & Properties of Poly hydroxyalkanoates, synthesis-bacterial biosynthesis of polyhydroxyalkanoates , Production by genetically modified bacteria Chemical synthesis , Properties & applications of polyhydroxyalkanoates blends Poly caprolactone Natural fibres as fillers / reinforcements in thermoplastics, fibre content, type of coupling, high fibre filled composites, Starch-Polymer composites,	10	20
5	<b>Unit V:</b> Thermoplastic starch, Creep and dynamic mechanical properties, water absorption, recycling and reprocessing, accelerated environment tests. Production technologies for Biopolymers, Extrusion and compounding, Injection moulding, other processing methods, additives, organic recycling compared to mechanical recycling Food packaging applications of Biobased films, specifications, safety, edible films & coatings. Environmental Impact of biopolymers: Biomedical applications of biopolymers	5	20

### Reference Books :

1. Biodegradable Polymers for Industrial Applications : Ray Smith
2. Renewable Resources for Functional Polymers and Biomaterials : Park, Wiley Publ
3. Biopolymers : R.M. Johnson, L.Y. Mwaikambo and N. Tucker
4. Green Composites : Polymer Composites & the environment : Caroline Bathe,CRC
5. Polymeric Biomaterials : Severian Dumitriu, CRC Press
6. Low Environment Impact Polymers ,Nick Tucker & mark Johnson, RAPRA Technology Ltd
7. Biopolymers : R.M. Johnson, L.Y. Mwaikambo and N. Tucker
8. Polymers as Biomaterials : Shalby .E.Shalby, Plenum Press
9. Biopolymers – New materials for Sustainable Films and Coatings. Editor. David Plunkett, Wiley

### Course Outcomes:

### List of Experiments:

### Open Ended Problems:

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.