GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Under Graduate

Branch: Plastics Engineering

Subject Code: BE04053051

Subject Name: Environmental Impact of Plastics

w. e. f. Academic Year:	2024-25
Semester:	4
Category of the Course:	Basic Science Course

Prerequisite:	• Basic knowledge of chemical structures, bonding, polymers and reactions. • Familiarity with polymer properties. • Understand of pollution types and waste management systems.
Rationale:	Plastics are essential materials, but their persistent waste and pollution create major environmental challenges. This course introduces students to the science, impacts and life-cycle considerations of plastics, enabling them to evaluate environmental risks and explore sustainable solutions. By integrating principles of environmental engineering and materials science, the course prepares future engineers to design responsible systems for plastic use, management and mitigation.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Analyse the chemical and physical properties of different plastics and their implications for environmental persistence.
02	Evaluate the environmental impacts of plastics, including pollution, ecosystem disruption and human health risks.
03	Apply life cycle assessment and other quantitative tools to assess plastic use, disposal and sustainability.
04	Identify and propose strategies for plastic waste management, recycling and alternative materials.
05	Develop solutions and recommendations that integrate engineering, environmental and policy perspectives to minimize the ecological footprint of plastics.

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	15	00	30	90	03	70	30	20	30	0	150

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

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Introduction to Plastics and Environmental Concerns:** Overview of plastics – types, production and applications, historical development and global consumption trends, environmental issues related to plastics, plastic pollution in terrestrial and aquatic ecosystems.	5	10
2.	**Chemistry and Properties of Plastics:** Polymer chemistry – structure, bonding, and types of polymers, physical and chemical properties relevant to environmental behavior, biodegradable vs. non-biodegradable plastics, additives, fillers and their environmental effects.	8	15
3.	**Environmental Impact of Plastics:** Plastic degradation – physical, chemical and biological processes, microplastics and nanoplastics – sources, transport and impacts, effects on soil, water, air and living organisms, human health implications.	10	25
4.	**Assessment and Management Strategies:** Life Cycle Assessment (LCA) of plastics, plastic waste management techniques – reduction, reuse, recycling and recovery, landfills, incineration and composting of plastics, policy frameworks and regulations on plastic management.	12	25
5.	**Sustainable Alternatives and Future Directions:** Bioplastics and biodegradable polymers, circular economy approaches for plastics, innovations in material design and waste-to-resource technologies, case studies and practical solutions for mitigating plastic pollution.	10	25
	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**
20	25	10	5	5	5

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

References/Suggested Learning Resources:

(a) Books:

1) Plastic Waste and Recycling by T. M. Letcher.
2) Plastic Pollution: Challenges and Green Solutions by M. Goel and N. G. Tripathi.
3) Environmental Hazards of Plastic Wastes by J. Zdarta, R. T. Kapoor and H. Treichel.
4) Plastics and the Environment by A. L. Andrady.
5) Plastics and the Environment by R. M. Harrison and R. E. Hester.

(b) Open source software and website:

1) https://nptel.ac.in/

Suggested Course Practical List: NIL

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

S. No.	Activity	No. of Hours	Total Hours Claimed	Evaluation Criteria
1	Industry / Research laboratory visit	Visit = 5 h, Report preparation = 5 h	10	Based on report submitted
2	Poster / chart / power point preparation on technical topics	Duration = 10 h	10	Based on Poster / Chart / PPT preparation and presentation skills
3	Assignment writing	5 assignments of 2 h each	10	Based on the assignment submitted
4	Technical Video based learning related to the subject	Duration of video = 5 h Report preparation = 5 h	10	Report / presentation based on the video learning outcomes
5	Group Discussion on emerging / trending technical topics based on subject	Duration = 1 h each	-	Based on performance in group discussion, technical depth, knowledge, etc.
6	Attending Expert Lecture / Webinar / Seminar	Duration = 1 h each	-	Based on Short report
7	Self-learning on-line course	Minimum duration of the course should be 10 h	10	Examination based assessment at the end of course. Based on the certificate produced
8	Exhibition / Conference / Trade Fair / Industrial exposure for 2-3 days	Visit = 15 h, Report preparation = 5 h	20	Based on learning, observations and short report
9	Working model on technical topics	Working = 15 h	15	Based on design, understanding & presentation of the model

10	Non-working model on technical topics	Non-working = 5 h	5	Based on design, understanding & presentation of the model
11	Videos on Industrial safety aspects based on subject	Duration of video = 5 h Report preparation = 5 h	10	Based on report submitted

- Above activities are suggestive, faculty can choose any of these activities and cover up the rest of the 30 Self Learning Hours.
- The number of hours is suggestive.
- Faculty can sub-divide the number of hours based on the activity. However, the total number of hours is fixed.

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