# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Engineering**

**Level: UG**

**Branch: Plastic Technology**

**Subject Code: BE04023041**

**Subject Name : Thermoplastics Materials**

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

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|---|---|
| **Prerequisite:** | Students should be having the knowledge and understanding of the chemical composition, structure, and functional groups of monomers and polymers. Since polymers are large, complex molecules. knowledge of polymerization methods (addition and condensation) is essential for understanding how thermoplastics are created. |
| **Rationale:** | This course provides technical knowledge which help students in understanding the properties, processing, applications and manufacturing of commodity and engineering thermoplastic materials. Since the use of thermoplastic products is extended from consumer goods to critical components in aerospace and medical devices, this course fills the gap and provides knowledge of their properties, processing, and applications essential for future engineers. |

**Course Outcome:**

After Completion of the Course, Student will able to:

| No | Course Outcomes |
|---|---|
| 01 | List the basic characteristics of Thermoplastic Materials and compare their properties with Thermoset Materials. |
| 02 | Identify and write the structure of different Thermoplastic Materials and analyze their basic properties based on their structures. |
| 03 | Explain the monomer preparation and preparation of various commodity and engineering thermoplastic materials. |
| 04 | Understand the properties and applications of different commodity and engineering thermoplastic materials and apply knowledge of these properties to select materials for specific applications. |

**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 | 00 | 00 | 45 | 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:<br>Basic characteristics of Thermoplastic Molding materials. -Structures of various commodity and engineering thermoplastic materials | 4 | 10 |
| 2. | Monomer Preparation:<br>Styrene, Vinyl chloride, Bisphenol-A, Methyl methacrylate, Ethylene glycol, Terephthalic acid, 1,4-Butanediol, Dimethyl terephthalate | 5 | 10 |
| 3. | Manufacturing of Commodity Plastic Materials like:<br>Polyethylene: High Density Polyethylene, Low Density Polyethylene & Linear Low Density Polyethylene)<br>Polypropylene<br>Poly Vinyl Chloride<br>Polystyrene<br>Poly Methyl Methacrylate | 10 | 20 |
| 4. | Properties, applications and processing characteristics of:<br>Polyethylene:High Density Polyethylene, Low Density Polyethylene &Linear Low DensityPolyethylene)<br>Polypropylene<br>Poly Vinyl Chloride<br>Polystyrene<br>Poly Methyl Methacrylate, Poly acrylonitrile, Poly Vinyl acetate, Poly Vinyl Alcohol, Ethylene Vinyl Acetate, Ethylene Vinyl Alcohol, Cellulose Acetate | 10 | 25 |
| 5. | Manufacturing of Engineering Plastic Materials like:<br>Nylon 6 & Nylon 66<br>Polycarbonate<br>Polyacetal<br>Polyethylene terephthalate<br>Polybutylene terephthalate | 8 | 15 |

| | | | |
|---|---|---|---|
| 6. | Properties, applications and processing characteristics of:<br>Nylon<br>Polycarbonate<br>Polyacetal<br>Polyethylene terephthalate<br>Polybutylene terephthalate<br>Acrylonitrile Butadiene Styrene,<br>High Impact Polystyrene<br>Styrene Acrylonitrile | 8 | 20 |
| | **Total** | **45** | **100** |

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| **R Level** | **U Level** | **A Level** | **N Level** | **E Level** | **C Level** |
| 15 | 25 | 15 | 10 | 5 | 0 |

**Suggested Specification Table with Marks (Theory):**

*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 Materials by J.A.Brydson
2) Plastics: Materials and Processing by A.Brent Strong
3) Plastics Materials & Processes by Sidney H.Goodman
4) Shreve's Chemical Process Industries by George Austin
5) Plastics Technology Handbook by Manas Chanda, Salil K. Roy

**(b) Open source software and website:**

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

**Suggested Course Practical List: If any**

Practical based on above topics.

- **Problem Based Learning Activities:**

| Sr. No. | Activity | No. of hours | Total hours claimed | Evaluation Criteria |
|---|---|---|---|---|
| 1 | Industry/Research laboratory visit | Visit = 5h,<br>Report preparation = 5h | 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 2h each. | 10 | Based on the assignment submitted. |
| 4 | Technical Video based learning related to the subject | Duration of video = 5h<br>Report preparation = 5h | 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- 1hr each | -- | Based on Short report |
| 7 | Self-learning on-line course | Minimum duration of the course should be 10h. | 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 hr<br>Report preparation- 5 hr | 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 = 5h<br>Report preparation = 5h | 10 | Based on report submitted |

Above activities are suggestive, faculty can choose any of these activities and cover up the rest of the 45 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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