



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3172313

Semester – VII

Subject Name: Speciality Plastics and Applications

Type of course: Professional Core Course

Prerequisite: NA

Rationale: At the end of the course, the student will understand various specialty plastics and their applications. They will understand the importance and characteristics of specialty plastics. They will also understand requirements and applications various plastics used in medical device applications and various special applications.

Teaching and Examination Scheme:

| Teaching Scheme | | | Credits C | Examination Marks | | | | Total Marks |
|-----------------|---|---|--------------|-------------------|---------|-----------------|----|----------------|
| L | T | P | | Theory Marks | | Practical Marks | | |
| | | | ESE (E) | PA (M) | ESE (V) | PA (I) | | |
| 3 | 0 | 0 | 3 | 70 | 30 | 00 | 00 | 100 |

Content:

| Sr. No. | Content | Total Hrs |
|---------|---|--------------|
| 1. | HIGH PERFORMANCE PLASTICS <ul style="list-style-type: none">- Introduction- Structure, Properties and applications of High performance plastics like Polytetrafluoroethylene, Polychlorotrifluoroethylene, Polyetheretherketone, Polyphynelene sulfone, Polysulfones, Polyphynelene ether, Polyether sulfone, Polyamide imide, Polyether imide, | 8 |
| 2. | PLASTICS USED IN MEDICAL DEVICE APPLICATIONS: <ul style="list-style-type: none">- Material Requirements for Plastics used in Medical Devices<ul style="list-style-type: none">● Introduction,● Material Characterization,● Sterilization,● Chemical Resistance,● Biocompatibility,● USP Class VI, ISO 10993,● Shelf Life and Aging & Joining and Welding.- Polymer Additives for Medical Device Applications<ul style="list-style-type: none">● Introduction,● Types of Additives,● Things to Consider When Using Additives, Plasticizers, Wear-Resistant and Lubricious Additives, Pigments, Laser Marking, Radiopaque Additives, Antimicrobials, Conductive Fillers, Nanoadditives & Stabilizers. | 10 |



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|----|--|----|
| | <ul style="list-style-type: none"> • Applications of commodity plastics like PVC, Polyolefins and Polystyrene in Medical Devices • Applications of engineering thermoplastics like Acrylic, PC, PU, Polyamides in Medical Devices • Applications of high performance thermoplastics like Polysulfones, Polyetherimides, Polyphenylene Sulfones, Fluoropolymers | |
| 3. | <p>USE OF PLASTICS IN SPECIAL APPLICATIONS-I</p> <p>-High Temperature and Fire-Resistant Polymers - Liquid Crystal Polymers - Electroactive Polymers:</p> <ul style="list-style-type: none"> • Filled polymers and inherently conductive polymers and their applications like Rechargeable batteries, Electrochromic devices, Sensors, Microelectronics, Electrostatic discharge protection • Photoconductive polymers • Polymers in Fibre optics • Piezo- and Pyroelectric Polymers and its applications <p>-Polymers in Optical information storage - Polymers in adhesives: Solvent based adhesives, water based adhesives, hot melt adhesives, radiation-curable adhesives</p> | 12 |
| 4. | <p>USE OF PLASTICS IN SPECIAL APPLICATIONS-II</p> <p>-Degradable polymers, Applications of Degradable polymers: Packaging, medical and related applications (controlled release agents and tissue engineering) - Synthetic Polymer Membranes: Membrane Preparation, Applications -Hydrogels -Shape memory polymers -Microencapsulation and its applications -Polymer Nanocomposites - Ionic Polymers:</p> <ul style="list-style-type: none"> • Physical properties and applications: Ionic crosslinking, Ion exchange, hydrophilicity • Ionomers: Polyethylene Ionomers, | 12 |

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 |
| 20 | 25 | 10 | 10 | 3 | 2 |

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)



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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. Plastic Materials by J.A.Brydson
2. Plastic Technology Handbook by Manas Chanda
3. Plastics: Materials and Processing by A.Brent Strong
4. Plastics in Medical Devices: Properties Requirements and Applications by Vinny Sastri

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 | List the basic characteristics of High Performance Plastics | 10 |
| CO-2 | Draw the structure and describe the properties and applications of High Performance plastic materials. | 25 |
| CO-3 | Discuss the importance of plastics used in medical devices and list their applications | 20 |
| CO-4 | Discuss the importance of use of plastics used in special applications | 20 |
| CO-5 | Explain the characteristics of plastics used in Special applications | 25 |

List of Experiments: - As per the syllabus topics

List of Open Source Software/learning website:

1. nptel.ac.in
2. bpf.co.uk