

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

PLASTIC MATERIALS-I (Code: 3332304)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	3 rd Semester

1. RATIONALE

The course deals with structures, properties & applications of plastic materials prepared by various polymerization techniques and compounding. The course will help students to understand uses of plastic materials for various applications in different industries as well as replacement of other engineering materials. It will also help to understand advance plastic materials and plastic product design in future.

2. COMPETENCY (Programme Outcome according to NBA Terminology):

The course should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Select the relevant plastic materials to produce specified plastic product**

3. Teaching and Examination Scheme

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit ESE - End Semester Examination; PA - Progressive Assessment.

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Rheology	1a. Distinguish different types of plastic flow	1.1 Basics of plastic flow, Types of flow, Newtonian, Non-Newtonian, Pseudo-plastic, Dilatants, Bingham.
	1b. Understand rheology of material by model demonstration	1.2 Rheological properties, Temperature viscosity relation, Maxwell's Model
Unit– II Thermo Plastics	2a. Classify thermoplastic materials 2b. Co-relate structure and properties of thermoplastic material 2c. List applications of thermoplastic	2.1 Structure, properties and applications of the following Thermoplastic material a. Olefins: Polyethylene(LDPE,HDPE), Polypropylene (PP) b. Vinyls : Polyvinyl chloride (PVC), Polyvinyl acetate(PVAc), Polyvinyl alcohol(PVA) c. Styrenics: Polystyrene, Styrene acrylonitrile(SAN), Acrylonitrile butadiene styrene(ABS) d. Acrylics :Polymethyl methacrylate (PMMA), Polyacrylo nitrile(PAN) e. Cellulosics: Cellulose nitrate(CN), Cellulose acetate (CA)
Unit– III Thermo Sets	3a. Classify thermo set materials 3b. Co-relate structure and properties of thermo set material 3c. List applications of thermo sets	3.1 Structure, properties and applications of following Thermo set material a. Phenol formaldehyde(PF) b. Melamine formaldehyde(MF) c. Urea formaldehyde(UF) d. Epoxy e. Silicones f. Polyesters g. Furan h. Polyurethane resin(PUR) i. Diallyl phthalate(DAP)
Unit – IV Engineering Plastics	4a. Classify thermo engineering plastic materials 4b. Compare properties of various engineering plastic material 4c. List applications of engineering plastic	4.1 Structure, properties and applications of following engineering plastic materials: a. Polyamides(nylon-6,6-6,6-12) b. Polytetrafluoroethylene(PTFE) c. Polyesters(PET,PBT) d. Polyurethane resin(PUR) e. Acetal(POM) f. Polycarbonate(PC)
Unit – V High Performance and Heat	5a. Classify High performance and heat resistant polymers	5.1 Introduction, Structure, properties and applications of following High performance and heat resistant polymers: a. Polyetherketones(PEK)

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Resistant Polymers	5b. Compare properties of various High performance and heat resistant polymers 5c. List applications of High performance and heat resistant polymers	b. Polyetheretherketones(PEEK) c. Polyethersulfone(PES) d. Polyphenyl sulfone(PPS) e. Polyphenylene Oxide(PPO) f. Polyvinyl dichloride(PVDC)
Unit – VI Compounding	6a. Explain necessity of compounding	6.1 Introduction of compounding, Significance
	6b. Explain function of additives	6.2 Additives, Types, Function
	6c. Describe compounding equipments	6.3 Compounding equipments, Constructional detail, Process, High speed mixer, Ribbon mixer, Ban burry mixer, Two roll mill

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level I	U Level I	A Level I	Total Marks
1.	Rheology	04	02	04	00	06
2.	Thermo Plastics	12	10	05	03	18
3.	Thermo Sets	08	08	03	03	14
4.	Engineering Plastics	08	08	03	03	14
5.	High Performance and Heat Resistant Polymers	06	05	03	02	10
6.	Compounding	04	02	03	03	08
	Total	42	35	21	14	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised 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.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical Exercise/Experiment (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx Hours Required
1	I	Demonstrate Maxwell's model	04
2	II	Perform identification tests of high density polyethylene(HDPE)	02
3		Perform identification tests of Polystyrene(PS)	02
4	III	Perform identification tests of Epoxy	02
5		Perform identification tests of Urea formaldehyde(UF)	02
6	IV	Perform identification tests of Polycarbonate(PC)	02
7		Perform identification tests of Polyester	02
8	V	Perform identification tests of Polyphenyl sulfone(PPS)	02
9		Perform identification tests of Polyphenylene Oxide(PPO)	02
10	VI	Perform compounding of Polyvinyl chloride(PVC)	04
11		Perform compounding of Polypropylene(PP)	04
Total			28

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will collect different plastic raw materials as well as moulded products and would comment on their quality.
- ii. Students will collect information related to the experiment through internet.
- iii. Students will visit nearby plastic raw material suppliers shop.

8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Demonstration of samples of different type of materials in the class while teaching about the concerned material.
- ii. Mini projects to students about comparison of different type of materials.

9. SUGGESTED LEARNING ACTIVITIES

A. List of Books

Sr. No.	Title of Book	Author	Publication
1.	Plastics Material	J. A. Brydson	Butterworth-Heinemann 1982
2.	Plastics Material and Processes	S. S. Schwartz	
3.	Engineering Polymer source book	Margolis	
4.	PVC compounding	Swan	
5.	PVC compounding	Tittow	
6.	PVC compounding	A. S. Athaley	

B. List of Major Equipment/ Instrument

- i. Burner (Bunsen Burner)
- ii. Test tube (10 ML)
- iii. Beaker (250 ML)
- iv. Titration sets (Burette 50ML; Pipette 10ML.)
- v. High speed mixer
- vi. Ribbon mixer
- vii. Ban burry mixer
- viii. Two roll mill

C. List of Software/Learning Websites

- i. <http://www.curbellplastics.com/technical-resources/pdf/plastic-material-selection.pdf>
- ii. http://www.okw.co.uk/technical/Material_Specs.pdf
- iii. <http://faculty.ksu.edu.sa/othman/CHE498/General%20Properties%20of%20Plastics.pdf>

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, Govt. polytechnic, Chhotaudepur

Co-ordinator and Faculty Members from NITTTR Bhopal

- **Dr. Anju Rawley**, Professor, Dept. of Applied Sciences,
- **Dr. Abhilash Thakur**, Associate Professor, Dept. of Applied Sciences