

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN PLASTIC ENGINEERING

**TEACHING SCHEME ( w.e.f.18<sup>th</sup> July,'11)**

### SEMESTER- VII

Sr. No	SUBJECT CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	
1	361905	Industrial Management	3	0	0	3
2	372301	Plastic Product Design	3	0	0	5
3	372302	Extrusion Die Design	3	0	4	5
4	372303	High Performance and Green Plastics	3	0	0	3
5	372304	Blow and Thermoforming Mould Design	3	0	4	7
6	372305	Advance Fabrication Techniques	3	0	4	7
		<b>TOTAL</b>	<b>18</b>	<b>0</b>	<b>12</b>	<b>30</b>

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**DIPLOMA IN MECHANICAL ENGINEERING**  
**SEMESTER- VI**

Subject Code : 361905

Subject Name: INDUSTRIAL MANAGEMENT.

<b>Sr. No.</b>	<b>Subject Content</b>	<b>Hrs.</b>
<b>1</b>	<p><b>1.0 INTRODUCTION TO INDUSTRIAL MANAGEMENT.</b></p> <p>1.1 Know the objectives of learning this subject.            1.2 Need, Scope &amp; importance of Industrial Management in Industries.            1.3 Need of attitude, knowledge &amp; skill required for application of Industrial Management.            1.4 System- concept , definition, types, parameters , variables and behavior.            1.5 Management – definition and functions.            1.6 Features and need of various laws , regulations and acts such as factory act , minimum wages act , etc.</p>	<b>4</b>
<b>2</b>	<p><b>2.0 ORGANISATION STRUCTURE AND ORGANISATIONAL DYNAMICS.</b></p> <p>2.1 Organisation structure-definition, goals, factors considered in formulating structure.            2.2 Concept, meaning and importance of division of labor, scalar &amp; functional processes, span of control, delegation of authority, centralisation and decentralisation in industrial management.            2.3 Types, advantages, disadvantages and applications of organisation structure.            2.4 Organisational culture and climate –meaning , differences and factors affecting them.            2.5 Moral-factors affecting moral.            2.6 Relationship between moral and productivity.            2.7 Effect of high and low moral.            2.8 Job satisfaction- factors influencing job satisfaction.            2.9 Case study and analysis of any two related situations.</p>	<b>8</b>
<b>3</b>	<p><b>3.0 MATERIALS MANAGEMENT .</b></p> <p>3.1 Material management-definition, functions, importance, relationship with other departments.            3.2 Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department.</p>	<b>12</b>

	<p>3.3 Storekeeping- functions , classification of stores as centralised and decentralised with their advantages, disadvantages and application in actual practice.</p> <p>3.4 Functions of store keeper, types of records maintained by store, various types and applications of storage equipments, need and general methods for codification of stores.</p> <p>3.5 Definition of inventory control, objectives of inventory control, derivation for expression for Economic Order Quantity (EOQ), ABC analysis, other modern methods of analysis, various types of inventory models such as Willson’s inventory model, replenishment model and two bin model.</p> <p>3.6 Material Requirement Planning(MRP)-concept ,applications and brief details about software packages available in market.</p> <p>3.7 Waste control- need and ways to reduce material wastage, recycle/reuse,</p> <p>3.8 Case study and analysis-study and analyse any two related cases. Note : Examples (2 to 3) from 3.5 above(application type) of 8-10 marks out of total 70.</p>	
4	<p><b>4.0 PRODUCTION, PLANNING AND CONTROL (PPC):</b></p> <p>4.1 PPC-meaning, phases, importance and objectives.</p> <p>4.2 Explain in detail the functions of PPC along with necessary forms used in it, softwares available in market and their features.</p> <p>4.3 Types of productions, calculation of Economic Batch Quantity (EBQ), critical ratio scheduling and Gantt charts.</p> <p>4.4 Given the data, schedule the production using Gantt chart.</p> <p>Note : Example from 4.3 above(application type) of 4-6 marks out of total 70.</p>	6
5	<p><b>5.0 CRITICAL PATH METHO AND PRE EVALUATION REVIEW TECHNIQUE (CPM/PERT).</b></p> <p>5.1 CPM &amp; PERT-meaning, features, difference, applications.</p> <p>5.2 Understand different terms used in network diagram.</p> <p>5.3 Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.</p> <p>5.4 Determination of critical path on network.</p> <p>5.5 Floats, its types and determination of floats.</p> <p>5.6 Crashing of network, updating and its applications. Note : Examples (1 to 2-application types) of 8-10 marks out of total 70.</p>	8
6	<p><b>6.0 VALUE ANALYSIS (VA) :</b></p>	4

	6.1 VA-definition, terms used, process, importance and methods. 6.2 VA flow diagram. 6.3 Case study and analysis of any three related cases which can be studied/analysed under VA application. Note : Question/s (application type) of 4-6 marks out of total 70.	
	<b>Total</b>	<b>42</b>

**Notes:**

**A. FOR STUDENTS.**

- a. It is advised that student download this copy of syllabus and plan to achieve the objectives of learning this subject.

**B. FOR PAPER SETTER/MODERATOR.**

- a. Refer GTU syllabus and do not take reference of previous TEB question papers.
- b. Ask the questions from each topic having marks weightage proportionate to hours allotted to that topic.
- c. Optional questions must be asked from the same topic. That is weightage of compulsory attendance part of questions will be equal to proportionate to hours allotted to each topic.
- d. Marks ratio of knowledge: comprehension: application types questions must be 30:30:40 respectively.
- e. Submit solution / answer keys along with distribution of marks in each question for the paper being submitted.

**Reference Books:**

- |  |              |
|--|--------------|
| 1. System Analysis                           | O.Optner     |
| 2. Learning Package on Industrial Management | TTTI, Bhopal |
| 3. What every supervisor should know         | Lester R.    |
| 4. CPM & PERT principles and Applications    | L.S.Srinath  |
| 5. Modern Production Management              | Buffa        |
| 6. Materials Management                      | N. Nair      |
| 7. Value Analysis                            | Mikes        |
| 8. Industrial Engineering & Management       | O. P. Khanna |

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN PLASTIC ENGINEERING

### SEMESTER- VII

Subject Code : 372301

Subject Name: Plastic Product Design

<b>Sr. No.</b>	<b>Subject Content</b>	<b>Hrs.</b>
1	Introduction  1.1 Basic concept of product design 1.2 Factors affecting product design	2
2	Product design considerations 2.1 Preliminary design considerations 2.2 General design considerations 2.2.1 Product Shape 2.2.2 Product Reinforcement 2.2.3 Product Application Enhancement 2.2.4 Product and Mold Considerations 2.2.5 Aesthetic Value Improvement	10
3	Material Selection 3.1 General concept of material selection 3.2 Short term & long term properties 3.3 Rating of material by property comparison	6
4	Process Selection 4.1 General concept of process selection 4.2 Features of different processes with respect to product design	6

5	Product Design with specialized properties 5.1 Specialized properties of different plastics materials 5.2 Products with specialized properties and suitable material	6
6	Product design and machine performance 6.1 Inter-relation of machine performance and product design 6.2 Limitations of machines	4
7	Product design case study 7.1 Procedure for designing [1] Pipe [2] Gear [3] Ring / Seal [4] Chemical Container [5] Water Tank [6] Food package..... ETC	8
<b>Total</b>		<b>42</b>

Text Book :

Reference Books:

- |   |    |               |
|---|----|---------------|
| [1] Plastics Product Design Hand Book       | by | Edward Mil    |
| [2] Hand Book Of Plastics & Elastomers      | by | C.A.Harper    |
| [3] Product Design with Plastics            | by | J.B.Dym       |
| [4] Plastics Product Design Engg. Hand Book | by | Levy & Dubois |
| [5] Plastics Product Design                 | by | R.D.Back      |

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN PLASTIC ENGINEERING

### SEMESTER- VII

Subject Code : 372302

Subject Name: Extrusion Die Design

Sr. No.	Subject Content	Hrs.
1	<p><b>1.0 POLYMER RHEOLOGY FOR EXTRUSION DIES</b></p> <p>1.1 Basic Definitions: shear, shear stress, shear rate &amp; viscosity</p> <p>1.2 Relationship between viscosity, shear stress &amp; shear rate</p> <p>1.3 Velocity profiles of Newtonian and Non-newtonian fluids Types of flow</p>	4
2	<p><b>2.0 FUNDAMENTALS OF EXTRUSION DIE DESIGN</b></p> <p>2.1 Factors affecting die design</p> <p>2.2 Equation for output of newtonian fluid through tubular crosssection</p> <p>2.3 land length/orifice thickness ratio with respect to different viscosity materials</p> <p>2.4 melt fracture phenomenon</p> <p>2.5 Die geometry</p> <p>2.6 Die restriction</p> <p>2.7 Streamlining of extrusion dies</p> <p>2.8 viscoelasticity and die-swell phenomena</p> <p>2.9 General die design rules</p> <p>2.10 Materials for extrusion dies</p>	12
3	<p><b>3.0 DIE ADAPTOR, BREAKER PLATE &amp; SCREEN PACK</b></p>	8

	<p>3.1 State the significance and position of the die adaptor in extruder</p> <p>3.2 Explain various factors to be considered for adaptor design.</p> <p>3.3 State various design considerations for breaker plate</p> <p>3.4 State various factors to be considered for correct breaker plate assembly</p> <p>3.5 Function of screen pack &amp; breaker plate assembly</p>	
4	<p><b>4.0 CLASSICATION OF EXTRUSION DIES</b></p> <p>4.1 Classify various extrusion die with respect to melt flow direction</p> <p>4.2 Applications of straight through, crosshead and offset dies</p> <p><b>4.3 FILM DIES – TUBULAR AND FLAT</b></p> <p>4.3.1 Types of blown film dies – side fed &amp; center fed dies</p> <p>4.3.2 Constructional features of various types of tubular film die</p> <p>4.3.3 Constructional features of flat film die</p> <p>4.3.4 Compare side fed &amp; centre fed tubular dies</p> <p>4.3.5 Advantages of rotating die</p> <p>4.3.6 Multilayer film die</p> <p><b>4.4 WIRE COATING DIE</b></p> <p>4.4.1 Difference between pressure die and tubing die</p> <p>4.4.2 Constructional features of wire coating die and function of various components</p> <p><b>4.5 PIPE DIE &amp; TUBE DIE</b></p> <p>4.5.1 Constructional features of pipe and tube die</p> <p>4.5.2 Sizing calibrators–Internal and external sizing calibrators</p> <p><b>4.6 SHEET DIE</b></p> <p>4.6.1 Constructional features of sheet die</p> <p>4.6.2 Fish tail die for heat sensitive materials</p> <p><b>4.7 SOLID SECTION DIES</b></p> <p>4.7.1 Dies for Rod, tape and profiles</p>	18
<b>Total</b>		<b>42</b>

**NOTE:- Following are the minimum experiences required, but the college can do more experiences if possible.**

Laboratory Experiences:

<b>Sr. No.</b>	<b>Name</b>	<b>Hours</b>
1	Draw assembly drawing of any one film die.	20
2	Draw detail drawing of Die drawn in sheet 1.	16
3	Draw assembly drawing of any one pipe die.	20
<b>TOTAL</b>		<b>56</b>

**Reference Books:**

<b>Sr. No.</b>	<b>Name of Reference</b>	<b>Author</b>
1	Extrusion of Plastics	Fisher
2	Extrusion dies	Michaeli
3	Extrusion Dies	M.V.Joshi
4	Polymer Extrusion	Chris Rauwendal
5	Plastics Extrusion Technology	Friedhelm Hensen
6	Plastic Materials and Processes	Goodman

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN PLASTIC ENGINEERING

### SEMESTER- VII

**Subject Code :** 372303

**Subject Name:** High Performance and Green Plastics

SR. NO.	SUBJECT CONTENT	HRS.
<b>HIGH PERFORMANCE PLASTICS</b>		
<b>1</b>	<b>1.0 High Quality Plastics</b>  Properties and applications of 1.1 Chlorinated Polyether 1.2 Polyarylates 1.3 Poly etherimide 1.4 Poly (amide-imide) 1.5 Poly imides	4
<b>2</b>	<b>2.0 Speciality Polymers</b>  2.1 High temperature Polymers 2.2 Fire resisting Polymers 2.3 Biomedical Polymers 2.4 Barrier Polymers 2.5 Photoconductive Polymers 2.6 Thermoplastic Elastomers (TPE) 2.7 Solid Polymer Electrolytes	8
<b>3</b>	<b>3.0 Polymer Alloys &amp; Blends</b>  3.1 Introduction and Importance of Polymer Alloys & Blends 3.2 Requirements for alloys and blends 3.2.1 Polymer Compatibility 3.2.2 Polymer-polymer miscibility 3.2.3 Interfacial energies 3.3 Preparation methods 3.3.1 Melt blending 3.3.2 Solution blending 3.3.3 Latex or dispersion mixing 3.4 Properties and applications of following alloys & blends. 3.4.1 PC-ABS 3.4.2 PC-PBT (Xenoy) 3.4.3 PPO-NYLON 3.4.4 PPO-PS (Noryl) 3.4.5 NYLON-ABS	10

	3.4.6 NYLON-PBT 3.4.7 POLYSULFONE-ABS 3.4.8 ABS-PBT 3.4.9 PPE-PS	
<b>GREEN PLASTICS</b>		
<b>4</b>	<b>4.0 OVERVIEW OF BIODEGRADABLE POLYMERS</b>  4.1 Introduction 4.2 Definition of biodegradable polymers 4.3 Mechanism of polymer degradation 4.3.1 Non-biological 4.3.2 Biological 4.4 Measuring biodegradability of polymers 4.5 Factors affecting biodegradable polymers 4.6 Additives used to make plastic biodegradable	<b>8</b>
<b>5</b>	<b>5.0 CLASSES OF BIODEGRADABLE POLYMERS (PROPERTIES &amp; APPLICATIONS)</b>  5.1 NATURALLY BIODEGRADABLE / AGRO POLYMERS 5.1.1 Polysachharides – Starch and Cellulose based 5.2 POLYMERS FROM MICROORGANISMS 5.2.1 Poly Hydroxyalkanates (PHA) 5.2.2 Poly Hydroxybutyrate (PHB) 5.3 POLYMERS SYNTHESISED FROM BIO-DERIVED MONOMERS 5.3.1 Poly lactide 5.3.2 Poly lactic acid (PLA) 5.4 POLYMERS SYNTHESISED FROM PETROLEUM PRODUCTS 5.4.1 Poly caprolactone (PCL) 5.4.2 Poly esteramide (PEA) 5.4.3 Aliphatic co-polyester (PBSA) 5.4.4 Aromatic co-polyester (PBAT)	<b>8</b>
<b>6</b>	<b>6.1 Processing methods of biodegradable polymers.</b> 6.1.1 Injection Molding 6.1.2 Blow Molding 6.1.3 Thermoforming 6.1.4 Film blowing and casting <b>6.2 Advantages and disadvantages of biodegradable polymers.</b> <b>6.3 Environmental effects of biodegradable polymers.</b>	<b>4</b>
	<b>Total</b>	<b>42</b>

**REFERENCE BOOKS:-**

1. Handbook of Biodegradable Polymers – Catia Bastioli
2. Green Plastics – Stevens
3. Biodegradable Polymers and Plastics – Chiellini
4. Plastics Materials – Brydson
5. Polymer Alloys & Blends – R.P.Singh
6. Engineering Thermoplastics – James Margolis
7. Plastics Technology Handbook – Chanda & Roy
8. Principles of Polymer Science – Bahadur & Sastry
9. Engineering Polymers – Dyson
10. Polymer Blends & Alloys – L.A. Utracki

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN PLASTIC ENGINEERING

### SEMESTER- VII

Subject Code : 372304

Subject Name: Blow and Thermoforming Mould Design

Sr. No.	Subject Content	Hrs.
1	<p><b>1.0 BLOW MOULD DESIGN</b></p> <p><b>1.1 INTRODUCTION</b></p> <p><b>1.2 BLOW MOULD MATERIALS</b></p> <p>1.2.1 Blow mould material requirements</p> <p>1.2.2 Types of mould materials and their characteristics</p> <p><b>1.3 DIE AND MANDREL DESIGN</b></p> <p>1.3.1 Importance</p> <p>1.3.2 Types of extruder die head</p> <ul style="list-style-type: none"> <li>- Spider or Axial flow head</li> <li>- Side feed head</li> <li>- Accumulator head</li> </ul> <p><b>1.4 INJECTION BLOW MOULD</b></p> <p>1.4.1 Preform mould construction</p> <p>1.4.2 Blow mould design for Injection Blow Moulding</p> <p>1.4.3 Core rods/ Parison stick design</p> <p><b>1.5 EXTRUSION BLOW MOULD</b></p> <p>1.5.1 Factors to be considered for blow mould design</p> <p>1.5.2 Mould cavity design</p> <p>1.5.3 Method for deciding mould clamping force</p> <p>1.5.4 Design consideration for mould parting line</p> <p>1.5.5 Venting &amp; Cavity surface</p> <p>1.5.6 Welding edges &amp; flash pockets in pinch-off</p> <p>1.5.7 Neck insert design considerations</p> <p>1.5.8 Radii and corner edge rounding</p> <p>1.5.9 Moulded holes and handle design</p> <p>1.5.10 Shrinkage</p> <p>1.5.11 Moulds for undercut products (moving section molds)</p> <p>1.5.12 Swell ratio</p> <p>1.5.13 Blow ratio</p> <p>1.5.14 Mould cleaning</p> <p><b>1.6 MOULD COOLING</b></p> <p>1.6.1 Significance of mould cooling</p> <p><b>1.6 MOULD COOLING</b></p> <p>1.6.1 Significance of mould cooling</p>	28

	<p>1.6.2 Describe various mould cooling methods</p> <p><b>1.7 ANCILLIARY ELEMENTS</b></p> <p>1.7.1 Base plates</p> <p>1.7.2 Alignment pins</p> <p>1.7.3 Striker plates</p> <p>1.7.4 Ejectors</p> <p>1.7.5 Miscellaneous features</p>	
2	<p><b>2.0 THERMOFORMING MOULD DESIGN</b></p> <p><b>2.1 INTRODUCTION</b></p> <p><b>2.2 MOULD MATERIALS</b></p> <p>2.2.1 State various properties required for thermoforming mould material</p> <p>2.2.2 List various mould making materials for (1) Proto type tooling (2) Production Tooling</p> <p><b>2.3 DESIGN CONSIDERATIONS FOR THERMOFORMING MOULD</b></p> <p>2.3.1 Vent holes/ Vacuum holes</p> <p>2.3.2 H:D ratio</p> <p>2.3.3 Shrinkage and its effect on draft/taper</p> <p>2.3.4 Surface treatments</p> <p>2.3.5 Surface texture</p> <p>2.3.6 Mould clamping mechanism</p> <p>2.3.7 Mould cooling</p> <p>2.3.8 Sheet support/sag bands</p> <p><b>2.4 MULTI-IMPRESSION MOULDS</b></p> <p>2.4.1 State the factors to be considered for deciding correct impression layout</p> <p>2.4.2 Describe the method of determining the number of impressions for a given forming platform size and product size</p> <p><b>2.5 MOULDS FOR UNDERCUTS</b></p>	14
Total		42

**NOTE:- Following are the minimum experiences required, but the college can do more experiences if possible.**

Laboratory Experiences:

<b>Sr. No.</b>	<b>Name</b>	<b>Hours</b>
1	Draw assembly drawing of blow mould for any product.	20
2	Draw detail drawing of mould drawn in 1.	16
3	Draw assembly drawing of multi-impression Thermoforming mould.	20
<b>TOTAL</b>		<b>56</b>

**Reference Books:**

<b>Sr. No.</b>	<b>Name of Reference</b>	<b>Author</b>
1	Blow Moulding Handbook	Rosato/Rosato
2	Plastic Blow Molding Handbook	Norman Lee
3	Blow Moulding	Fisher
4	Thermoforming	James L. Throne

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN PLASTIC ENGINEERING

### SEMESTER- VII

Subject Code : 372305

Subject Name: Advance Fabrication Techniques

Sr. No.	Subject Content	Hrs.
1	1.0 Introduction 1.1 Brief on basic fabrication techniques like shaper and planner, lathe, milling machine, Surface grinder, cylindrical grinder, tool and cutter grinder, drilling etc 1.2 Introduction to advancement in fabrication techniques	2
2	2.0 Need for Advance Fabrication Techniques 2.1 Improvement in quality 2.2 Improvement in productivity 2.3 Enhancement in finishing 2.4 Precision & Accuracy	2
3	Copying Lathe 3.1 Types 3.2 Construction & Working Principle 3.3 Limitations	4
4	Copy Milling Machine 4.1 Types of copy milling machine 4.2 Working principle, construction and working 4.3 Advantages and disadvantages	4
5	Pentagraph Die Sinking machine 5.1 Basic working principle 5.2 Construction and working 5.3 Merits and Demerits of pantograph	4

6	<p>Jig-boring Machines</p> <p>6.1 Working principle of jig boring machine</p> <p>6.2 Construction &amp; working</p> <p>6.3 Comparison with vertical milling</p>	4
7	<p>Spark Erosion Machining Process</p> <p>7.1 Working principle , construction &amp; working</p> <p>7.2 Dielectric medium</p> <p>7.3 different tool materials</p> <p>7.4 Advantages &amp; Limitations</p>	6
8	<p>Hobbing Process</p> <p>8.1 Characteristics of mold material &amp; hob materials</p> <p>8.2 Hobbing process steps</p> <p>8.3 Limitations</p>	4
9	<p>Electroforming Process</p> <p>9.1 Basic working principle</p> <p>9.2 Process steps</p> <p>9.3 Advantages &amp; disadvantages</p>	4
10	<p>CNC Machining</p> <p>10.1 Creating a CAD Model</p> <p>10.2 Development of NC part programme in CAM</p> <p>10.3 Programme structuring &amp; sequencing</p> <p>10.4 Advantages of CNC Machining</p>	8
Total		42

**NOTE:- Following are the minimum experiences required, but the college can do more experiences if possible.**

Laboratory Experiences:

Sr. No.	Subject Content	Hrs.
1	Prepare a guide pin and bush for injection mold	26
2	Prepare core / cavity using spark erosion technique OR CNC machining	30
Total		56

Text Book :

Reference Books :-

- |     |                               |    |                     |
|-----|-------------------------------|----|---------------------|
| [1] | Plastics Mold Engg. Hand Book | by | Dubois & prible     |
| [2] | How to make injection molds   | by | Menges / Mohren     |
| [3] | Plastics Molds & Dies         | by | Laszlosors & others |
| [4] | Extrusion Dies                | by | Walter Micheli      |
| [5] | Workshop Technology           | by | Hajra & Chaudh      |