

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN PLASTIC ENGINEERING

TEACHING SCHEME (w. e. f. 10th Jan,' 11)

SEMESTER- VI (Re-Revised on 25-3-11)

Sr. No	SUB. CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	
1	362301	Instrumentation , Maintenance and Safety in Plastic Engg.	3	0	2	3
2	362302	Testing and Quality Management	3	0	2	3
3	362303	Rotational, Blow Moulding and Thermoforming Process	3	0	2	4
4	362304	Miscellaneous Processing Techniques	3	0	2	4
5	362305	Compression and Transfer Mould Design	2	0	4	3
6	362306	Process Techniques for Finished Plastics	2	0	2	3
		TOTAL	16	0	14	20

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN PLASTIC ENGINEERING

SEMESTER- VI

Subject Code : 362301

Subject Name: Instrumentation, Maintenance & Safety in Plastic Engineering

Sr. No.	Subject Content	Hrs.
1	1.0 Instrumentation Fundamentals 1.1 Introduction 1.2 Selection of measuring instruments 1.3 Errors in instruments 1.4 Block diagrams of instrumentation system	4
2	2.0 Process Instrumentation 2.1 Temperature measurement 2.2 Thermocouple & resistance thermometer 2.3 Pressure measurement 2.4 Data Handling 2.5 Transducers	8
3	3.0 Servo mechanism & PLC system 3.1 Open & close loop control system 3.2 Regulators & servo-mechanism 3.3 Servomotors 3.4 PLC control system	6
4	4.0 Plant maintenance practice 4.1 Types of maintenance 4.2 Fault finding methods 4.3 Planning & Scheduling of maintenance work 4.4 Maintenance cost and economy 4.5 Service life of equipments	6
5	5.0 Wear, Corrosion & Lubrication 5.1 Wear and its reduction techniques 5.2 Corrosion and its significance 5.3 Corrosion reduction techniques 5.4 Principle of lubrication 5.5 Types of lubricants	6

6	6.0 Maintenance of Plastics processing machines 6.1 Maintenance of an Extruder 6.2 Maintenance of an Injection Moulding machine 6.3 Maintenance of Moulds & dies 6.4 Maintenance of cooling / chilling plants 6.5 Maintenance of Hydraulic & pneumatic systems	6
7	7.0 Safety 7.1 Importance of safety 7.2 Major safety measures in plastics processing plants 7.3 Management responsibilities 7.4 Accidents and its prevention 7.5 Activities related to promotion of safety	6
	Total	42

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

Laboratory Experiences:

Sr. No.	Name	Hrs.
1	Demonstration of working principle and construction of Bi-metallic thermometer.	2
2	Calibration of a given thermocouple.	2
3	Carryout thermal analysis of flow characteristics.	4
4	Calibration of capacitive type pressure transducer.	2
5	Carryout plant maintenance of extrusion plant.	4
6	To prepare a schedule of maintenance for injection Moulding machine.	2
7	To list out maintenance activities for Mould/Dies & chilling plants.	4

8	To identify and list safety measures for an extrusion plant.	4
9	To prepare charts for safety measures in plastic industry.	4
	TOTAL	28

Reference Books:

1. Industrial Instrumentation & Control by S.K.Singh
Tata McGraw Hill Publications Co.Ltd
2. Industrial Instrumentation by Donald P.Eckman
Wiley Eastern Ltd
3. Hand Book of Instrumentation and control by H.P.Kallen
McGraw Hill Company Ltd.
4. Maintenance Engineering Hand Book by Higgins & Morrow
5. Plastics Industry Safety Hand Book by Dominick V.Rosato & John R.Lawrence

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN PLASTIC ENGINEERING

SEMESTER- VI

Subject Code : 362302

Subject Name: TESTING AND QUALITY MANAGEMENT

Sr. No.	Subject Content	Hrs.
1	1.0 Importance of testing 1.1 Specification and standards 1.2 Sample preparation & conditioning of sample	2
2	2.0 Mechanical tests 2.1 Tensile strength test 2.2 Impact strength test 2.3 Flexural strength test 2.4 Creep & stress relaxation 2.5 Hardness & abrasion resistance	6
3	3.0 Thermal tests 3.1 Melting point determination 3.2 Vicat softening point 3.3 Heat deflection temperature	4
4	4.0 Electrical tests 4.1 Die Electric strength 4.2 Arc resistance 4.3 Insulation resistance 4.4 Volume & surface resistivity	4
5	5.0 Optical tests 5.1 Light transmittance 5.2 Haze, Gloss & Clarity	3

6	6.0 Flow properties 6.1 Melt flow index 6.2 Cup flow test 6.3 Viscosity measurement 6.4 Spiral flow	3
7	7.0 Environmental tests 7.1 Environmental stress & cracking resistance 7.2 Weather resistance	3
8	8.0 Failure analysis 8.1 Types of failure 8.2 Analyzing failures	3
9	9.0 Quality assurance practices 9.1 Raw material quality control 9.2 Process quality control 9.3 Product quality control 9.4 Documentation 9.5 Quality assurance manual	6
10	10.0 Statistical quality control 10.1 Procedure for S.Q.C. 10.2 Advantages of S.Q.C. 10.3 Process control charts	4
11	11.0 Organizations dealing with quality management 11.1 Bureau of Indian standards 11.2 American Society for testing and materials 11.3 International standards organization	4
	Total	42

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

Laboratory Experiences:

Sr. No.	Name	Hrs.
1	Measurement of tensile / impact / flexural properties of a given plastics products.	8
2	Measurement of die- electric strength of a given sample.	2
3	Measurement of heat deflection / Vicat softening point of a given sample.	6
4	Measurement of refractive index of a given sample.	2
5	Measurement of insulation properties of a given sample.	2
6	Measurement of light transmittance and haze of a given sample.	2
7	Measurement of a ESCR of given sample.	2
8	Prepare quality assurance manual for an extended product plant..	2
9	Prepare a model of statistical quality control for plastic product.	2
	TOTAL	28

Reference Books:

1. Hand Book of Plastics Testing Technology by Vishu Shah
2. Hand Book of Plastics Test Methods by R.P.Brown
3. Statistical Quality Control by O.P.Khanna
4. Plastics processing data hand book by D.V.Rosato
5. Hand book of plastics & elastomers by C.A.Harper

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN PLASTIC ENGINEERING

SEMESTER- VI

Subject Code : 362303

Subject Name: ROTATIONAL, BLOW MOULDING AND THERMOFORMING
PROCESS

Sr. No.	Subject Content	Hrs.
1.0 BLOW MOULDING		
1	1.1 BLOW MOULDING PROCESS 1.1.1 Basic principle of blow moulding 1.1.2 Types of blow moulding process (i) Injection Blow Moulding (ii) Extrusion Blow moulding- Intermittent & Continuous 1.1.3 Compare Injection Blow Moulding & Extrusion Blow Moulding 1.1.4 Advantages & Disadvantages of process 1.1.5 Applications of Blow Moulding process 1.2 PARISON 1.2.1 Parison forming methods 1.2.2 Parison Blowing systems (a) Needle Inflation (b) Mandrel Inflation-Top Mandrel, Bottom Mandrel, Top Mandrel with calibration 1.2.3 Parison Programming 1.2.4 Parison wall thickness control 1.3 BLOW MOULDING MACHINE 1.3.1 Extruder & its requirements 1.3.2 Screw design 1.3.3 Die head & die design 1.3.4 Die orifice/mandrel design 1.4 MATERIALS FOR BLOW MOULDING 1.4.1 Polymer selection criteria 1.4.2 Various types of materials 1.5 PROCESSING PARAMETERS 1.5.1 State various blow moulding processing parameters 1.5.2 Effects of process variables such as Raw material, Parison die, Air entrance, Mould & Cooling	18

	1.6 TROUBLE SHOOTING 1.7 STRETCH BLOW MOULDING PROCESS 1.7.1 Basics of Stretch Blow Moulding 1.7.2 Injection & Extrusion Stretch Blow Moulding process steps 1.7.3 Advantages & Disadvantages of Stretch Blow Moulding 1.8 OTHER BLOW MOULDING PROCESSES 1.8.1 Neck ring process 1.8.2 Drape process 1.8.3 Dip/Displacement process	
2.0 ROTATIONAL MOULDING		
2	2.1 INTRODUCTION 2.2 ROTATIONAL MOULDING PROCESS 2.2.1 Process steps 2.2.2 Advantages and disadvantages of rotational moulding 2.2.3 Applications of rotational moulding 2.3 MATERIALS 2.3.1 Moulding material requirements 2.3.2 Types of moulding materials 2.4 ROTATIONAL MOULDING MACHINE 2.4.1 Batch type machine 2.4.2 Carousel type machine 2.4.3 Clamshell single-station, single arm machines 2.4.5 Rock and roll machine 2.4.6 Independent arm type machine 2.4.7 Jacketed mould machine 2.4.8 Straight line machine 2.5 MOULDS 2.5.1 Mould materials 2.5.2 Heating and cooling of moulds 2.6 PROCESS VARIABLES 2.7 PART DESIGN 2.8 TROUBLE SHOOTING 2.9 Comparison with blow moulding and thermoforming	12
3.0 THERMOFORMING		
3	3.1 INTRODUCTION 3.2 THERMOFORMING PROCESS	12

	3.2.1 Various stages of thermoforming process 3.2.2 Explain various methods of forming (a) Vacuum Forming (b) Pressure forming 3.2.3 Advantages and disadvantages of thermoforming 3.2.4 Applications of thermoforming 3.3 THERMOFORMING MACHINES 3.3.1 Single-stage sheet fed machine 3.3.2 Multiple stage sheet fed machine 3.3.3 In-line sheet fed machine 3.3.4 Continuous roll fed machine 3.3.5 Packaging machines 3.4 MATERIALS 3.4.1 Material requirements 3.4.2 Types of materials 3.5 PROCESSING REQUIREMENTS 3.5.1 Heating methods 3.5.2 Temperature control 3.5.3 Vacuum/air pressure 3.5.4 Cooling 3.5.5 Trimming 3.6 PROCESS VARIABLES 3.7 TROUBLE SHOOTING	
	Total	42

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

Laboratory Experiences:

Sr. No.	Name	Hrs.
1	Demonstration of the constructional details of blow moulding machine.	2
2	Operating of the blow moulding machine.	4
3	Finding of blow moulding cycle time for a given product.	2
4	Finding the effect of process variables (temperature/ pressure) on quality or end product in blow mouldings.	2
5	Demonstration of the constructional details of rotational moulding machine.	2
6	Finding of rotational moulding cycle time for a given product.	2
7	Operating of the rotational moulding machine.	4

8	Finding the effect of process variable (temperature/ pressure) on quality or end product in rotational moulding.	2
9	Demonstration of the constructional details of thermoforming machine.	2
10	Operating of the thermoforming machine.	2
11	Finding of the thermoforming cycle time for a given product.	2
12	Finding the effect of process variable (temperature/ pressure) on quality of end product in thermoforming.	2
	TOTAL	28

Reference Books:

SR.NO.	NAME OF REFERENCE	AUTHOR
1	Blow Moulding	Fisher
2	Blow Moulding Handbook	Rosato & Rosato
3	Plastic Blow Moulding Handbook	Norman Lee
4	Rotational Moulding	Glenn Beall
5	Rotational Moulding of Plastics	R.J.Crawford
6	Moulding of Plastics	Norbert Bikales
7	Handbook of Plastic Technology	Allen & Baker
8	Plastic Materials and Processes	Goodman
9	Plastic Engineering Handbook	J.L.Frados
10	SPI Plastic Engineering Handbook	Bearins
11	Thermoforming	J.L.Throne
12	Technology of Thermoforming	J.L.Throne

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN PLASTIC ENGINEERING

SEMESTER- VI

Subject Code : 362304

Subject Name: MISCELLANEOUS PROCESSING TECHNIQUES

Sr. No.	Subject Content	Hrs.
1	1.0 Calendering 1.1 Premixing, blending & gelation 1.2 Calender roll arrangements 1.3 Calender roll construction, heating, driving & lubrication 1.4 Calendering plant lay-out 1.5 Gauge thickness control for calendered sheets 1.6 Trouble-shooting 1.7 Post calendaring processes	6
2	2.0 Reinforced Plastics 2.1 Introduction 2.2 Raw materials for reinforced plastics 2.3 Reinforced plastics Moulding materials 2.4 Processing equipments & process 2.5 Troubleshooting 2.6 Applications and advantages	6
3	3.0 Casting 3.1 Introduction 3.2 Materials for casting process 3.3 Process steps for casting 3.4 Troubleshooting 3.5 Applications and advantages	6
4	4.0 Encapsulation 4.1 Principle of Encapsulations 4.2 Materials & formulations 4.3 Processes for encapsulations	6

	4.4 Applications and advantages 4.5 Troubleshooting	
5	5.0 Foaming 5.1 Principle of Foaming 5.2 Terms used in foaming 5.3 Process steps 5.4 Applications and Advantages 5.5 Troubleshooting	6
6	6.0 Laminating 6.1 Principle of Lamination 6.2 Laminating processes 6.3 Applications 6.4 Merits and demerits 6.5 Raw material selection criteria	6
7	7.0 Vinyl Dispersions 7.1 Introduction 7.2 Formulations for vinyl dispersions 7.3 Process steps 7.4 Applications 7.5 Troubleshooting	6
	Total	42

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

Laboratory Experiences:

Sr. No.	Name	Hrs.
1	To study and arrange different layout of calendaring rolls.	4
2	To prepare a product from fiber reinforced plastic through hard lay up technique.	4
3	To prepare a product from resin by casting technique.	4
4	To prepare a product from encapsulation technique.	4
5	To prepare a sample product by foaming technique.	4
6	To prepare a product by lamination.	4
7	To decide the criteria for raw material selection in vinyl dispersion.	4
	TOTAL	28

Reference Books:

- | | |
|-----------------------------------|-------------------------|
| 1. Calendaring | by R.A.Elden & A.D.Swan |
| 2. Plastics materials & processes | by Schwarts & Goodman |
| 3. Plastics Engg. Handbook | by Joel fredos |
| 4. Laminated plastics | by D.J.Duffin |

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN PLASTIC ENGINEERING

SEMESTER- VI

Subject Code : 362305

Subject Name: COMPRESSION AND TRANSFER MOULD DESIGN

Sr. No.	Subject Content	Hrs.
1	1.0 COMPRESSION MOULD 1.1 HAND COMPRESSION MOULD 1.1.1 Elements of hand compression mould and their function 1.1.2 Assembly and detail drawing of hand compression mould 1.2 TYPES OF COMPRESSION MOULDS 1.2.1 Open flash mould 1.2.2 Positive mould 1.2.3 Landed positive mould 1.2.4 Semi-positive mould 1.2.5 Gand or Sub-cavity mould 1.3 DESIGN FEATURES OF AUTOMATIC COMPRESSION MOULD 1.3.1 LAND LENGTH 1.3.1.1 Land length 1.3.1.2 Land area and its effect on flash thickness 1.3.2 PRESSURE PAD 1.3.2.1 Significance 1.3.2.2 Positioning of pressure pads 1.3.2.3 Pressure pad designs 1.3.2.4 Pressure pad fitting 1.3.2.5 Effect of height of pressure pad on flash thickness 1.3.3 BULK FACTOR AND POWDER WELL 1.3.3.1 Define bulk factor 1.3.3.2 Values of bulk factor with various fillers	18

	1.3.3.3 Define powder well 1.3.3.4 Significance of powder well 1.3.3.5 Powder well volume calculation 1.3.3.6 Height of powder well calculation 1.3.4 PREFORMS 1.3.4.1 Definition 1.3.4.2 Significance of performs 1.3.4.3 Advantages & Disadvantages of performs 1.3.5 HEATING LOAD REQUIREMENTS 1.3.5.1 Types of heaters 1.3.5.2 Method of calculating heating load requirement for compression mould 1.3.6 PRESS TONNAGE REQUIREMENT FOR MOULD 1.3.7 METHODS OF EJECTION 1.3.8 CORE PINS & LOOSE PARTS 1.3.9 ASSEMBLY & DETAIL DRAWING OF COMPRESSION MOULD 1.4 STRIPPER PLATE MOULD 1.5 SIDE-RAM MOULDS	
2	2.0 TRANSFER MOULD 2.1 INTEGRAL POT TRANSFER MOULD 2.1.1 List the main parts of Integral Pot transfer mould 2.1.2 Explain each component of Integral Pot transfer mould with respect to their position in the mould and their function 2.1.3 Factors to be considered for determining pot dimensions 2.2 PLUNGER TRANSFER MOULD 2.2.1 Top plunger / Bottom plunger transfer mould 2.2.2 List the main parts of Plunger transfer mould 2.2.3 Explain each component of Plunger transfer mould with respect to their position in the mould and their function 2.2.4 Transfer chamber calculation (i) Chamber depth (ii) Transfer pressure 2.2.5 Compare Integral Pot transfer mould and Plunger transfer mould 2.3 CULL AND ITS REMOVAL 2.3.1 Definition 2.3.2 Importance of cull removing 2.3.3 Various cull removing techniques 2.4 GATE & RUNNER DESIGNS FOR TRANSFER MOULD 2.5 VENTING	10

	2.6 MOULD HEATING TECHNIQUES 2.6.1 Steam heating 2.6.2 Electric heating 2.6.3 Oil heating	
	Total	28

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

Laboratory Experiences:

Sr. No.	Name	Hrs.
1	Assembly drawing of hand compression mould.	8
2	(A) Assembly drawing of machine compression mould. (B) Detail drawing of compression mould.	32
3	Assembly drawing of internal Pot / plunger transfer mould.	16
	TOTAL	56

Reference Books:

SR.NO.	NAME OF REFERENCE	AUTHOR
1	Plastics Mould Design	Bebb
2	Moulding of Plastics	Norbert Bikales
3	Plastics Mould Engineering Handbook	Dubois & Pribble
4	Handbook of Plastic Technology	Allen & Baker
5	Plastic Materials and Processes	Goodman
6	Plastic Engineering Handbook	J.L.Frados
7	SPI Plastic Engineering Handbook	Bearins

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN PLASTIC ENGINEERING

SEMESTER- VI

Subject Code : 362306

Subject Name: PROCESS TECHNIQUES FOR FINISHED PLASTICS

Sr. No.	Subject Content	Hrs.
1	1.0 MECHANICAL FASTENERS FOR PLASTIC PARTS 1.1 Explain role of mechanical fasteners for joining plastics parts like 1.1.1 Screws 1.1.2 Thread forming screws 1.1.3 Thread cutting screws 1.1.4 Post Moulded inserts 1.1.5 Self tapping screws 1.1.6 Hinges 1.1.7 Rivets 1.1.8 Nuts and bolts	2
2	2.0 JOINING AND ASSEMBLING TECHNIQUES 2.1 SOLVENT CEMENTING TECHNIQUE 2.1.1 Basic principle of solvent bonding 2.1.2 Factors to be considered for good cementing 2.1.3 list of solvents use for solvent bonding 2.1.4 Different methods for applying solvents for solvent cementing 2.2 ADHESIVE BONDING 2.2.1 Basic principle of adhesive bonding 2.2.2 Types of adhesives used for adhesive bonding 2.2.3 Method of applying adhesives 2.2.4 Applications of adhesives 2.3 THERMAL BONDING TECHNIQUES 2.3.1 State basic principle of welding 2.3.2 Explain following types of welding techniques with respect to process equipment, their advantages and disadvantages 2.3.2.1 Hot gas welding 2.3.2.2 Hot plate welding 2.3.2.3 Induction welding 2.3.2.4 Spin welding/friction welding 2.3.2.5 Ultrasonic bonding 2.3.2.6 Ultrasonic spot welding	10

	2.3.2.7 Ultrasonic swaging 2.3.2.8 Vibration welding 2.3.2.9 Electromagnetic Induction bonding 2.3.2.10 Heat sealing / Induction cap sealing 2.3.2.11 Dielectric heat sealing 2.3.2.12 Ultrasonic Heat sealing 2.3.3 Typical applications of thermal bonding	
3	3.0 DECORATING TECHNIQUES 3.1 INTRODUCTION 3.1.1 Functional and aesthetic purposes of decorating plastics 3.1.2 Various methods of decorating and their application 3.1.3 Factors to be considered for selection of decorating technique 3.2 SURFACE TREATMENT 3.2.1 Significance of surface treatment 3.2.2 State technical reasons for non-sticking of printing ink on surfaces of film/mouldings 3.2.3 State materials which necessitates surface treatment 3.2.4 Explain following surface treatments 3.2.4.1 Washing and cleaning 3.2.4.2 Mechanical abrasion 3.2.4.3 Chemical etching 3.2.4.4 Priming 3.2.4.5 Flame treatment 3.2.4.6 Corona discharge 3.2.4.7 Plasma treatment 3.3 PAINTING OR COATING 3.3.1 Explain types of paint materials and paint coatings 3.3.2 Explain various painting techniques such as 3.3.2.1 Conventional spray 3.3.2.2 Electrostatic spray 3.3.2.3 Spray and wiping 3.3.2.4 Roller coating 3.3.3 Explain materials for Powder coating 3.3.4 Explain powder coating techniques such as 3.3.4.1 Fluidized bed coating	16

	3.3.4.2 Electrostatic deposition 3.4 PRINTING 3.4.1 Explain various printing techniques such as 3.4.1.1 Screen printing 3.4.1.2 Flexography printing 3.4.1.3 Gravure printing 3.4.1.4 Pad printing 3.5 HOT TRANSFER PROCESS 3.5.1 Explain various hot transfer processes such as 3.5.1.1 Laser marking 3.5.1.2 Dyeing 3.5.1.3 Electroplating 3.5.1.4 Vacuum metalizing- vacuum evaporation & sputter deposition 3.5.1.5 Labels and decals 3.5.1.6 Water transfer process 3.5.1.7 Flocking 3.5.1.8 Hot stamping 3.6 EMBOSSING AND SURFACE TEXTURING 3.6.1 Explain embossing and surface texturing process	
	Total	28

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

Laboratory Experiences:

Sr. No.	Subject Content	Hrs.
1	Performing of joining plastic with different mechanical fasteners.	2
2	Performing solvent cementing .	2
3	Performing adhesive bonding.	2
4	Performing hot air welding.	2
5	Demonstration of high frequency welding.	2
6	Performing heat sealing.	2
7	Performing spray painting.	2
8	Performing screen printing.	4
9	Demonstration of dip coating technique.	2
10	Performing hot stamping process.	2
11	Demonstration of vacuum metalizing process.	4
12	Demonstration of pad printing.	2
	TOTAL	28

Reference Books:

SR.NO.	NAME OF REFERENCE	AUTHOR
1	Handbook of Plastic Technology	Allen & Baker
2	Plastic Materials and Processes	Goodman
3	Plastic Engineering Handbook	J.L.Frados
4	SPI Plastic Engineering Handbook	Bearins
5	Plastic Blow Moulding Handbook	Norman Lee
6	Modern Plastics Magazine	