GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

ADVANCED PLASTIC PROCESSING TECHNIQUES

(Code: 3372301)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	7th Semester

1. RATIONALE

The course deals with advancement in plastic processing techniques. Stretch blow molding and multi-layer blow molding are the latest technologies used for making bottles and containers for packaging. Students should be aware of recent developments in injection blow molding and extrusion blow molding as new products are coming in the market every day. With the advancement in extrusion technology many products came into existence for the mankind e.g. reinforced pipes, coextruded multilayer films & sheets, foam extruded products, nylon braided pipes etc. Also with the use of various post extrusion processes so many products like nets, corrugated sheets etc can be manufactured. Hence plastics engineer is expected to know the latest extrusion technology along with theory of technology and screw design for better quality products. The advanced injection molding technology enhances production rate as well as quality to fulfill the requirements of emerged new market. Precise computer controls and programs enable the process variables with zero defects at the lowest cost through fine tuning of machine settings.

2. COMPETENCIES

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:

- Operate, set process parameters and control Blow molding machine, Extrusion plant and Injection molding machine for non conventional products.

3. COURSE OBJECTIVES:

At the end of the course students will be able to:

1. Explain stretch blow molding process
2. Understand non conventional blow molding process
3. Differentiate various screw designs used in extrusion plants
4. Explain specialized extrusion processes for non conventional extrusion product
5. Distinguish non conventional injection molding techniques

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	200
4	0	4	8	70	30	40	60	

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

5. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
UNIT 1: ADVANCED BLOW MOLDING PROCESSES	1.a Understand the stretch blow molding process 1.b Differentiate various stages of process 1.c Troubleshoot the problems in co extrusion blow molding 1.d Explain various non conventional blow molding techniques and post operative operations	**1. STRETCH BLOW MOLDING** 1.1 Introduction 1.2 Single stage & two stage processes and its comparison 1.3 Orientation and stretch ratio 1.4 Pre-forming 1.5 Extrusion stretch blow molding 1.6 Injection orientation blow molding **2. CO-EXTRUSION BLOW MOLDING** 2.1 Co-extrusion equipment 2.2 Process **3. MISCELLANEOUS BLOW MOLDING PROCESSES** 3.1 Neck ring process 3.2 Drape process 3.3 Dip / displacement processes 3.4 Blow molding of irregular shaped parts
UNIT 2: ADVANCED EXTRUSION TECHNIQUES	2.a Distinguish between various screw designs 2.b List merits and demerits of co-extrusion process 2.c Explain various specialized process for non conventional extruded products	**1. ADVANCED EXTRUDER MACHINE FEATURES** 1.1 Twin screw extruder 1.1.1 Intermeshing and non Intermeshing 1.1.2 Counter rotating and co-rotating 1.1.3 Comparison with single screw 1.2 Vented screw extruder designs. 1.3 Internal Bubble cooling. **2. CO-EXTRUSION** 2.1 Co-extrusion structures 2.2 Barrier materials & adhesives 2.3 Comparison: Feed block die and multi manifold die 2.4 Advantages of co-extrusion products.

Unit	Major Learning Outcomes	Topics and Sub-topics
		2.5 Applications of co-extruded products. **3. SPECIALIZED PROCESSES** 3.1 Reinforced pipes- Nylon braided pipes 3.2 Hose pipe 3.3 Fishing net 3.4 Heat shrink film 3.5 Cling film 3.6 Corrugated sheets and pipes
UNIT 3: ADVANCED INJECTION MOLDING PROCESSES	3.a Describe the RIM process 3.b List merits and demerits of RIM process 3.c Describe Gas Assisted Injection Molding process 3.d Explain various non conventional injection molding techniques	**1 REACTION INJECTION MOLDING (RIM)** 1.1 Introduction to RIM process 1.2 Materials and additives 1.3 Features of RIM process and variables 1.4 Machine & auxiliary 1.5 Flow diagram of RIM process 1.6 Characteristic of RIM parts 1.7 Merits and demerits of RIM process **2 NON CONVENTIONAL INJECTION MOLDING PROCESS** Material, process, advantages and disadvantages of the following processes: 2.1 Gas-assisted injection molding 2.2 Sandwich injection molding 2.3 Structural foam injection molding 2.4 Flow molding 2.5 Metal filled 2.6 Multicolor molding 2.7 Injection molding of reinforced thermoplastics

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

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Advanced blow molding processes**	13	2	8	5	15
II	**Advanced extrusion techniques**	20	5	13	7	25
III	**Advanced injection molding processes**	23	5	15	10	30

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Total		**56**	**12**	**36**	**22**	**70**

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

S. No.	Unit Number	Description of Laboratory Experiment	Hour
1	I	Set the extrusion stretch blow mold and machine parameters	02
2		Operate stretch extrusion blow molding machine.	04
3		Operate stretch injection blow molding machine.	04
4		Find out production rate of stretch extrusion blow molding machine.	02
5		Find out production rate of stretch injection blow molding machine.	02
6		Operate co-extrusion blow molding machine for a given product	04
7		Find out production rate or co-extrusion & co-injection blow molding machine	02
8		Perform Neck ring process for given product	04
9		Perform Drape process for given product	04
10		Perform Dip/displacement process for given product	04
11	II	Operate twin screw extruder for PVC pipe plant	04
12		Study of various vented screw extruder design	02
13		Study constructional features of multilayer blown film plant	02
14		Operate multilayer blown film plant	04
15		Study manufacturing of Nylon braided pipes	02
16	III	Set mold and process parameters for given product of RIM process	02
17		Operate RIM process for given product	04
18		Operate gas assisted injection molding machine for given product	04

19		Operate sandwich injection molding machine for given product	04
20		Operate structural foam injection molding machine for given product	04
21		Operate flow molding machine for given product	04
22		Operate metal filled process for given product	04
23		Operate multi color injection molding machine for given product	04
24		Operate reinforced thermoplastic injection molding machine for given product	04
		Total	**78**

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Plastics Blow moulding hand book	Norman lee	Rapra Technology Limited
2	Blow moulding of plastics	E G Fisher	The Plastics Institute
3	Hand book of plastic processing technology	D. V. Rosato	Springer
4	Blow moulding hand book	Rosato & Rosato	Hanser Publishers
5	Plastics Extrusion Technology	Fried helm Hence	Hanser Publishers
6	Polymer Extrusion	Chris Rauwendaal	Hanser Verlag
7	Extrusion of Plastics	Fisher	The Plastics Institute
8	Plastics Engineering Hand book	Bearins	Van Nostrand Reinhold Company
9	Plastics processing data hand book	Rosato & Rosato	
10	Reaction injection moulding	Walter E. Becker	
11	Injection moulding theory and practice	Rubbin	Wiley-The University of Michigan
12	Developments in injection moulding	Whelen and goff.	

13	Fundamentals of RIM	Macosko	
14	Injection moulding machines	John Hapbern	
15	Plastics injection moulding	Bryce	

(B) List of Software/Learning Websites:

1. http://www.bpf.co.uk/
2. http://www.paulsontraining.com
3. http://www.traininteractive.com
4. http://www.kenplas.com/project/pet/petblow.aspx

9. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Students will collect various shaped and different material articles and analyze the process being used for that product.
2. Students will collect information related to processes through internet.
3. Students will visit nearby such industries for practical knowledge.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

1. **Prof. A.S.Amin, LPE, Government Polytechnic, Ahmedabad.**
2. **Prof. J.R.Desai, LPE, Government Polytechnic, Valsad.**
3. **Smt. S.R.Shah, LPE, Government Polytechnic, Valsad.**
4. **Prof. B.I.Oza, LPE, Government Polytechnic, Ahmedabad.**
5. **Prof. N.C.Suvagya, LPE, Government Polytechnic, Chhotaudepur.**

Coordinator and Faculty Members from NITTTR, Bhopal

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