GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM
DESIGNING OF EXTRUSION DIES
(Code: 3372303)

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

1. RATIONALE

Extrusion is the highest plastic consuming process mainly used for continuous manufacturing of rods, profiles, tubes, pipes, films, sheets, wire and cable etc. Amongst the different items of equipment employed for the operation of extrusion process, the extruder and die are perhaps the most important. A Plastic Diploma engineer has to supervise the designing and manufacturing process of dies and monitor extrudate production using these dies. This competency requires the knowledge of various designing aspects of extrusion dies. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCIES

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

- Identify requirements of various dies.
- Design extrusion dies.

3. COURSE OBJECTIVES:

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

1. Understand melt rheology.
2. Analyze die design factors.
3. Select proper breaker plate design.
4. Select proper die design according to shape of extrudate.

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
3	0	4	7	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 – I POLYMER MELT RHEOLOGY	1.a Understand the terms related with rheology 1.b Identify various types of flow	1.1 Basic Definitions: shear, shear stress, shear rate & viscosity 1.2 Effect of shear stress and shear rate on viscosity of melt 1.3 Velocity profiles of Newtonian and Non-Newtonian fluids 1.4 Types of flow 1.5 Visco-elasticity, viscous flow and elastic flow
UNIT- II BASICS OF DIE DESIGN	2. a Identify Factors for die design. 2. b Analyze die design factors	2.1 Factors affecting die design 2.2 General die design rules 2.3 Materials for extrusion dies 2.4 Equation for output of Newtonian fluid through tubular cross section 2.5 Land length and its importance in die design 2.6 Die geometry 2.7 Die restriction methods and its effect on melt flow 2.8 Die streamlining methods 2.9 Melt fracture phenomenon 2.10 Die-swell and its effect on extrudate
UNIT – III DIE ADAPTOR, BREAKER PLATE & SCREEN PACK	3.a Understand die adaptor design 3.b Select proper adaptor design 3.c Understand functions of breaker plate and screen packs 3.d Analyze various breaker plate designs 3.e Select proper breaker plate design	**Die Adaptor** 3.1 Significance of die adaptor 3.2 Position of die adaptor and its fitting methods 3.3 Factors to be considered for adaptor design **Screen Pack & Breaker Plate** 3.4 Position and functions of screen pack and breaker plate 3.5 Various breaker plate designs 3.6 Factors for correct breaker plate assembly
UNIT – IV TYPES OF EXTRUSION DIES	4.a Understand constructional features of various dies 4.b Analyze various dies according to shape of extrudate 4.b Select proper die	4.1 Types of various extrusion dies with respect to melt flow direction 4.2 Straight through, crosshead, offset dies and its applications **Flat and Tubular Film Dies** 4.3 Tubular (blown) film dies – side fed & center fed dies 4.4 Constructional features of tubular dies 4.5 Comparison of side fed & centre fed tubular

Unit	Major Learning Outcomes	Topics and Sub-topics
		dies 4.6 Constructional features of flat film die 4.7 Multilayer film die and its features 4.8 Compare feed block and multi-manifold multilayer dies **Wire Coating Die** 4.9 Pressure and tubing die 4.10 Constructional features of wire coating die and functions of various components **Pipe & Tube Die** 4.11 Constructional features of tube die 4.12 Construction features of straight through and offset pipe die 4.13 Significance of internal and external sizing calibrators **Sheet Dies** 4.14 Constructional features of coat hanger sheet die 4.15 Fish tail die constructional features and its applications **Dies for Solid Sections** 4.16 Dies for Rod, tape and profiles

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	**Polymer Melt Rheology**	4	2	5	0	07
II	**Basics of Die Design**	12	4	12	5	21
III	**Die Adaptor, Breaker Plate & Screen Pack**	8	4	8	2	14
IV	**Types of Extrusion Dies**	18	4	14	10	28
TOTAL		**42**	**14**	**39**	**17**	**70**

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

S. No.	Unit Number	Description of Laboratory Experiment	Hours
1	IV	Draw assembly drawing of film die.	20
2		Draw detail drawing of film die drawn in first sheet.	16
3		Draw assembly drawing of pipe die.	20
		TOTAL	**56**

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Extrusion of Plastics	Fisher	Plastics and Rubber Institute, University of Verginia
2	Extrusion Dies for Plastics and Rubbers	Walter Michaeli	Hanser
3	Dies for Plastics Extrusion	M.V.Joshi	Mcmillan
4	Polymer Extrusion	Chris Rauwendal	Hanser
5	Extruding Plastics	D.V.Rosato	Chapman & Hall

(B) List of Software/Learning Websites:

1. http://www.kostic.niu.edu/extrusion_die_design-echp-1.pdf
2. https://web.fe.up.pt/~fpinho/pdfs/jmpt1.pdf
3. http://rheology.tripod.com/z11.07.pdf
4. http://en.wikipedia.org/wiki/Die_forming_(plastics)

9. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Students will collect information about recent trends in extrusion die design.
2. Students will prepare banners showing constructional features of various dies.

3. Students will visit nearby industries and collect information about die design.

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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