GOVERNMENT OF TAMILNADU
DIRECTORATE OF TECHNICAL EDUCATION, CHENNAI
STATE PROJECT COORDINATION UNIT
(Established under Canada India Institutional Cooperation Project)

CURRICULUM

Course Name	**PLASTIC INJECTION MOULDING**
Course Code	ME/2020/036
Course Duration	75 Hours
Minimum Eligibility Criteria/	ITI/10th/+2/Diploma/Graduates
Pre-requisites (if any)	-
Course Objectives	Training module has been designed to provide the participants to • Familiarize different plastics materials and their properties • Familiarize of the conventional injection - moulding machine types, their specification, operation terminology and their parts. • Compare different moulding processes used in industries, their application • Explain the design procedure for injection moulding. • Appreciate the decoration techniques, plating techniques used for plastic components. • Understand the intermediate injection moulding design concepts • Design and fabricate single cavity injection mould • Design and fabricate multi cavity injection mould
Course Outcomes	A student passing this module should be able to • List out the different plastics materials and their properties • Explain the types of injection moulding machine their specification and operational procedure • Compare different moulding process used in industries and their application • Explain the design procedures of injection moulding • Describe the decoration techniques, plating techniques used for plastic components • Make plastic moulds using different machine tools such as lathe, milling machine, drilling machine, Grinding machine and EDM. • Design and fabricate single cavity injection mould • Fabricate a multi cavity injection mould for the given component
Expected Job Roles	Plastic mould machine operator, Production Engineer for Injection Molding Products

TEACHING AND SCHEME OF ASSESSMENT						
Course Code	Course Name	Hours		Assessment Marks		Duration of the Examination
				Min	Max	
ME/2020/036	**PLASTIC INJECTION MOULDING**	Theory	35	10	20	3 hours
		Practical	40	40	80	
		Total	75	50	100	

ME/2020/036 - PLASTIC INJECTION MOULDING

DETAILED SYLLABUS

Unit No.	Modules	No. of Hours	
		Theory	Practical
I	**PLASTIC MATERIALS AND PROCESSING TECHNIQUES**	**15 hours**	
1.1	**Plastics:** Introduction – type of Plastics – Thermo Plastic Materials – Thermo setting Materials – Commodity Plastics	06	
1.2	Engineering materials – Density – Melting Temperature – Shrinkage – Bulk Factor – Moulding Properties – Applications – Additives - Master Batches – Pigments.		
1.3	**Injection Moulding:** Hot Runner Injection Moulding Process, Multi colour and multi component Injection Moulding Process, Reaction Injection Moulding Process**.**		
1.4	**Practical:** ➢ Design of Hand injection mould ➢ Design of three plate mould		09
II	**INJECTION MOULDING MACHINE, INJECTION MOULD AND ITS FUNCTIONAL SYSTEMS**	**25 hours**	
2.1	**Injection Moulding Machines:** Basic parts and functioning of an injection moulding machine. Types of injection moulding machine (Screw type & Plunger Type) – Single stage and two stage – Clamping unit (Toggle & Hydraulic) - Types of nozzles – Typical injection. Moulding cycle, Cycle time - Machine specifications (Definition only).	09	
2.2	**Injection Mould: - Terms** used in connection with injection moulds, classification of moulds, Functions of the injection moulds**.**		
2.3	**Functional systems of injection mould** – **Sprue and runner system** - Runner, Cross section shape, Runner size, Runner layout – Gates, Necessity, Centre gate, Edge gate, Balanced gating, Types of Gates.		
2.4	**Core and Cavity-** Shrinkage calculation - Core and cavity dimension. **Parting surface:** Flat Parting surface – Non flat parting surface - Venting – Mould clamping - direct, indirect.		

2.5	**Practical:** ➢ Design and Fabrication of single cavity hand injection mould (Guide Pin) ➢ Design and Fabrication of single cavity hand injection mould (Core Plate and Cavity Plate) ➢ Design and Fabrication of single cavity hand injection mould (Cover plate and Core pin)		16
III	**INJECTION MOULD DESIGN & INTERMEDIATE MOULDS**	**25 hours**	
3.1	**Basic procedure for mould design –** Determination of mould size – Maximum number of cavities, Clamping force , Maximum clamping area, Required opening stroke. Computation of number of cavities, cavity layouts, number of parting lines, Design of runner and gate.	10	
3.2	**Intermediate Moulds:** Moulding external undercuts-Split mould - Finger cam, dog leg cam & track. Hydraulic & spring actuation of split - Side core and side cavity, Methods of actuation - Mould with internal undercut: Form pin, actuation, split core, jumping off		
3.3	Mould for threaded component: Manual & automatic unscrewing methods hand mould for rotating & lose core methods - Multi day light mould – Under feed mould – Triple day light mould – Hot runner unit mould, Advantages and Limitations, Hot runner nozzles & sprue, runner less mould - Materials for Injection Mould – Standard Mould systems, Advantages and limitations (Concept & Description of design only).		
3.4	Practical: ➢ Design and Fabrication of multi cavity hand injection mould (Core Plate) ➢ Design and Fabrication of multi cavity hand injection mould (Stripper Plate) ➢ Design and Fabrication of multi cavity hand injection mould (Cover Plate)		15
IV	**PLASTIC PRODUCT DESIGN, DECORATION OF PLASTIC PRODUCTS AND MAINTENANCE & REPAIR OF INJECTION MOULDS:**	**10 hours**	
4.1	**Plastic Product Design:** Wall thickness - Ribs and profiled structures – Gussets or support ribs - Bosses - Holes - Radii & Corners - Tolerances - Coring - Undercuts – Draft angle.	10	
4.2	**Decoration of Plastic Parts:** Painting and coating (Dipping, Spraying and Depositing) – Metalizing (Vacuum metallization, Vacuum evaporation, sputtering) – Plating (Electroless plating, Electrolytic plating) - Flame and arc spraying – hot foil stamping – hot transfer – In mold decorating – Water transfer–Printing–Laser Marking, Vapor polishing, Decals – Understanding Recycling Codes.		

4.3	**Maintenance of Injection Moulds:** Advantages of Preventive maintenance, maintenance of – cooling lines, mould surfaces, heating & control systems. Action taken after examination and cleaning. Repair and alterations of injection moulds.		
	Total theory and Practical hours	**35**	**40**
	Total hours	**75**	

HARDWARE REQUIREMENT

S. NO.	LIST OF THE EQUIPMENTS WITH SPECIFICATIONS REMARKS, IF ANY	QUANTITY REQUIRED
1	Centre Lathe, 4 ½' bed length	5
2	Drilling machine	2
3	Shaping machine, stroke length 300mm	2
4	Vertical milling machine	2
5	Surface grinding machine	2
6	Bench vice	10
7	Fitting file set	10
8	Tap set	4
9	Surface plate	2
10	Vernier height gauge 0-250mm	1
11	Dial test indicator with magnetic stand	2
12	Angle plate	2
13	Hand injection Moulding machine	1
14	Hand Blow Moulding machine	1
15	Tool maker‘s straight edge – 150 mm	2
16	Digital Micrometer – 0.-25mm range, 0.001mm least count	1

REFERENCE BOOKS

Sl. No	Name of the Book	Author	Publisher & Year
1	Injection Mould Design	Pye.R.G.W	Affiliated East – West PressPvt Ltd, 2000
2	Injection Moulding	Athalye.A.S	2nd Edn., Multi Tech Publishing Co., 1998
3	Introduction to Plastics Engineering	Vijay K. Stokes	John Wiley & Sons, 2020
4	Plastic Injection Molding:Manufacturing Process Fundamentals	Douglas M. Bryce	Society of Manufacturing Engineers, 1996
5	Plastic Injection Molding: MaterialSelection and Product Design Fundamentals	Douglas M. Bryce	Society of Manufacturing Engineers, 1997

ASSESSMENT AND CERTIFICATION

S. No.	Criteria for Assessment
1	A trainee will be assessed based on the performance in End Examination for Theory and Practical conducted internally in the Project Polytechnic College for a duration of 3 hours
2	A trainee must have 75% of attendance to appear for End examination in Theory and Practical.
3	The assessment for theory part will be based on the marks scored in the end examination on the knowledge bank of questions (1 word/objective type questions)
4	The assessment for practical part will be based on the marks scored in the end examination conducted by the Project Polytechnic and assessed by the Examiners approved by Strategic Plan Implementation Committee (SPIC) of the project polytechnic.
5	The passing criteria for successful completion of training is every trainee should score 50% of marks in theory and practical examination.
6	On successful completion of training, Certificate will be issued to the participants by the Directorate of Technical Education through the Project Polytechnics.

END EXAMINATION
ALLOCATION OF MARKS

S.NO	Description	Max.Marks
1.	Theory Examination	20
2.	Practical Examination	
	a)Aim and Procedure	20
	b)Demonstration / Execution	25
	c) Result & Viva Voce	15
	d)Record	20
	Total Marks	**100**

THEORY MODEL QUESTION PAPER

ME/2020/036 - PLASTIC INJECTION MOULDING

(Maximum Marks: 20)

(N.B: Answer any **Twenty** questions) **20x1= 20 Marks**

1. What are the types of Plastics?
2. Name any two Thermoplastic Materials.
3. Phenol Formaldehyde is Thermo set Material? Give the reason.
4. Define Bulk Factor.
5. What is Additive?
6. Expand RIM. Write short notes on RIM.
7. What are the functions of Injection moulding machine?
8. Define Cycle Time.
9. What is Clamping Tonnage?
10. What is Mould? List its functions.
11. What Feed System?
12. What are the functions of Runner?
13. Write short notes on Balancing of runner.
14. Define Shrinkage.
15. What is Parting Line? List the types of Parting Line.
16. Write Short notes on Cavity Layout.
17. What are the different types of cam actuation in Split Mould?
18. Define Undercut.
19. What is under feed mould?
20. Discuss about Hot runner Mould.
21. What is the use of Ribs and Boss in the plastic product?
22. What is draft angle? Why it is provided in plastic product?
23. What are the methods of decoration of plastic products?
24. Draw any two codes of recycling of plastic with illustration.
25. List the advantages of preventive maintenance.