



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

**CURRICULUM**

Course Name	<b>TOOL DESIGN</b>
Course Code	ME/2020/004
Course Duration	60 Hours
Minimum Eligibility Criteria	ITI/10th/+2/Diploma/Graduates
Pre-requisites (if any)	-
Course Objectives	<p>Training module has been designed to provide the participants to</p> <ul style="list-style-type: none"> <li>• Acquire knowledge on single point cutting tool nomenclature and cutting forces</li> <li>• Classify the cutting tool materials and chip breakers</li> <li>• Understand the Merchant's theory of mechanics of metal cutting</li> <li>• Design the milling cutters</li> <li>• Design the taper shank twist drill, reamer and broach</li> <li>• Design the blanking dies, piercing dies and bending dies</li> <li>• Design the drawing dies and forming dies</li> <li>• Design the jigs and fixtures</li> </ul>
Course Outcomes	At the end of training, the participants will be able to design, select and draw the cutting tools, Press tools, Jigs and Fixtures.
Expected Job Roles	Tool Engineer, Tool Maker

**TEACHING AND SCHEME OF EXAMINATION**

Course Code	Course Name	Hours		Assessment Marks		Duration of the Examination
				Min	Max	
ME/2020/004	<b>TOOL DESIGN</b>	Theory	30	10	20	3 Hours
		Practical	30	40	80	
		Total	60	50	100	

**ME/2020/004- TOOL DESIGN**  
DETAILED SYLLABUS

Unit No.	Modules	No. of Hours	
		Theory	Practical
<b>I</b>	<b>DESIGN OF CUTTING TOOLS</b>	<b>25 Hours</b>	
1.1	<b>Design of single point cutting tools:</b> Nomenclature of Single Point Cutting Tool – Tool signature – Functions of various tool angles – Optimum values of tool angles – Cutting tool materials IS:2428-1964 and IS:2832-1964 – Orthogonal & Oblique cutting – Chip formation – Merchant’s theory of mechanics of metal cutting – Permissible speed, feed& depth of cut – Design of single point cutting tools:IS:3019-1973 – Chip breaker – Types and uses	05	
1.2	<b>Design of Multipoint Cutting Tools</b> <b>Design of milling cutters:</b> Introduction – types of milling cutter – ISO designation of cutting tools -Force analysis – Design of Plain Milling cutter.	03	
1.3	<b>Design of taper shank twist drill:</b> Nomenclature of Twist drill IS:5103-1969– Design aspects – Cutting forces – Material selection:IS:5099-1969	02	
1.4	<b>Design of reamer and broach tool:</b> Nomenclature of reamer IS: 236/II– Types – Reamer design – Tool materials – Design problems Introduction – Design considerations – Constructional detail of broach – Tool life of a broach	02	
1.5	<b>Practical</b> ➤ Design Problems on cutting tools		13
<b>II</b>	<b>Design of Press Tools</b>	<b>20 Hours</b>	
2.1	<b>Design of blanking and piercing dies:</b> Fundamentals of die – Cutting operations – Power press types – Cutting action in punch and die operation – Die clearance – Cutting forces – Types of die construction – Die block design – Punch Design – Description of other parts in a die and punch – Assembly – Stock feed mechanism – Simple Design problems.	04	
2.2	<b>Design of bending dies:</b> Bending terminology – Bending methods – Design principles – Blank length – Bend radius – Bend allowances – Spring back – Bending pressure – Simple Design problems.	03	
2.3	<b>Design of drawing dies:</b> Drawing operations – Deep drawing and materials for deep drawing – Drawing die – Design consideration – Calculation of blank diameter, number of draws – Pressure – Clearance – Allowance – Radius of draw dies – Punch radius – Drawing speed and single and double action draw dies – Simple Design problems.		

2.4	<b>Forming dies:</b> Embossing dies, curling dies, Bulging dies – Hole flanging or extruding dies – Twisting operations – Coining dies – Swaging dies (Descriptions only).	03	
2.5	<b>Practical</b> ➤ Design Problems on press tools.		10
<b>III</b>	<b>Design of Jigs and Fixtures</b>	<b>15 Hours</b>	
3.1	<b>Design of jigs:</b> Principles of locating and clamping – Definition of drill jig – General considerations in the design of drill jigs – Drill bushings – Jig feet – Types of drill jigs – Methods of constructions – Design of solid jigs, leaf jig, plate jig and indexing jig.	04	
3.2	<b>Design of fixtures:</b> Definition of fixture – Design of Milling fixtures, lathes fixtures, welding fixtures and grinding fixtures.	04	
3.3	<b>Practical</b> ➤ Design problems on Jigs and Fixtures		07
<b>Total Theory and Practical hours</b>		<b>30</b>	<b>30</b>
<b>Total hours</b>		<b>60</b>	

#### HARDWARE REQUIREMENTS

S. No.	List of Tools and Equipments
1	High End Workstation (with Intel Processor i5 or i7) with 1 TB HDD / 16 GB DDR4 RAM / 2GB PCI Graphics Card / KBD / Mouse
2	LCD / LED Monitor - 22" Wide
3	Microsoft Operating system (Windows 8 / 10 - 64 Bit Support)
4	Drafting Tables
5	Cutting Tools and Press Tools

#### SOFTWARE REQUIREMENTS

S. No.	List of Software
1	Design and Modelling software: AutoCAD / CATIA / ProE / Solid works

#### REFERENCE BOOKS

S. NO.	NAME OF THE BOOK	AUTHOR	PUBLISHER
01	A Text Book of Production Engineering	P.C.Sharma	S.Chand & Co. Ltd.,
02	Tool Engineering	G.R.Nagpal	Khanna Publishers, New Delhi.
03	Tool Design	Donaldson	Tata McGraw Hill, New Delhi

04	Fundamentals of Tool Design	ASTME (American Society of Tool and Manufacturing Engineers)	Prentice-Hall of India, New Delhi
05	Production Engineering Science	P.C.Pandey & Singh	Charator Publishing

### 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
<b>Total Marks</b>		<b>100</b>

**THEORY MODEL QUESTION PAPER**

**ME/2020/004- TOOL DESIGN**

(Maximum Marks: 20)

(N.B: Answer any **Twenty** questions)

**20x1= 20 Marks**

1. What is tool signature?
2. List any two cutting tool materials.
3. What is the purpose of providing rake angle in the single point cutting tool?
4. List any two types of milling cutter?
5. What is radial rake angle of plain milling cutter?
6. Write the optimum value of point angle of twist drill.
7. Write any one design factor of twist drill.
8. List any two types of reamer.
9. List any two tool materials of reamer.
10. What is broach allowance?
11. What is blanking?
12. Name any two power presses.
13. Define die clearance.
14. Write the formula for bend allowance.
15. What is Spring back?
16. Define deep drawing.
17. How do you calculate the blank diameter for drawing operation?
18. List any one design factor of drawing die.
19. What is the purpose of curling operation?
20. Define coining.
21. List any two elements of drill jig.
22. List any two types of drill jig.
23. What is the use of jig feet?
24. Define fixture.
25. What is the purpose of providing the setting block in the milling fixture?