3PE06: TOOL ENGINEERING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

This course illustrates the basic aspects of tooling, tool design and methods used in various metal cutting and forming processes.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Cutting Tools Design** Types of cutting tools, Design of single point cutting tools, milling cutters, drills, reamer, broach, cutting tool materials and heat treatment, manufacturing of cutting tools, coating on tool, Tool holders for turning and milling, tool inserts-types, ISO-designation and applications, Tool Reconditioning	6
2	**Jig and Fixtures** Concept of location and clamping, 3-2-1 principle of location, Location system for standard work and tool holding devices, locating and clamping methods, analysis of clamping force required, general guideline for design of jig and fixtures, fool proofing and ejecting, various elements of jigs and fixture, drill jig, fixtures for milling, lathe, grinding and welding processes, economics of jig and fixtures, concept of modular fixture and tool presetting.	8
3	**Press Tool Design** Press operations, Press working equipment, press selection, types of dies, principle of sheet metal cutting, stages of cutting operation, center of pressure, strap strip layout, cutting force and press tonnage, methods to reducing cutting force, design and manufacturing of blanking die, piercing die, deep drawing die, bending die	10
4	**Forging die design** Forging equipment and selection, impression in multiple impression die, design and manufacturing of forging dies, Guidelines for selection of various design factors, parting line, draft, rib-web, Corner & fillet radius, shrinkage & die wear etc., Determination of stock size.	6
5	**Die-casting dies design** Die Casting processes Hot & Cold Chamber, Metals for die casting, Design considerations in die casting. Types of cores, feeders, inserts, die lubrications & rules, heat transfer consideration, directional solidification, cooling system, feed and flow system and ejection system, interlocks & safety devices, die casting defects and remedies.	6

Unit No.	Topics	Teaching Hours
6	**Plastic Moulding** Introduction of compression and transfer moulding process, Study of Injection and blow moulding process; - machine specifications, moulding cycle. Design of simple two plate injection moulds. Design of simple blow moulds for articles, Study of types of ejectors, gates, runner's, Study of cooling systems and heat transfer consideration. Calculation of no. of cavities, Mould opening force, ejection force etc.	6
	Total	**42**

List of References:

1. Donaldson C., *"Tool design"*, 4th edition, McGraw Hill Education, 2012
2. Eary D. F., Jhonson G. E., *"Process Engineering for Manufacturing"*, Prentice-Hall, 1962
3. Basu S., Mukherjee S., Mishra R., *"Fundamental of Tool Engineering Design"*, Oxford & IBH Publishing Co. Pvt. Ltd., 1979
4. Sharma P., *"A textbook of Production Engineering"*, S. Chand & company Pvt. Ltd., 2015
5. Nagpal G., *"Tool Engineering & Design"*, Khanna Publication
6. Grant H., *"Jig and fixtures non-standard Clamping Devices"*, McGraw Hill Education, 1971
7. Joshi P., *"Jigs and fixtures"*, 3rd edition, McGraw Hill Education, 2017
8. *Handbook of Die design Handbook, McGraw Hill, 2006*
9. *Metal Hand Book, Vol-II and III.ASME*
10. *Forging Handbook, ASM, Vol. 5, 9th edition*

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand the fundamental concept of design of various tooling used in the manufacturing processes.
2. Design and manufacturing of single point and multipoint cutting tools.
3. Apply concept of location theory for the design of jigs and fixtures.
4. Design the dies used in the press working, forging, die-casting and plastic molding processes for simple shape components.