Devi Ahilya Vishwavidhyalaya, Indore, India **Institute of Engineering & Technology**					**III Year B.Tech. (Mechanical Engineering)**	
Course Code & Name	**Instructions Hours per Semester and Credits**					
5RMPE1 **PRODUCTION ENGINEERING-I**	**Classroom Instruction (CI)**		**Lab Instruction (LI)**	**Term Work (TW) and Self Learning (SL)**	**Total no. of Hours Per semester**	**Total Credits (Total Hours/30)**
	L	**T**	**P**	**TW+SL**	**120**	**4**
	20	**10**	**20**	**70**		

Course Learning Objectives:

1. To provide an understanding of the basic design features and constructional details of the machine tools.
2. To provide an understanding of the tooling used for manufacturing of parts with special emphasis on the design of jigs and fixtures.
3. To learn about the various sheet metal operations, the equipments like Press Tools and the tooling (sheet metal dies) used to produce sheet metal parts.
4. To learn about the DFMA approach and the other contemporary design and manufacturing methodologies used in production of parts.
5. To learn about the basics of production systems and automation in production systems.

Prerequisites:
A basic course in manufacturing processes which includes fundamentals of machining, metal forming and workshop practice.

COURSE CONTENTS

Unit –I
Fundamentals of Machine Tools: Introduction and classification of machine tools, requirements and characteristics of conventional and CNC machine tools, basic design features of the elements of machine tool structure: beds, columns and frames, slides and sideways, spindles and spindle bearings, machine tool drives, machine tool testing, maintenance and safety.

Unit-II
Tooling for Machine Tools: General tooling for the conventional and CNC machine tools,
Jigs-Fixtures: principles of jigs and fixture design, locating, clamping and indexing, Design of drilling jigs: drill jig bushes and types of jigs ; Milling fixtures, Lathe fixtures, Grinding fixtures, Broaching fixtures, Assembly fixtures, Automated jigs and fixtures, Materials for jigs and fixtures and jigs & fixture economics.

Unit-III
Sheet Metal Working & Press Tools: Introduction to sheet metal forming, forming limit diagram, basic operations on sheet-metal, press working equipment & press selection, components of a die assembly, types of dies, die and punch clearances, forces and power requirements for sheet metal operations, center of pressure, blanking dies, drawing dies, bending

dies, design considerations and defects in sheet-metal parts, materials & manufacture of sheet metal working dies.

Unit-IV

Design for Manufacture & Assembly: Role of processing in design, factors determining process selection, Design for Manufacturability (DFM), Design for Assembly (DFA), product design considerations for machining, casting, forging, welding, plastic and composite parts. Product Design Methodologies like fool proofing, standardization, design for reliability, failure mode-effect analysis, value analysis, development of modular design and design for safety.

Unit-V

Production Systems and Automation: Types of production systems, review of production concepts and mathematical models, reasons for automation, automation strategies and levels of automation, automation for machining operations, automated flow lines and conveyor systems, Types of assembly systems, design considerations for the automated assembly systems, design considerations for material handling system, automated guided vehicle systems(AGV's).

Books Recommended

[1] Sharma P. C., *A text Book of Production Engineering,* S. Chand Publishing , 11ed,1982.

[2] Pandey PC & Singh CK, *Production Engineering and Science,* Standard Pub. & Distr. 2011.

[3] Dieter E. George, Schmidt Linda, *Engineering Design,* McGraw-Hill Education,5ed, 2012.

[4] Rao P.N., *Manufacturing Technology,Vol-1,Vol-2,*McGraw-Hill Education, 2017

[5] Groover Mikell P. *Automation, Production Systems & Computer Integrated Manufacturing*, PHI Learning Pvt Ltd.3ed, 2015.

LIST OF PRACTICALS/ASSIGNMENTS

Practical 1: To study the constructional features and operation of a CNC Lathe.

Practical 2: To study the constructional features and operation of a CNC Milling Machine.

Practical 3: To study the various types of locating elements used in Jigs and Fixtures.

Practical 4: To study the various types of clamping and Indexing elements used in Jigs and Fixtures.

Practical 5: To design a Jig/Fixture for a given work part geometry.

Practical 6: To study the design features of a Blanking and Punching Die.

Practical 7: To improve a product design using DFX methodologies.

Practical 8: To study the part programming for the machining of a workpart on a CNC Milling/CNC Turning Centre and write a part program for a given workpart geometry.

Practical 9: To study the various components and working of an FMS.

Course Out Come (CO)	After completion of the course, students will be able to:
CO1	To understand the design features and capabilities of different types of machine tools so as to select and use them for production purposes.
CO2	To understand the basic tooling used on conventional and CNC Machines and to select them appropriately for different production processes and environments, design jigs-fixtures for different part geometries.
CO3	To select the press tools for sheet metal operations, the processing requirements including the design related features of sheet metal dies so as to produce quality parts.
CO4	To understand some of the contemporary methodologies used for product/process design and improvements.
CO5	To understand the parameters related to different production systems and the basic components of an automated production system so as to develop a pre-requisite knowledge for production and operations planning in automated environments.

CO-PO-PSO Mapping

Course Name**: Production Engineering-I** Course Code**: 5RMPE1**

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	1	2	1	1	1	1	1	3	3	2	3	2	1
CO2	3	2	2	1	2	1	1	1	3	3	2	3	2	2
CO3	3	2	3	1	2	1	1	1	3	3	2	3	3	3
CO4	3	3	3	2	2	3	3	2	3	3	2	3	3	3
CO5	3	3	3	2	2	1	2	1	3	3	3	2	2	2
Avg	3	3	3	1.4	1.8	1.4	1.6	1.2	3	3	2.2	2.8	2.4	1.6

* CO (rows) mention nil/very small/insignificant contribution to the PO(column)
1→ relevant and small significance 2 → medium or moderate and 3 →strong