

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>			<b>III Year B.E. (Mechanical Engg.) (Full Time)</b>				
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>5MERC1 PRODUCTION ENGINEERING - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>Duration of Theory Paper: 3 Hours</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>1</b>	<b>0</b>

### **Course Objective:**

The course is designed

1. To provide an understanding of the design features of the machine tools and the types tooling used in the manufacturing of mechanical components.
2. To learn about the various sheet metal processes and the equipments and tooling used to produce sheet metal parts.
3. To learn about the DFMA approach and methodologies
4. To learn about the basics of production systems and automation in production systems.

**Pre requisite(s):** A basic course in manufacturing processes and workshop practice.

### **COURSE CONTENTS**

#### **UNIT-I**

**Fundamentals of Machine Tools:** Introduction and classification of machine tools, requirements and characteristics of machine tools, 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 machine tools, jigs-fixtures: locating and clamping, principles of jigs and fixture design, design of drilling jigs, drill jig bushes and type 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, center of pressure, blanking die design, piercing die design, pilots, 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. Design evaluation: minimum part assessment, robustness assessment, 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, design and fabrication considerations, automated flow lines, methods of workpart transport and transfer mechanisms, assembly systems, types and design considerations for the automated assembly systems, types of material handling equipment, design considerations for material handling system, conveyor systems, automated guided vehicle systems(AGV's).

### **Course Outcome:**

Students earned credits will develop ability to

- CO1 Understand the design features of the machine tools and tooling like jigs-fixtures and select them appropriately for different production processes and environments.
- CO2 Understand the basic processes and set-ups used to produce sheet metal parts.

CO3 Understand some of the contemporary design methodologies used for the design and manufacture of parts.  
CO4 Learn about basics of production systems and automation in materials handling and assembly systems.

**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.

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**Course Outcome:**

Students earned credits will develop ability to

CO.No.	CO	PO
CO1	Understand the design features of the machine tools and tooling like jigs-fixtures and select them appropriately for different production processes and environments.	PO1,PO2,PO3,PO4,PO5,PO12
CO2	Understand the basic processes and set-ups used to produce sheet metal parts.	PO1,PO5,PO11,PO12
CO3	Understand some of the contemporary design methodologies used for the design and manufacture of parts.	PO1,PO2,PO5,PO11,PO12

**CO-PO Relationship**

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3	3	3							2
CO2	3				3						2	2
CO3	3	3			3						2	2
CO4												
CO5												

\* CO (rows) mention nil/very small/insignificant contribution to the PO(column)

1 → relevant and small significance    2 → medium or moderate    and    3 → strong