



Year / Semester: **III B.Tech V Semester**

Regulation: **R23**

Subject and Code: **MACHINING PROCESS & METROLOGY & 23MEC352T**

**MACHINING PROCESS &  
METROLOGY**

**L T P C**

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**PRE-REQUISITES:**

**COURSE EDUCATIONAL OBJECTIVES:** The objectives of the course are to

1. Gain knowledge on working principle of different metal cutting processes and familiarize with cutting forces, machining calculations and cutting fluids..
2. Make the student learn about principles of lathe and Drilling machines.
3. Make the student learn about principles of Grinding and Milling machines.
4. Explain the system of limits, fits & tolerances and design of gauges
5. Know the measurement of screw thread and Describe the Measurement of Displacement, Force.

**UNIT -1:**

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry of single point tool and angles, chip formation and types of chips – built up edge and its effects, chip breakers. Mechanics of orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, heat generation, tool life, coolants, machinability – economics of machining. Cutting Tool materials and cutting fluids –types and characteristics.

**UNIT -2:**

Engine lathe – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread cutting operations and attachments for Lathes. Drilling, Boring Machines, Shaping, Slotting and planning machines - Principles of working, specifications, types, Tools and tool holding devices – operations performed, machining time calculation.



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**UNIT -3:**

Milling Machine–Principles of working–specifications–classifications of milling machines– Methods of indexing, milling cutters-machining operation, Accessories to milling machines.

Grinding Machine –Theory of grinding – classification– cylindrical and surface grinding machine – Tool and cutter grinding machine – Grinding wheel specification -types of abrasives – bonds, Truing and Dressing of wheels.

Lapping, Honing and Broaching Machines–comparison of grinding, lapping and honing. Principles of design of Jigs and fixtures and uses, Classification of Jigs & Fixtures – Principles of location and clamping –types.

**UNIT -4:**

Concept of Measurement: Concept of feedback Control systems -generalized measurement system, units and standards, measuring instruments, sensitivity, readability, range of accuracy, precision, terminology and limits fits and tolerances, hole basis and shaft basis system, interchangeability.

Linear and Angular Measurement: Linear measuring instruments: Vernier instruments, micrometers, slip gauges, tool maker’s microscope, Angular measurements: Sine bar, bevel protract.

Roughness measurement:-Methods of measurement of surface finish-profilograph, talysurf.

**UNIT -5:**

Screw Thread and Gear Measurement: errors in screw threads, various methods for measuring external and internal screw threads.

Coordinate Measuring Machine (CMM)-Construction and features.

Measurement of Displacement: Theory and construction of various transducers to measure displacement Piezo-electric, capacitance, transducers.

Measurement of Force: Direct method-load cells and proving rings.

**COURSE OUTCOMES:**

On successful completion of the course, students will be able to		Pos
CO1	Illustrate advanced machining processes, cutting tools and cutting fluids for a specific material and part features	L1,L2
CO2	Operation of various machines like lathe, drilling, grinding, slotting, shaping, milling etc	L2
CO3	Practical exposure on flat surface machining, milling and grinding operations	L1,L2
CO4	List various measuring instruments used in metrology	L3
CO5	Measure Screw Thread, Displacement and Force	L2,L4



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**TEXT BOOKS:**

1. Manufacturing Technology-Kalpak zian-Pearson Seventh edition.(2018)
2. R.K.Jain, Engineering Metrology,20/e, Khanna Publishers,2013.

**REFERENCE BOOKS:**

1. Production Technology by R.K.Jain and S.C.Gupta, Khanna Publishers, 17th edition.
2. Workshop Technology –Vol II, B.S.Raghu Vamshi, DhanpatRai&Co,10th edition, 2013
3. Mahajan, Engineering Metrology, 2/e,DhanpatRai,2013.
4. S.Bhaskar, Basic Principles-Measurements and Control Systems, Anuradha Publications, 2014.
5. D.S.Kumar, Mechanical Measurements & Control, Metropolitan Publishers,5/e,2015.

**REFERENCE WEBSITE:**

<https://nptel.ac.in/courses/112/107/112107078/>

- [https://youtu.be/t3y\\_Ys3LgGM](https://youtu.be/t3y_Ys3LgGM)
- [https://www.youtube.com/watch?v=E4VZ\\_rFqpG4](https://www.youtube.com/watch?v=E4VZ_rFqpG4)
- [https://youtu.be/-tcaR7oSx\\_w](https://youtu.be/-tcaR7oSx_w)
- <https://youtu.be/Uybg6VDLoRQ>
- <https://youtu.be/Uybg6VDLoRQ>
- <https://youtu.be/aWQsEX1TrSI>



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**Max Marks: 10**

S.No.	CO	Questions	BT
<b>Unit I: (Elementary treatment of metal cutting theory)</b>			
1	1	Describe basic requirements of machining with neat sketch.	L2
2	1	a) List out various tool materials and explain their applications ? b) Explain the use of chip breakers in metal cutting ?	L2
3	1	Explain various cutting tool materials?	L2
4	1	Describe the factors affecting on tool life and write its effects?	L2
5	1	Explain the geometry of a single point cutting tool with suitable sketches.	L2
6	1	Explain different types of chips formed while machining?	L2
7	1	Differentiate between orthogonal cutting and Oblique cutting	L4
8	1	Explain the terms cutting speed, feed and depth of cut in detail.	L2
9	1	Discuss different types of Cutting fluids ?	L2
10	1	Draw a Merchant's circle diagram and derive expressions to show relationships among the different forces acting on the cutting tool ?	L4



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S.No.	CO	Questions	BT
<b>Unit II:</b>			
1	2	Explain the Constructional features and working principle of lathe ?	L2
2	2	Discuss the different types of lathe machines and their applicatons.	L2
3	2	Briefly explain the different operations performed on lathe ?	L2
4	2	Comparison between a turret and capstan ?	L4
5	2	Explain the working principle of shaping and types of shaper ?	L2
6	2	Discuss the working principle of slotting and operations performed on it?	L2
7	2	Explain the principle of planner and types of planner machine?	L2
8	2	Write the difference between shaping and planning machine?	L4
9	2	What are the operations that can be performed on a Drilling machine?	L2
10	2	Describe the principle of working of Boring machines and explain their importance in precision machining.	L2



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S.No.	CO	Questions	BT
<b>Unit III</b>			
1	3	Give a brief classification of milling machines and explain the principle of milling machine?	L2
2	3	What are the various types of milling cutters used in milling explain?	L2
3	3	Differentiate between up milling and down milling explain their applications?	L4
4	3	What do mean by broaching explain principle related to broaching and types of broaching machines?	L2
5	3	Discuss different types of grinding machines?	L2
6	3	Explain the different types of abrasives used in grinding wheel ?	L2
7	3	Briefly describe about tool and cutter grinding machine?	L2
8	3	Explain the working principle and applications of Electric Discharge Machining with a neat sketch.	L2
9	3	Describe the principle and working of Electrochemical Machining (ECM).	L2
10	3	Discuss the working principle and applications of Laser Beam Maching with a neat sketch.	L2



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S.No.	CO	Questions	BT
<b>Unit IV</b>			
1	4	Define Limits and Fits. Describe the various types of fits in brief.	L2
2	4	Explain the construction and working principles of sine bar and its applications.	L2
3	4	Describe the construction and working of a tool maker's microscope. Explain its applications in precision measurement.	L2
4	4	Explain the concept of slip gauges. Discuss wringing, grades, and their applications in calibration.	L2
5	4	Compare Vernier caliper and micrometer in terms of construction, accuracy, and applications.	L4
6	4	Explain the construction and working of a Talysurf instrument. Discuss its advantages over conventional methods.	L2
7	4	Describe the working principle of a profilograph with a neat sketch. Explain how surface profile is obtained.	L2
8	4	Differentiate between accuracy and precision with suitable examples	L4
9	4	Define and explain the following characteristics of measuring instruments: <ul style="list-style-type: none"><li>• Sensitivity</li><li>• Readability</li><li>• Range</li><li>• Accuracy</li><li>• Precision</li></ul>	L2
10	4	Explain the hole basis system and shaft basis system with suitable diagrams and applications.	L2



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S.No.	CO	Questions	BT
<b>Unit V</b>			
1	5	Explain various types of errors in screw threads. Discuss their causes and methods to minimize them.	L2
2	5	Explain the construction and working principle of LVDT.	L2
3	5	Explain the measurement of major diameter, minor diameter, and pitch of screw threads.	L2
4	5	Explain the construction and working of a Coordinate Measuring Machine (CMM) with a neat diagram.	L2
5	5	Describe the construction and working of a proving ring with neat sketch.	L2
6	5	Explain the working principle, construction, and applications of load cells.	L2
7	5	Describe the working principle of capacitance transducers with suitable diagrams.	L2
8	5	Describe the construction and working of a gear tooth vernier caliper.	L2
9	5	Explain the theory, construction, and working of piezoelectric transducers for displacement measurement.	L2
10	5	Explain different methods for measuring external screw threads: <ul style="list-style-type: none"><li>• Screw thread micrometer</li><li>• Two-wire method</li><li>• Three-wire method</li></ul>	L3

Note: L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating, and L6-Creating



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## Instruction to Faculty Members:

### The Six Levels of Bloom's Taxonomy:

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory (e.g., list, define, name, locate).
2. **Understanding:** Constructing meaning, explaining ideas, or concepts (e.g., summarize, interpret, classify, compare).
3. **Applying:** Using information in new situations or implementing procedures to solve problems (e.g., solve, use, demonstrate, implement).
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure (e.g., contrast, categorize, distinguish, diagram).
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing (e.g., judge, critique, justify, defend, argue).
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure (e.g., design, construct, develop, formulate).