

**MACHINING SCIENCE**  
**Semester I (Production Engineering) SUB CODE: MEPR102**  
**Teaching Scheme (Credits and Hours)**

Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
4	0	2	6	5	3	70	30	20	30	150

**LEARNING OBJECTIVES:**

The objective of this course is

- To learn various concepts related to machining.
- To have practical purview of various production techniques.

**LESSON PLANNING**

SR.NO	CHAPTER NO	DATE/WEEK	%WEITAGE
1	1,2,3	1 <sup>st</sup> 2 <sup>nd</sup> 3 <sup>rd</sup>	20
2	4,5	4 <sup>th</sup> 5 <sup>th</sup> 6 <sup>th</sup>	20
3	6,7	7 <sup>th</sup> 8 <sup>th</sup> 9 <sup>th</sup>	20
4	8,9	10 <sup>th</sup> 11 <sup>th</sup> 12 <sup>th</sup>	20
5	10,11	13 <sup>th</sup> 14 <sup>th</sup> 15 <sup>th</sup>	20

**Total hours (Theory): 60, Total hours (Practical):30, Total hours: 90**

**DETAILED SYLLABUS**

Chap . No.	Topic
1	<b>Introduction to Machining:</b> Basic Mechanism involved, Tensile test; stress and strain; Mechanism of Plastic Deformation- slip, dislocation
2	<b>Chip Formation:</b> Typical lathe tools; Orthogonal cutting; oblique cutting; Types of chips; Mechanism of built-up-edge formation
3	<b>Tool Geometry:</b> Reference planes; Tools specification in ASA, ORS and NRS; conversation from ASA to ORS; Selection of tools angles; Multi-point cutting tools-geometry of peripheral milling cutters and twist drills.
4	<b>Mechanics of Metal Cutting:</b> Merchant's circle diagram- determination of cutting and thrust forces; Coefficient of friction; Stress, strain and strain rate; Measurement of shear angle - direct and indirect methods
5	Mohr's circle diagram; slip line field method; Thin zone model - Lee and Shaffer's relationship; Thick zone model - Okushima and Hitomi model(analysis) ; Friction in Metal cutting.
6	<b>Mechanics of Oblique Cutting:</b> Concept of rake angle measured in different planes; Shear angle; Velocity and force relationship.
7	<b>Measurement of Cutting Forces:</b> Cantilever beams, rings; Dynamometer requirement; turning, drilling milling and grinding.

8	<b>Tool Wear and Tool Life:</b> Mechanism of wear; Progressive tool wear; Flank wear; Crater wear; Model of diffusion wear; Tool life : Variables affecting tool life-Cutting conditions; tool geometry; Tool materials; work materials; Work materials; Cutting fluids; Determination of tool life equation; Mach inability.
9	<b>Economics of Machining:</b> Minimum production cost criterion; Maximum production rate criterion; maximum profit rate criterion; Restriction on cutting conditions.
10	<b>Abrasive Machining Processes:</b> Introduction; Grinding: Characteristics of a grinding wheel; Specification of grinding heels; Mechanics of grinding process; Chip length in horizontal surface grinding; External and internal cylindrical grinding; Specific energy in grinding; Wheel wear; Thermal analysis; Selection of grinding wheels; Honning and lapping operations.
11	<b>Thermal Aspects of Machining:</b> Regions of heat generation; Distribution of heat generated; Equations of flow due to conduction, transportation, heat absorbed and heat generated; Average shear plane temperature; Average chip-tool interface temperature Experimental determination of cutting temperature - tool-work thermocouple technique, infrared photographic technique

#### LIST OF PRACTICALS

Sr. No.	Practical Content
1	ANALYSIS OF TOOLS & CUTTERS BASED ON GEOMETRY & MATERIALS TO BE PROCESSED
2	TO UNDERSTAND THE EFFECT OF VARIOUS PARAMETERS ON THE TYPE OF CHIP PRODUCED
3	COMPUTATION OF TOOL WEAR UNDER VARIOUS CUTTING CONDITIONS
4	VALIDATION OF OBLIQUE CUTTING THEORIES BY EXPERIMENTATION
5	EFFECT OF THE APPLICATION OF A CUTTING LUBRICANT ON POWER CRITERION IN ORTHOGONAL CUTTING
6	MEASUREMENT OF CHIP TOOL INTERFACE TEMPERATURE IN ORTHOGONAL CUTTING
7	EFFECT OF RAKE ANGLE IN ORTHOGONAL MACHINING ON POWER CRITERION & SHEAR ANGLE
8	MEASUREMENT OF CUTTING FORCES IN TURNING & DRILLING
9	MEASUREMENT OF SHEAR ANGLE IN ORTHOGONAL CUTTING
10	MEASUREMENT OF CHIP LENGTH IN GRINDING

#### INSTRUCTIONAL METHOD AND PEDAGOGY (Continuous Internal Assessment (CIA) Scheme)

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all units while conducting teaching & examination.
- Attendance is compulsory in lectures and Tutorial.
- Viva Voce will be conducted at the end of the semester of 30 Marks.
- One internal exam of 30 marks is conducted as a part of Mid semester evaluation.

**STUDENTS LEARNING OUTCOMES:**

At the end of the course

The students will gain an experience in the implementation of machining concepts which are applied in the field of production

**Reference Books:**

1. An introduction to the principles of Metal working - Rowe, Edward Arnold, 1968
2. Manufacturing properties of metals and Alloys - Alexander and Brewar, Van Nostrand.
3. Principle of metal cutting- Dr.A.Bhattacharya
4. Fundamental of machining and machine tools-Geoffrey Boothroyd-CRC Taylor & Francis
5. Manufacturing Engineering and Technology-serope kalakjian-Addison Wesley longman (Singapore)Pvt. Ltd.

