SEMESTER S5

MECHANICS OF METAL CUTTING

Course Code	PEIET522	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To provide students with a thorough understanding of the principles and mechanics underlying metal cutting processes.
2. To equip students with the skills to analyze and apply advanced machining techniques.

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	**Fundamentals of metal cutting:** Definition and importance of metal cutting, types of metal cutting processes- turning, milling, drilling and grinding. Overview of cutting tools and their materials. Mechanics of cutting - chip formation and types of chips, orthogonal and oblique cutting. Forces in cutting - cutting force, thrust force, radial force. Cutting tool geometry - single-point and multi-point cutting tools, tool angles and their significance. Tool life and wear mechanisms. Cutting fluids- types and properties of cutting fluids, functions and applications of cutting fluids.	9
2	**Cutting tool materials and coatings:** High-speed steels, carbides, ceramics, and diamond tools, properties and applications of different tool materials. Tool coatings - types of coating - TiN, TiC and Al2O3, benefits of coatings in cutting performance. Tool material selection - criteria for selecting tool materials. Cost benefit analysis of different tool materials and coatings.	9
3	**Cutting parameters and surface integrity:** Cutting parameters - speed, feed, and depth of cut, influence of cutting parameters on cutting forces and tool life, optimization of cutting parameters for different materials. Surface integrity- surface roughness and its measurement, factors affecting surface	9

	finish in machining, impact of cutting conditions on surface integrity. Inspection methods for machined components, statistical process control in machining, tolerances and fits in metal cutting.	
4	**Advanced Machining Techniques and Future Trends:** Introduction to non-traditional machining processes - EDM, ECM, LBM, applications and advantages of non-traditional machining, high-speed and ultra-precision machining, principles of high-speed machining, equipment and techniques for ultra-precision machining, applications in aerospace, automotive, and electronics industries. Emerging technologies in machining- additive manufacturing, hybrid machining.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

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End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the fundamentals of metal cutting processes and cutting tool geometry.	**K2**
CO2	Identify cutting tool materials and coatings for their suitability in various machining applications.	**K3**
CO3	Apply cutting parameters to improve surface integrity and enhance the overall quality of machined components.	**K3**
CO4	Make use of advanced machining techniques and automation technologies to address the challenges in the industry.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	-	1	-	-	-	-	-	-	2
CO2	3	-	2	-	2	-	-	-	-	-	-	2
CO3	3	-	2	-	2	-	-	-	-	-	-	2
CO4	3	-	2	-	3	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Metal Cutting Principles	Milton C. Shaw	Oxford University Press	2nd Edition, 2005
2	Machining and Machine Tools	A. B. Chattopadhyay, P. C. Mishra	Wiley India	2nd Edition, 2011

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Elements of Workshop Technology	S. K. Hajra Choudhury	Media Promoters and Publishers	15th Edition, 2010
2	Fundamentals of Metal Cutting and Machine Tools	B. L. Juneja	New Age Publishers	2nd Edition 2017

Video Links (NPTEL, SWAYAM…)	
LINK ID	https://archive.nptel.ac.in/courses/112/105/112105233/

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