

Branch Name:	Mechanical Engineering (Production Technology)
Program Code:	ET209
Course Name:	Machining Science
Course Code:	2ET2090103T
Pre-requisite Course:	Basic Manufacturing Engineering Courses

Course Objectives:

1. To get familiar the students in the art of machining Science as many developments are taking place in manufacturing.
2. The students will thoroughly get a feel of the relevant suitable process while evaluating and deciding.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	4	-	-	4	24	60	16	40	-	-	-	-	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Mechanics of Metal Cutting: Tool geometry-effect of rake, lead and clearance angles; shear angle and its relevance, strain and strain rate in orthogonal cutting, stress distribution along rake face, theories of Merchant, Lee and Shaffer, Oxley, etc. Inserts-chip groove geometries; nomenclature, selection and applications in turning, milling, drilling, design concepts, new tool geometries, selection of operating conditions, carbide grade design, carbide coatings, ceramic, super hard grade design, effect of cutting variables on forces, tool failure analysis, theories of tool wear, measurement of tool wear, tool life and economics of machining, CNC machining.	10	40
2	Thermal Aspects in Machining: Heat and temperature distribution, modeling of chip formation in metal cutting, modeling of machining characteristics in turning, milling, drilling, grinding, etc., measurement of cutting forces and cutting temperatures, surface analysis, methods of improving surface characteristics, Minimum Quantity Lubrication. Grinding; wheel conditioning - Electrolytic in-Process Dressing.	08	30
3	Micro Machining: Tool based micromachining methods, cutting edge radius effect, minimum uncut chip thickness, micro turning, micro milling, unconventional micromachining methods – micro EDM, micro		

	WEDM. Ultra-precision machining; mechanism of material removal, methods and applications. High speed machining (HSM)- mechanics, applications. nano surface generation, brittle versus ductile regime machining - ductile cutting of silicon wafers, nanometric cutting, chip formation, recent developments. Rapid Prototyping: Principle of rapid prototyping, various RP technologies, selection of a suitable RP process for a given application, emerging trends, reverse engineering; data extraction, data processing. Applications and case studies, Introduction to file formats, Processing STL files.	08	30
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Review Presentation:

The student is expected to spend minimum 2 hours per week (as mentioned in the teaching and evaluation scheme) to refer at least two peer reviewed journal papers related to this domain/subject. The student is expected to identify issues/challenges and emerging trends in the domain/subject. Student is supposed to explore various video lectures (E.g. NPTEL) available in the domain/subject. Student is required to make a review-presentation on the work carried out for the same.

Recommended sites for journal papers are (1) asmedigitalcollection.asme.org (2) springer.com (3) sciencedirect.com (4) ieeexplore.ieee.org (5) scholar.google.co.in or others of similar repute.

List of Reference Books:

1. A. Ghosh, and A. K. Mallik, Manufacturing Science, Affiliated East West Press Ltd, 2014.
2. J. A. McGeough, Advanced Methods of Machining, Chapman and Hall, 2011
3. Winston A. Knight, and Geoffrey Boothroyd, Fundamentals of Metal Machining & Machine Tools, 3rd ed., CRC Press, 2005.
4. Serope Kalpakjian, and Steven R. Schmid, Manufacturing Engineering and Technology, 7th ed., Pearson Education, 2013.
5. C. K. Chua, K.F. Leong and C. S. Lim, Rapid Prototyping: Principles and Applications, 3rd ed., World Scientific, 2008

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the Mechanics of Metal Cutting	1 Remembering 2 Understanding
CLO2	Acquainted with Thermal Aspects in Machining	2 Understanding
CLO3	Learn about the process of micro-machining	2 Understanding
CLO4	Understand various unconventional micro-machining methods	2 Understanding
CLO5	Explore emerging trends in RP and reverse engineering	3 Applying
CLO6	Select of a suitable RP process for a given application	4 Analyze

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	M	M											M	
CLO2			M										M	
CLO3				M									M	
CLO4					M					M			M	
CLO5				M							M			M
CLO6				M						M	L			M

H: High, M: Medium, L: Low