

Branch Name:	Mechanical Engineering (Production Technology)
Semester/Year:	Semester I / First Year
Subject Title:	Machining Science
Subject Code:	1ET2090103
Pre-requisite:	Basic Manufacturing Engineering Courses

Course Objectives:

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

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
02	00	02	04	60	40	30	20	150

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.	08	30

	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.		
		26	100

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 (5) ieeexplore.ieee.org (6) scholar.google.co.in or others of similar repute.

Course Outcomes:

The student will be able to

1. Select material processing technique with the aim of cost reduction, reducing material wastage & machining time.
2. Identify the process parameters affecting the product quality in various advanced machining of metals/ non-metals, ceramics and composites.
3. Perform process analysis taking into account the various responses considered in a process

List of References:

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

List of Experiments:

Students are required to perform experiments based on parametric study of various conventional manufacturing processes.