

ME451: PRECISION MANUFACTURING
CREDITS = 5 (L=3, T=0, P=2)

Course Objective:

To relate the functional requirements with precision machining processes.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P		Theory		Practical		Total Marks
			ESE	CE	ESE	CE		
3	0	2	5	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	<p><u>Fundamentals of Precision Manufacturing:</u> Introduction, Need of precision, accuracy and surface finish, Development of overall machining precision, Classes of achievable machining accuracy, Precision machining, High precision machining, Ultra precision machining, Applications of precision machining, Materials for tools and machine elements, Tool and work material compatibility, Role of CAD/CAM in precision manufacturing, Aspects of sustainable manufacturing and design for sustainability.</p>	08
2	<p><u>Precision Machine Elements:</u> Introduction, Guide ways, Drive systems, Spindle drive, Rolling elements, Hydrodynamic and hydrostatic bearings, Hybrid fluid bearings, Aero static and aero dynamic bearings, Hybrid gas bearings, Materials for bearings.</p>	08
3	<p><u>Error Control:</u> Error – Sources – Static stiffness – Variation of the cutting force – total compliance – Different machining methods – Thermal effects – heat source – heat dissipation – Stabilization – decreasing thermal effects – forced vibration on accuracy – clamping & setting errors – Control – errors due to locations – principle of constant location surfaces.</p>	07
4	<p><u>Sensors in Precision Manufacturing:</u> Identification of manufactured components, Digital encoders, Opto-electronic colour sensors: principles, properties, features and control, Applications.</p>	06

Unit No.	Topics	Teaching Hours
5	<u>MEMS (Micro-Electro-Mechanical Systems):</u> Characteristics, Principle, and Applications.	05
6	<u>Applications of Precision Manufacturing :</u> Micro machining processes-diamond machining - micro engraving - Micro replication techniques-forming-casting-injection moulding - micro embossing - Energy assisted processes - LBM, EBM, FIB, Micro electro discharge machining- photolithography-LIGA process- Silicon micro machining-Wet and dry etching- thin film deposition.	08
TOTAL		42

List of References:

1. Venkatesh V.C. and Izman S., “*Precision Engineering*”, Tata McGraw Hill, 2007.
2. Murthy R.L., “*Precision Engineering*”, New Age International, 2009
3. Nakazawa H., “*Principles of Precision Engineering*”, Oxford University Press, 1994.
4. Madou M.F. “*Fundamentals of Micro fabrication*”, CRC Press, 2002, 2nd Edition
5. McGeough J.A., “*Micromachining of Engineering Materials*”, CRC Press, 2001

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Outline precision machining.
2. Identify the importance of precision machine elements.
3. Recognize the importance of error control.
4. Relate the role of various sensors.
5. Outline MEMS and its application
6. Illustrate various precision manufacturing applications.