



**National Institute of Technology Meghalaya**  
An Institute of National Importance

**CURRICULUM**

Programme	<b>Bachelor of Technology in Mechanical Engineering</b>	Year of Regulation	<b>2018</b>
Department	<b>Mechanical Engineering</b>	Semester	<b>IV</b>

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total

<b>ME 212</b>	<b>Metrology &amp; Instrumentation</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>200</b>	
Course Objectives	To understand basic principles and laws of metrology and measurement.	Course Outcomes	CO1	Understand the need for measurement and the working principles of various instruments used for linear and angular measurements (Understanding)						
			CO2	Understand the standards of measurement and various tolerances and limits, Apply the principles of metrology for designing the limit gauges (Understanding)						
	CO3		Analyse the principle of operation of the optical instruments and usage of those instruments.(Applying)							
	CO4		Apply the design principles to measure various parameters of gear and screw threads, Surface roughness and gear thread measurements. (Applying)							
	CO5		Analyse the functionality of different types of transducers and Able to design various transducers. For measuring the mechanical parameters. (Analysing)							

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	3	2	3	0	0	0	0	0	0	0	0	0	3	2	0
2	CO2	3	2	3	0	0	0	0	2	0	0	0	2	2	2	0
3	CO3	3	2	3	0	0	0	0	2	0	0	0	2	2	2	0
4	CO4	3	2	3	0	0	0	0	2	0	0	0	2	2	2	0
5	CO5	3	2	3	0	0	0	0	2	0	0	0	2	3	2	0

**SYLLABUS**

No.	Content	Hours	COs
I	<b>Engineering Metrology Introduction</b> Characteristics of measuring instruments, Functional elements of instruments, classification of methods of measurement; Standards for measurement and standardizing organizations ; International system (SI) of units; Measurement uncertainty/ error, types of error. <b>Simple Measurement Tools</b> Rules, calipers, height gauges, micrometers, depth gauges, combination set, dial indicators, slip gauges, sine bars etc.	<b>09</b>	<b>CO1</b>
II	<b>Limits, Fits and Tolerances, and Gauge Design</b> Basic concepts in limits, fits and tolerances; Selective assembly; Tolerance grades; ISO system of tolerance; Principles gauge design; Work Shop and Inspection gauges; Gauge Design & Basic design rules for Plug and Ring gauges; Taper Plug Gauges, Taper Ring Gauges; Bore gauge.	<b>05</b>	<b>CO2</b>
III	<b>Interferometers</b> Types of light sources and Interferometers, Types of scales and gratings, Optical flats, Use of different interferometers for calibration of height standards etc.	<b>05</b>	<b>CO3</b>
IV	<b>Screw Thread Measurement</b> Standard thread profiles, Different Thread Elements, Effective diameter, 2 wire and 3 wire methods as applied to standard and non-standard thread profiles, Best wire size, Virtual Effective Diameter <b>Surface Roughness</b> Sources of surface irregularities in manufacturing, Different elements of surface roughness, Definition of centre line and related roughness parameters, Measurement Instruments, Profilometers, Analysis of roughness signal in frequency domain, Auto-correlation of surface roughness signals, Use of such analysis in identification of state of health of the manufacturing process. <b>Gear Metrology</b> Different types of gears, Basic elements of a gear, Involute function, Relations between different gear elements of spur and helical gears, Virtual number of teeth, Use of gear tooth vernier for chordal and constant chordal measurements, Span measurement using Base Tangent Micrometers	<b>12</b>	<b>CO4</b>
V	<b>Measurement of Mechanical Parameters</b> Introduction; Active Passive transducers; Analog/digital mode of operation; Null/deflection methods of measurement; Generalized I/O configuration of measurement systems. Methods of correction of interfering and modifying inputs; Static and Dynamic characteristics of the measuring instruments. Force, Pressure, Torque, Temperature, Viscosity, Flow and Strain measurement	<b>08</b>	<b>CO5</b>
Total Hours		<b>39</b>	

**Essential Readings**

- N.V. Raghavendra & L. Krishnamurthy, "Engineering Metrology and Measurements", Oxford University Press, Edition 2013.
- E. O. Doebelin and D. N. Manik, "Measurement systems", Tata McGraw Hill Publishing Company Ltd, Fifth Edition, 2007.

**Supplementary Readings**

- B.C.Nakra, K.K.Chaudhary, "Instrument Measurement and Analysis", Tata McGraw Hill Publishers, Fifth Edition, 2016.
- J. P.Holman, "Experimental Methods for Engineers", McGraw Hill Publishers, Seventh Edition, 2017.
- J. W. Dailly, William F. Riley, G. Kenneth, "Instrumentation for Engineering Measurement", Wiley, 2nd Edition.