



SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109

DEPARTMENT OF MECHANICAL ENGINEERING

SESSION: 2021-2022 (EVEN SEMESTER)

CO-PO MAPPING

Course: Mechanical Measurements and Metrology			
Type: Core		Course Code:18ME46B	
No of Hours per week			
Theory (Lecture Class) 04	Theory (Lecture Class) 04	Theory (Lecture Class) 04	Total teaching hours 50
Marks			
Internal Assessment 40	Internal Assessment 40	Internal Assessment 40	Credits 4
<u>Aim/Objective of the Course:</u>			
<ol style="list-style-type: none"> 1. To have a working knowledge of the different measuring instruments 2. To have a knowledge of different types of comparators 3. To understand the effect Errors during measuring 4. To get an idea of Calibration of measuring instruments 			
Course Learning Outcomes			
After completing the course, the students will be able to			
CO1	Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars. Describe slip gauges	Applying (K3)	
CO2	Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design. Understand the principle and working of comparator	Applying (K3)	
CO3	Describe the measurement of Thread and gear parameters by various method	Applying (K3)	
CO4	Understand laser interferometers and Coordinate measuring machines. Explain measurement systems, transducers, intermediate modifying devices and terminating devices.	Understandin g (K2)	
CO5	Describe functioning of force, torque, pressure, strain and temperature measuring devices	Understandin g (K2)	
Syllabus Content			
Module-1 Introduction to Metrology Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars(Numerical), standardization.			CO1 08 hrs PO1 PO2 PO3 PO7 PO12

<p>Linear Measurement and angular measurements Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112). Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and squareness.</p> <p>LO: After competing this unit the student will be able to</p> <ol style="list-style-type: none"> 1. Define the term metrology and list the various objectives of metrology. 2. Explain the principle and the process of measurement. 1. Explain the concept of angle measurement using sine bar, sine center, angle gauges. Also explain the concept of measurement of straightness and squareness using auto-collimator. 	
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<p>Module- 2</p> <p>System of Limits, Fits, Tolerance and Gauging Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances.</p> <p>Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.</p> <p>Comparators Functional requirements, classification, mechanical- Johnson Mikrokator, sigma comparators, dial indicator, electrical- principles, LVDT, Pneumatic- back pressure gauges, solex comparators and optical comparators- Zeiss ultra-optimeter.</p> <p>LO: After competing this unit the student will be able to</p> <ol style="list-style-type: none"> 1. Define the terms tolerance and fit. Also list the various types of fits and their designation, various types of gauges and the various Indian standards 2. Explain limits of size, principle of interchangeability and selective assembly, concept of limits of size, tolerances, hole basis system, shaft basis system, geometrical tolerance, positional-tolerances. 1. Explain classification of gauges and wear allowances on gauges, plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials 	<p>CO2 08 hrs PO1 PO2 PO3 PO4 PO5 PO6 PO12</p>
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<p>Module 3:</p> <p>Measurement of screw thread and gear Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Screw thread gauges, Tool maker's microscope. Gear tooth terminology, tooth thickness measurement using constant chord method, addendum comparator method and base tangent method, measurement of pitch, concentricity,</p>	<p>CO3 08 hrs PO1 PO2 PO3 PO5 PO7</p>
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<p>run out, and involute profile. Gear roll tester for composite error.</p> <p>Advances in metrology: Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications. Basic concepts of Coordinate Measuring Machines-constructural features, applications.</p> <p>LO: After competing this unit the student will be able to</p> <ol style="list-style-type: none"> 1. Explain the terminology of screw threads, measurement of major diameter, minor diameter and pitch angle. Also determine effective diameter of screw threads by 2-wire and 3-wire methods. 2. Explain the concept of best size wire, tool maker's microscope, and gear tooth terminology. 3. Explain tooth thickness measurement using constant chord method, addendum comparator method and base tangent method. 4. Explain the concept of measurement of pitch, concentricity, run out and involute profile 	<p>PO12</p>
<p>Module 4: Measurement systems and basic concepts of measurement methods: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-time delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.</p> <p>Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs.</p> <p>LO: After competing this unit the student will be able to</p> <ol style="list-style-type: none"> 1. Define the terms accuracy, precision, calibration, threshold, sensitivity, hysteresis and measurement and also explain the concept of generalized measurement system. 2. Define the terms accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times, delay time and list the various errors in measurement. 	<p>CO4 08 hrs PO1 PO2 PO3 PO4 PO5 PO12</p>
<p>Module -5: Force, Torque and Pressure Measurement Direct methods and indirect method, force measuring inst. Torque measuring inst., Types of dynamometers, Absorption dynamometer, Prony brake and rope brake dynamometer, and power measuring instruments. Pressure measurement, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.</p> <p>Measurement of strain and temperature Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement.</p>	<p>CO5 08 hrs PO1 PO2 PO3 PO4 PO5 PO6 PO12</p>


PO2: Problem Analysis
 PO3: Design & Development
 PO4: Investigations of Complex Problems
 PO5: Modern Tool Usage
 PO6: Engineer & Society


PO8: Ethics
 PO9: Individual & Team Work
 PO10: Communication
 PO11: Project Mngmt & Finance
 PO12: Life long Learning

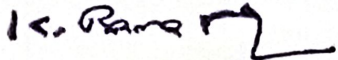
PSO1: Ability to apply concept of mechanical engineering to design a system, a component or a process/system to address a real world challenges

PSO2: Ability to develop effective communication, team work, entrepreneurial and computational skills

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS O1	PS O2
18 ME46B	K-level														
CO1	K3	3	3	3	2	-	1	-	-	-	-	-	1	3	1
CO2	K3	3	3	2	2	-	1	-	-	-	-	-	1	3	1
CO3	K3	3	3	3	2	1	1	-	-	-	-	-	1	3	1
CO4	K3	3	3	3	2	1	1	-	-	-	-	-	1	3	1
CO5	K3	3	3	3	2	1	1		-	-	-	-	1	3	1


 Course In charge


 Head of the Department


 Dr. K. Rama Narasimha
 Principal/Director
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