

Subject Code: 01ME0504
Subject Name: Metrology
B. Tech. Year - III (Semester - 5)

Type of course : Programme core

Prerequisite : Nil

Course Outcome :

After successful completion of course student will be able to:

1. Understand The Basic Concept of Metrology & Select Instrument for Particular Measurement. Describing The Calibration of Instrument
2. Demonstration Of Various Instrument for Hands on Experience.
3. Application Of Various Measuring Instrument in Industry & Day to Day Life
4. Analysing The Error in Measurement & Measuring Instruments
5. Describe The Use of Advanced Measuring Instrument

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks					Total Marks
THEORY	TUTORIAL	PRACTICAL		Theory Marks			Practical Marks		
			ESE(E)	IA	CSE	Viva (V)	Term Work (TW)		
3	0	2	4	50	30	20	25	25	150

Content :

Sr. No.	Content	Total Hrs.
1	Basics of Metrology and Measurement Meaning, Necessity and Objectives of Metrology, Standards of Measurement, Elements of Measuring System, Methods of Measurement, Static Performance Characteristics, Dynamic Performance Characteristics, Precision and Accuracy, Sources of Errors, Selection and Care of instruments, Standardizing organizations	06
2	Linear and Angular Measurements *(Introduction & classification of Linear Measuring Instruments, least count, working principle, Vernier Height Gauge, Vernier Depth Gauge, Micrometres, slip gauges, Dial indicators-construction & working,) comparators, calibration of various linear measuring instruments; Introduction, Working principle & construction of Angular Measuring instruments like Bevel Protractors, Sine bars, Taper Measuring instruments: Measurement of taper shafts & holes.	07

3	<p>Measurement of Motion and Force Motion: Measurement of displacement, velocity, acceleration and vibrations by potentiometer, strain gauges, seismic pickups, velocity pickups and acceleration pickups, calibration of pickups.</p>	07
4	<p>Measurement of Pressure Basic method of pressure measurement, dead weight gauges and manometers, elastic transducers and force balance transducer.</p>	03
5	<p>Temperature Measurement: Measurement of temperature by liquid in glass thermometers, pressure thermometers, thermocouples, their calibration, resistance thermometer, bimetallic thermometer, thermistors, radiation and optical pyrometers.</p>	04
6	<p>Metrology of Gears and Screw threads Gear tooth terminology, Sources of errors in manufacturing of gears, Measurement of tooth thickness: Gear tooth vernier, Constant chord method, Addendum comparator method and Base tangent method, Measurement of tooth profile: Tool maker's microscope or projector, Involute tester, Measurement of pitch, Measurement of run out, Lead and Backlash checking. Measurement of concentricity, Alignment of gears. Screw Thread Measurement: Errors in threads, screw thread gauges, measurement of element of the external and internal threads, thread calliper gauges.</p>	07
7	<p>Metrology of Surface finish Surface Metrology Concepts and terminology, Analysis of surface traces, Specification of surface Texture characteristics, and Method of measuring surface finish: Stylus system of measurement, Stylus probe instruments, Wave length, frequency and cut off. other methods for measuring surface roughness: Pneumatic method, Light Interference microscopes, Mecin Instruments.</p>	06
8	<p>Miscellaneous Metrology Precision Instrumentation based on Laser Principals, Coordinate measuring machines: Structure, Modes of Operation, Probe, Operation and applications. Optical Measuring Techniques: Tool Maker's Microscope, Profile Projector, Optical Square. Basics of Optical Interference and Interferometry, Optoelectronic measurements,</p>	05

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Level
10	20	25	25	10	10

Legends: R: Remember; U: Understand; A: Apply; N: Analyze; E: Evaluate; C: Create

Text Books :

1. R.K. Jain, Khanna Publishers - A Text Book of Engineering Metrology
2. M.Mahajan, DhanpatRai, New Delhi - A Text Book of Metrology
3. D.S. Kumar, Metropolitan book Co. - Mechanical Measurement & Control

4. R.K.Rajput, S.K.Kataria & Sons. - Mechanical measurement and instrumentation

List of Experiments :

1. Basic Understanding of Measurement and Metrology: Concepts, Application, Advantage and Future Aspect
2. Mechanical Component Measurement Using Vernier Calliper
3. Mechanical Component Measurement Using Vernier Height Gauge
4. Spur Gear Measurement Using Gear Tooth Vernier Calliper
5. Mechanical Component Measurement Using Micrometre
6. To determine unknown angle using Optical Bevel Protractor.
7. To determine unknown angle using Sine Bar
8. Dimensional Inspection of Parts Using Go and No Go Gages
9. Calibration of Micrometre using slip gauge
10. Measurement of speed of Motor using Stroboscope
11. Use of spirit level in finding the flatness of surface plate
12. Measurement run out cylinder component using dial indicator

Reference books:

1. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press,
2. Engineering Metrology and Measurements, Bentley, Pearson Education
3. Theory and Design for Mechanical Measurements, 3rd Edition, Richard S Figliola, Donald E Beasley, Wiley India
4. Metrology and Measurement, Anand Bewoor & Vinay Kulkarni McGraw-Hill
5. Doebelin's Measurement Systems Ernest Doebelin, Dhanesh Manik McGraw-Hill
6. Instrumentation, Measurement and Analysis, B.C. Nakra, K.K. Chaudhry McGraw-Hill
7. A Text book of Engineering Metrology, I C Gupta, Dhanpat Rai Publications
8. A course in Mechanical Measurements and Instrumentation, A K Sawhney, Dhanpat Rai Publications

9. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication(KATSON)
10. Mechanical Measurement and Metrology by R K Jain, Khanna Publisher Mechanical Measurement & Control by D.S. Kumar.
11. Industrial Instrumentation & Control by S K Singh, McGrawHill
12. Mechanical Measurements by Beckwith & Buck, Narosa publishing House
13. Thomas G. Beckwith, Pearson Edu. - Mechanical Measurement

Important Equipment Used:

1. Temperature Measurements Equipment
2. Force Measurements Equipment
3. Surface Measurements Equipment
4. Linear/Angular Measurements Equipment
5. Tachometers
6. Gears/Screw Threads Measurements Equipment

List of Open Base Software / learning website:

1. www.nptel.ac.in
2. www.mitutoyo.com
3. www.taylor-hobson.com