



16ME308 METROLOGY AND INSTRUMENTATION

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSB	CS	SA	S	BS
45	-	30	20	40	5	5	5	3

Course Description and Objective:

This course deals with the concepts of measurements to monitor and control the manufacturing process parameters to maintain the required quality. The objective of this course is to provide fundamental knowledge on limits, fits and gauges. In addition it deals with linear, angular, surface, temperature and strain measurements.

Course Outcomes:

The student will be able to:

- identify the uncertainties in dimensional metrology.
- describe the fundamentals of dimensional and geometric tolerances.
- perform linear, angular and surface measurements.
- demonstrate the procedures for calibration of various measuring instruments.
- measure strain using strain gauges.

SKILLS:

- ✓ Use appropriate methods for measuring straightness, flatness, roundness, profile and screw thread parameters.
- ✓ Measure displacement using various transducers
- ✓ Measure surface roughness of components.

UNIT - 1

L-9

INTRODUCTION TO METROLOGY: Product tolerance vs cost; Theory of limits, fits and tolerances; Fundamental deviation; Grades of tolerances; Fits, Types of fits; Hole basis and shaft basis systems ; Interchangeability and selective assembly. Limit Gauges; Taylor's principle; GO and NO GO gauges; plug and ring gauges.

UNIT - 2

L-9

LINEAR; ANGLE; TAPER AND OPTICAL MEASUREMENTS:

LINEAR MEASUREMENTS: Slip gauges, Dial indicators, Micrometer.

ANGLE AND TAPER MEASUREMENT: Bevel protractor, Angle slip gauges, sine bar, Taper determination using Rollers and spheres.

OPTICAL MEASUREMENTS: Optical flats, NPL Interferometer.

UNIT - 3

L-9

COMPARATORS & SURFACE ROUGHNESS MEASUREMENT:

COMPARATORS: Mechanical, Electrical and Pneumatic comparators.

SURFACE ROUGHNESS MEASUREMENT: Surface roughness and surface texture, Numerical assessment of surface finish, CLA, RMS, Ten point height of irregularity; Measuring Instruments: Profilograph and Talysurf.

UNIT - 4

L-9

INTRODUCTION TO INSTRUMENTATION & DISPLACEMENT MEASUREMENT:

INTRODUCTION TO INSTRUMENTATION: Generalized configuration and functional description of measuring instruments; Static and dynamic characteristics and Calibration.

DISPLACEMENT MEASUREMENTS: Theory and construction of various transducers to measure displacement, Resistance type, LVDT, Capacitive type, piezo electric type Instruments.

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UNIT - 5

L-9

TEMPERATURE; STRAIN MEASUREMENTS :

TEMPERATURE MEASUREMENTS: various principles of temperature measurements; expansion thermometers, resistance thermometers, thermistors, thermocouples, pyrometers.

STRAIN MEASUREMENTS: Various types of strain measurements; electrical resistance strain gauge; gauge factor; configurations to measure tensile, compressive and bending strains.

ACTIVITIES:

- o Design GO and NOGO gauges.
- o Measure angle of any component using Bevel protractor.
- o Measure angle of any component using sine bar and slip gauges
- o Design of an LVDT for displacement measurement
- o Development of a piezo embedded cantilever beam for strain measurements.

measurements

LABORATORY EXPERIMENTS**LIST OF EXPERIMENTS:**

Total hours: 30

1. Plug and ring gauges
2. Dial gauges and micrometer.
3. Angle measurement using slip gauges, sine bar and bevel protractor.
4. Angle measurement using balls, rollers, cylinders and height gauges.
5. Pneumatic comparators to inspect cylinder bore diameters.
6. Mechanical comparators.
7. Talysurf to measure surface roughness.
8. Static and dynamic characteristics of measuring instruments.
9. LVDT for displacement measurement.
10. Capacitive type instruments for calibration of angular measurements
11. RTD apparatus for temperature measurements.
12. Thermocouple application for temperature measurements
13. Strain gauges for strain measurements.

TEXT BOOKS:

1. D.S.Kumar, "Mechanical Measurements & Controls", 5th edition, Metropolitan Book, 2012.
2. R.K.Jain, "Engineering Metrology", 20th edition, Khanna Publishers, New Delhi, 2009.

REFERENCE BOOKS:

1. R.K. Rajput, "Mechanical Measurements & Instrumentation", 3rd edition, S.K. Kataria & Sons, 2010.
2. E.O. Doebelin, "Measurement Systems", 6th edition, Tata McGraw Hill, New Delhi, 2011.