

ME327 METROLOGY & INSTRUMENTATION

Course Description & Objectives:

Manufacturing of components with correct dimensions and features like tapers, center positioning and surface finish are essential for quality products. At the same time product inspection should be finished in less time without any error. Metrology course is aimed to provide knowledge of limits, gauges, linear and angular measurements. Different process parameters like temperature, pressure, flow rate are very much important in process industry for the quality production. Students are given sufficient exposure of these through this course.

Course Outcomes:

1. Sound knowledge in gauge design and gauge selection
2. Angle measurement with various measuring instruments
3. Different comparators working and selection, measurement of surface finish by different techniques
4. Various transducers working and application to physical parameters by the instruments
5. Different techniques to measure temperature force and flow.

UNIT - I Introduction to Metrology:

Line and end standards – Theory of limits, fits and tolerances - Fundamental deviation – types – 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 - II 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 - III comparators & Surface Roughness Measurement:

Comparators : Mechanical – Electrical – 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 – Talysurf.

UNIT - IV Introduction to Instrumentation & Displacement Measurement:

Introduction to Instrumentation : Generalized configuration and functional description of measuring instruments - Static and dynamic characteristics - Calibration.

Displacement measurements: Theory and construction of various transducers to measure displacement - Resistance type - LVDT – Capacitive type - piezo electric type Instruments

UNIT - V 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.

TEXT BOOKS:

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

REFERENCE BOOKS:

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