

## MECHANICAL MEASUREMENTS AND METROLOGY

Sub Code	: 10ME 32B / 42B	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

### PART- A

#### UNIT-1:

**Standards of measurement:** Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-12), Numerical problems on building of slip gauges.

06 Hours

#### UNIT-2:

**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, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, 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.

07 Hours

#### UNIT-3:

**Comparators and Angular measurement:** Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles, Zeiss ultra optimeter, electric and electronic comparators-principles, LVDT, pneumatic comparators, back pressure gauges, solex comparators. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numericals on building of angles), clinometers.

07 Hours

#### UNIT-4:

**Interferometer and screw thread, gear measurement:** Interferometer, interferometry, autocollimator. Optical flats. 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. Tool maker's microscope, gear tooth terminology, use of gear tooth vernier caliper and micrometer.

06 Hours

## **PART-B**

### **UNIT-5:**

**Measurements and measurement systems:** Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. **07 Hours**

### **UNIT-6:**

**Intermediate modifying and terminating devices:** Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters. **06 Hours**

### **UNIT-7:**

**Measurement of force, torque and pressure:** Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. **06 Hours**

### **UNIT-8:**


**Temperature and strain measurement:** Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. **07 Hours**

### **TEXT BOOKS:**

1. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6<sup>th</sup> Ed., 2006.
2. **Engineering Metrology**, R.K. Jain, Khanna Publishers, 1994.

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1. **Engineering Metrology**, I.C. Gupta, Dhanpat Rai Publications, Delhi.
2. **Mechanical Measurements**, R.K. Jain Khanna Publishers, 1994
3. **Industrial Instrumentation**, Alsutko, Jerry. D. Faulk, Cengage Asia Pvt. Ltd. 2002.
4. **Measurement Systems Applications and Design**, Ernest O. Doebelin, 5<sup>th</sup> Ed., McGraw Hill Book Co.
5. **Metrology & Measurement**, Anand K. Bewoor & Vinay A.

  
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