

PME41104 MECHANICAL MEASUREMENT, METROLOGY & RELIABILITY

MODULE – I (16 HOURS)

Definition and methods of measurement, classification of measuring instruments, Measuring systems, performance characteristics of measuring devices, types of errors. Functional elements of measuring system. Static and Dynamic Characteristics of Instruments:

Static Performance Parameters, Impedance Loading and Matching, Selection and Specifications of Instruments, Dynamic Response, Compensation.

Transducer Elements: Analog Transducers, Digital Transducers, Basic detector transducer elements : Electrical transducer, Sliding Contact devices, Variable-inductance transducer elements, the differential transformer, Variable-reluctance transducers, Capacitive transducers. The piezoelectric effect, photo-electric transducer, electronic transducer element.

Intermediate Elements: Amplifier, Operational Amplifier, Differential and Integrating Elements, Filters, A-D and D-A Converters

Strain Measurement

The electrical resistance strain gauge. The metallic resistance strain gauge, Selection and Installation factors for metallic strain gauge, Circuitry, metallic strain gauge. The strain gauge ballast circuit, the strain gauge bridge circuit, Temperature compensation.

Measurement of Pressure

Pressure measurement systems, Pressure measurement transducers, Elastic diaphragms, strain gauge pressure cells, measurement of high pressure, Measurement of low pressures, dynamic characteristics of pressure measuring systems.

Measurement of Fluid Flow

Flow characteristics obstruction meters, Obstruction meter for compressible fluids- Orifice, Venturi meter and Pitot tube, The variable-area meter, Turbine Flow meters.

Temperature Measurement

Use of bimetal pressure thermometers, Thermocouples, Pyrometry, Calibration of temperature measuring devices.

Force, Power, Speed and Torque Measurement :

Load Cell, Dynamometers, Tachometer and Tacho-generator, Stroboscope, The seismic instrument.- Vibrometers and accelerometers

MODULE – II (10 HOURS)

Principles of Measurements, Line and End & optical Standards, Calibration, accuracy and Precision, Random error and systemic error.

Measurement of Surface Roughness, Screw Thread and Gears.

Limits, Fits and Gauges, Assembly by full, partial and group interchangeability, geometric tolerances.

Measurement of straightness, Flatness and circularity.

MODULE – III (10 HOURS)

Definition, bath-tub-curve, system reliability, reliability improvement, maintainability and availability, Availability of single repairable system using Markov model, Life tests, acceptance sampling plan based on life tests, Sequential acceptance sampling plan based on MTTF & MTBF.

TEXT BOOKS :

1. Engineering Metrology & Measurement, N.V.Raghavendra and L. Krishnamurthy, OXFORD University Press
2. Instrumentation Measurement and Analysis, B.C.Nakra and KK.Chaudhry, Tata Mc Graw Hill, Third Edition.
3. Engineering Metrology, R.K. Jain, Khanna Publisher, Delhi
4. Reliability Engg. And Terotechnology , A.K. Gupta, Macmillan India.

Reference Books:

1. Metrology & Measurement, A. K. Bewoor and V.A.Kulkarni, Mc Graw hill
2. Mechanical Measurements, T.G. Beckwith and N. Lewis Buck, Oxford and IBH Publishing Co.
3. A text book of Engineering Metrology I.C. Gupta, Dhanpat Rai & sons, Delhi.
4. Introduction to /reliability and Maintainability Engg E. Ebeling, MC-Graw Hill.