

PCPR 4202: MEASUREMENT AND METROLOGY

Module-I (8 Hours)

MECHANICAL MEASUREMENTS (4+2+2=8)

Introduction: Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, units of measurement, static performance characteristics and elementary idea of dynamic performance characteristics of measurement devices, calibration, concept of error (systematic and random), sources of error, statistical analysis of errors. 4

Sensors and Transducers: Types of sensors, types of transducers and their characteristics. 2

Signal Transmission and Processing: Signal transmission and processing devices and systems. Signal display & recording devices 2

Module-II (10 Hours)

Time Related Measurements: (2+1+2+2+3=10)

Stroboscope, frequency measurement by direct comparison. Measurement of displacement

Measurement of Pressure: Gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures (high vacuum).

Strain Measurement: Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration.

Temperature Measurement: Thermometers, bimetallic thermocouples, thermistors and pyrometers.

Measurements of Force, Torque, Acceleration, and Vibration: Different types of load cells, elastic transducers, pneumatic & hydraulic systems. Seismic instruments, accelerometers vibration pick ups and decibel meters, vibrometers.

Module-III (14 Hours)

Measurement of Fluid Velocity and Flow rate: (2+2+2+1=7)

Measurement of fluid velocity, Hot Wire Anemometry, Laser Doppler Velocimetry. Flow measuring devices, Rotameter.

METROLOGY Metrology and Inspection : Standards of linear measurement, line and end standards. Limit fits and tolerances. Interchangeability and standardisation.

Linear and angular measurements devices and systems Comparators: Sigma, Johansson's Microkrator.

Limit gauges classification, Taylor's Principle of Gauge Design.

Measurement of Surface (2+1+2+1+1=7)

Measurement of geometric forms like straightness, flatness, roundness.

Tool makers microscope, profile project autocollimator.

Interferometry: principle and use of interferometry, optical flat.

Measurement of screw threads and gears.

Surface texture: quantitative evaluation of surface roughness and its measurement.

Books and References:

1. Experimental Methods for Engineers by Holman, TMH
2. Mechanical Measurements by Beckwith, Pearson
3. Principles of Measurement Systems by Bentley, Pearson
4. Metrology of Measurements by Bewoor and Kulkarni, TMH
5. Measurement Systems, Application Design by Doeblein, TMH
6. Hume K.J., "Engineering Metrology", MacDonald and Co
7. Jain, R.K., "Engineering Metrology" Khanna Publishers
8. Jain, R.K., "Mechanical Measurement" Khanna Publishers