

## APPE3010 INDUSTRIAL INSTRUMENTATION (3-0-0)

**Course Objectives:** To provide the knowledge of Pressure, Sound, Flow, Temperature, Level, Humidity, Torque, Viscosity and Vibration measurements.

**Module-I:** Metrology (Measurement of Length, Angle and Area): Dimensional measurement, Dial gauges, Gauge blocks, Comparators, Flatness measurement, Optical flats, Sine bar, Angle gauges, Planimeter. (4 Hours)

**Module-II:** Motion and Vibration Measurement: Translational and rotational displacement using potentiometers, Strain gauges, Differential transformer, Different types of tachometers, Accelerometers (4 Hours)

**Module-III:** Pressure Measurement: Moderate pressure measurement, Bourdon tube, Bellows and diaphragms, High pressure measurement: Piezoelectric, Electric resistance, Low pressure measurement: Knudsen Gauge, Viscosity gauge, Thermal conductivity, Ionization gauge, Dead weight gauges. (7 Hours)

**Module-IV:** Flow Measurement: Obstruction meter, Orifice, Nozzle, Venturi, Pitot tube, Rotameter, Turbine, Electromagnetic, Vortex, Positive displacement, Anemometers, Weirs and flumes, Laser Doppler anemometer, Ultrasonic flow meter, Mass flow meter. (7 Hours)

**Module-V:** Temperature Measurement: Bimetallic thermometers, Liquid-in-glass, Pressure thermometer, Semiconductor sensors, Digital thermometers, Pyrometers. Level Measurement: Visual level indicators, Purge method, Buoyancy method, Resistance, Capacitance and inductive probes, Ultrasonic, Laser, Optical fibre, Thermal, Radar, Radiation. (8 Hours)

### Course Outcomes:

By the end of this course, students will be able to:

- CO1 Explain the working principles of instruments used for dimensional, angular, and area measurement in metrology
- CO2 Measure displacement, speed, and vibration using potentiometers, strain gauges, tachometers, and accelerometers.
- CO3 Apply appropriate methods for measuring low, moderate, and high pressures using mechanical and electronic pressure sensors.
- CO4 Analyze different flow measurement devices and select suitable techniques for various flow conditions.
- CO5 Use appropriate temperature and level measurement instruments based on thermal, mechanical, electronic, ultrasonic, and radar methods.

### Text Books:

1. Doebelin, E.O., Measurement systems, Applications and Design, McGraw-Hill (1982).
2. Nakra, B. C. and Chaudhry, K. K., Instrumentation, Measurement and Analysis, Tata McGraw-Hill (2003).

### References:

1. Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Private Limited (2003).
2. Sawhney, A.K., A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Co. (P) Ltd. (2007).