

PCEI4302 **INSTRUMENTATION DEVICES & SYSTEMS-I**

(3-1-0)

Module –1

10 lectures

Elements of a general measurement system;

Static Characteristics: systematic characteristics, statistical characteristics, calibration;

Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, dynamic error in measurement systems.

(Bentley: Selected portions of Chapters 1 to 4)

Module-2

14 lectures

Sensing elements:

Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages.

Capacitive sensing elements: variable separation, area and dielectric;

Inductive sensing elements: variable reluctance and LVDT displacement sensors;

Electromagnetic sensing elements: velocity sensors,

Thermoelectric sensing elements: laws, thermocouple characteristics, installation problems, cold junction compensation.

IC temperature sensor

Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.

(Bentley: Sections 8.1 to 8.6; Ghosh: Section 10.3 to 10.4).

Module-3

16 lectures

Signal Conditioning Elements:

Deflection bridges: design of resistive and reactive bridges, push-pull configuration for improvement of linearity and sensitivity

Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting and differential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation.

(Bentley: Sections 9.1 to 9.3; Ghosh: Sections 15.1 and 15.2) .

Flow Measurement:

Basics of flow measurement; differential pressure flowmeters- Pitot tube, Orifice plate, Venturi tube; Rotameter, turbine type flowmeter, electromagnetic flowmeter. Doppler shift flowmeter.

(Bentley: Sections 12.1 to 12.3.2 and 12.5.1)

Text Books:

1. Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, New Delhi, 2007.
2. Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning, New Delhi, 2009.
3. Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi, 2009.

Reference Books:

1. Measurement Systems Application and Design- E.O. Doebelin (4/e), McGraw-Hill, International, NY.
2. Instrumentation for Engineering Measurements- J.W. Dally, W.F. Riley and K.G. McConnel (2/e), John Wiley, NY, 2003.
3. Industrial Instrumentation- T.R. Padmanabhan, Springer, London, 2000.