

PEI4I104 INSTRUMENTATION DEVICES & SYSTEMS-I

University level 80%

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, and dynamic error in measurement systems. Techniques for dynamic compensation, loading effect, signal and noise in measurement system. (Bentley & A. K. Ghosh: Selected portions of Chapters 1 to 4)

Module-2 15 lectures

Sensing elements: Transducers and sensors, Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages. Capacitive sensing elements: variable separation, area and dielectric; Inductive sensing elements: variable reluctance, LVDT and RVDT displacement sensors; Electromagnetic sensing elements velocity sensors; ultrasonic, radar, nucleonic type sensing elements, thermoelectric sensing elements: thermocouple laws, 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: (8 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, noninverting and differential amplifiers, instrumentation amplifier, and filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation. signal processing elements: A/D conversion: sampling, quantization,encoding,typical converter(Bentley: Sections 9.1 to 9.3; Gosh: Sections 15.1 and 15.2)

Text Books:

1. *Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, New Delhi, 2007.*
2. *Measurement Systems Application and Design- E.O. Doebelin (4/e), McGraw-Hill, International, NY.*
3. *Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning, New Delhi, 2009.*
4. *Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi, 2009.*

Reference Books:

1. *Instrumentation for Engineering Measurements- J.W. Dally, W.F. Riley and K.G. McConnel (2/e), John Wiley, NY, 2003.*
2. *Industrial Instrumentation- T.R. Padmanabhan, Springer, London, 2000.*

TENTATIVE
Likely to be Modified