

PEL4D002 SENSORS AND TRANSDUCERS

Module -1

University Portion (80%): (8 hours)

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.

(Bentley: Chapters 1-4)

College/Institute Portion (20%): (1 hour)

[Techniques for dynamic compensation, Loading Effects and Two-port Networks **(Bentley: Sections 4.4 and 5.1-5.2)**] Or related advanced topics as decided by the concerned faculty teaching the subject.

Module-2

University Portion (80%): (7 hours)

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 **(Bentley: Sections 8.1 to 8.6)**

College/Institute Portion (20%): (1 hour)

[RVDT, Hall Effect sensors **(Bentley: Sections 8.3 and 8.10)**] Or related advanced topics as decided by the concerned faculty teaching the subject.

Module-3

University Portion (80%): (7 hours)

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.

(Ghosh: Section 10.3 to 10.4)

College/Institute Portion (20%): (1 hour)

[Piezoelectric sensing elements, Piezoresistive sensing elements **(Bentley: Sections 8.7 and 8.8)**] Or related advanced topics as decided by the concerned faculty teaching the subject.

Module-4

University Portion (80%): (8 hours)

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)**

College/Institute Portion (20%): (1 hour)

[Current transmitters, Oscillators and resonators **(Bentley: Sections 9.4 and 9.5)**] Or related advanced topics as decided by the concerned faculty teaching the subject.

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.

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. McConnell (2/e), John Wiley, NY, 2003.
3. *Industrial Instrumentation*- T.R. Padmanabhan, Springer, London, 2000.