

<b>4<sup>th</sup> Semester</b>	<b>REC4D003</b>	<b>Sensors and Transducers</b>	<b>L-T-P 3-0-0</b>	<b>3 CREDITS</b>
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**MODULE–I (12 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.

**MODULE–II (10 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.

**MODULE–III (10 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.

**MODULE–IV (8 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.

**MODULE–V (5 Hours)**

Electromagnetic sensing elements: velocity sensors

**Books:**

- Principles of Measurement Systems, J.P. Bentley, Pearson Education, New Delhi, 3<sup>rd</sup> Edition 2007.
- Introduction to Measurement and Instrumentation, A.K. Ghosh , PHI Learning, 3<sup>rd</sup> Edition, 2009.
- Transducers and Instrumentation, D.V.S. Murthy, PHI Learning, New Delhi, 2009.
- Measurement Systems Application and Design, E.O. Doebelin, McGraw-Hill, 4<sup>th</sup> Edition.
- Instrumentation for Engineering Measurements, J.W. Dally, W.F. Riley and K.G. McConnel , John Wiley, NY, 2<sup>nd</sup> edition 2003.
- Industrial Instrumentation, T.R. Padmanabhan, Springer, London, 2000.