

**Nirma University**  
**School of Technology, Institute of Technology**  
**B. Tech (Electronics and Instrumentation Engineering)**  
**Semester V**

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3	0	2	4

<b>Course Code</b>	<b>2EI502</b>
<b>Course Title</b>	<b>Transducers and Measurement</b>

**Course Outcomes (CO):**

At the end of the course, students will be able to –

- explain the fundamentals of transducers, sensors and measurement system
- demonstrate the characteristics of various sensors and transducers
- discuss the operation of measurement systems for various parameters
- analyze, select and apply appropriate measurement system for given application

**Syllabus**

**Teaching  
Hours**

**UNIT 1: Introduction to measurement system**

**02**

Elements of measuring system, sensors and transducers, classification of transducers.

**UNIT 2: Static and dynamic characteristics of instruments**

**03**

Desirable and undesirable static characteristics, standard inputs to study time domain response, desirable and undesirable dynamic characteristics, concept of slope error and offset error, problems.

**UNIT 3: Temperature measurement**

**08**

Temperature scales, expansion thermometers, filled system thermometers, sources of static errors in filled system thermometers, electrical temperature transducers – RTD, thermistors, thermocouples, lead wire compensation, 3-wire and 4-wire system for resistive temperature sensors, cold junction compensation in thermocouples, thermowells, pyrometers, quartz thermometer.

**UNIT 4: Pressure measurement**

**07**

Definitions, pressure units and conversions, manometers, pressure measurement with force summing devices-diaphragms, bellows and bourdon tubes, pressure

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measurement with secondary transducers – mechanical, resistive, inductive, capacitive, photoelectric, vibrating elements, vacuum measurement – pirani gauge, mcLeod gauge, ionization gauge etc.

**UNIT 5: Flow measurement**

Reynolds number and flow patterns, classification, head type flowmeters – orifice, venture, flow nozzle, pitot tube etc., rotameters, velocity type flowmeters – electromagnetic, vortex shedding, turbine, ultrasonic, anemometer etc., mass-flow measurement type flowmeters, open channel flowmeters. 08

**UNIT 6: Level measurement**

Mechanical level indicators, optical level measurement methods, electrical level measurement methods, radiative and other type of methods. 05

**UNIT 7: Displacement measurement**

Pneumatic transducers, electrical transducers, optical transducers, ultrasonic transducers, Magnetostrictive transducers, digital displacement transducers. 05

**UNIT 8: Strain measurement**

Stress-strain relationship, resistance strain gauges, fibre-optic strain gauges. 03

**UNIT 9: Acceleration, Force and Torque measurement** 04

Acceleration measurement, force measurement, industrial weighing measurement, torque measurement.

**Self Study:**

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

**Laboratory Work:**

Laboratory work will consist of minimum 10 experiments based on the above syllabus.

**References:**

1. A. K. Ghosh, Introduction to Measurements and Instrumentation, PHI Publication.
2. B. G. Liptak, Instrumentation Engineers' Handbook, CRC Press.
3. Patranabis, Principles of Measurements and Instrumentation, PHI Publication.
4. A. K. Sawhney, A Course in Mechanical Measurements and Instrumentation, Dhanpat Rai Publication.
5. D. P. Eckman, Industrial Instrumentation, CBS Publication.