

School of Technology, Institute of Technology
B. Tech (Instrumentation & Control Engineering)
Semester V

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3	0	2	4

Course Code	2IC502
Course Title	Transducers and Measurement

Course Learning Outcome:

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

UNIT 5: Flow measurement

08

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.

UNIT 6: Level measurement **05**

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

UNIT 7: Displacement measurement **05**

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

UNIT 8: Strain measurement **03**

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

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.