

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech.in Electronics and Instrumentation Engineering
Semester:	V
Course Code:	3EI401CC24
Course Title:	Transducers and Measurement
Course Type:	Core
Year of Introduction:	2024-25

L	T	Practical component				C
		LPW	PW	W	S	
3	0	2	-	-	-	4

Course Learning Outcomes (CLOs):

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

1. illustrate the fundamentals of sensors, transducers and measurement systems (BL2)
2. discuss the operation of measurement systems for various measurands (BL3)
3. justify the selection of various transducers for specific applications (BL4)
4. utilize different sensors in measurement systems (BL5)

Unit	Contents	Teaching hours (Total 45)
Unit-I	Introduction to measurement system Elements of measuring system, sensors and transducers, classification of transducers.	02
Unit- II	Static and dynamic characteristics of instruments Desirable and undesirable static characteristics, standard inputs to study time domain response, desirable and undesirable dynamic characteristics, problems.	03
Unit-III	Temperature measurement 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.	08
Unit- IV	Pressure measurement 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.	07
Unit- V	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 type flowmeters, open channel flowmeters.	08
Unit- VI	Level measurement Mechanical level indicators, optical level measurement methods, electrical level measurement methods, radiative and other type of methods.	06



Unit- VII	Displacement measurement Pneumatic transducers, electrical transducers, optical transducers, ultrasonic transducers, Magnetostrictive transducers, digital displacement transducers.	05
Unit- VIII	Acceleration, force and torque measurement Acceleration measurement, force measurement, industrial weighing measurement, torque measurement.	06

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:

This shall consist of at least 10 practicals based on the above syllabus.

Suggested Reading:

1. J.R.Carstens, Electrical Sensors and Transducers, Regents/Prentice Hall of India Publication
2. D.P.Eckman, Industrial Instrumentation, Willey Eastern Publication
3. A.K.Ghosh, Introduction to Measurements and Instrumentation, Prentice Hall of India Publication
4. D.Patranabis, Sensors and Transducers, Prentice Hall of India Publication

**Suggested List of Experiments (not restricted to the following):
(Only for Information)**

1. To obtain the steady-state and dynamic response of various temperature sensors such as RTD, Thermistor, Thermocouple. **(02 Hrs)**
2. (A) To study a temperature On-Off controller using RTD. **(02 Hrs)**
(B) To monitor the measurement and control of temperature using Thermistor.
3. To study the signal conditioning & display technique in measurement and control of temperature using Thermocouple. **(02 Hrs)**
4. (A) To study different types of pressure sensors. **(02 Hrs)**
(B) Study of the characteristics of pressure transducer and how the pressure transducer output in voltage is converted in to current(4-20mA) for transmission purpose.
(C) Study of pressure control by an 'on/off' controller.
5. To Calibrate pressure gauge using dead weight tester **(02 Hrs)**
6. To measure linear displacement using L.V.D.T. **(02 Hrs)**
7. To Calibrate Orificemeter. **(02 Hrs)**
8. To Calibrate Venturimeter. **(02 Hrs)**
9. To Calibrate Rotameter. **(02 Hrs)**
10. (A) To study load and its calibration using load cell signal conditioning and measurement circuit. **(02 Hrs)**
(B) To study the weight measurement system using Strain gauge as a transducers.
11. To measure and calibrate level using hydrostatic pressure transducer. **(02 Hrs)**
12. (A) To measure tank level using capacitance level probe (Virtual Lab). **(02 Hrs)**
(B) To understand the working principal of strain gauge (Virtual Lab).

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. the academic year 2024 - 25 and onwards