



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

INSTRUMENTATION AND CONTROL SYSTEMS LABORATORY								
IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AMEE20	Core	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36			Total Classes: 36			
Prerequisite: Solid Mechanics and Materials Laboratory								

I. COURSE OVERVIEW:

Instrumentation is the division of engineering science which deals with measuring techniques, devices, and their associated problems. The primary objective of this laboratory course is to measure parameters related to linear and angular displacement, temperature, pressure, vacuum, speed, strain, and vibration using appropriate transducer. The transducer converts input signal to digital output, which will be compared with appropriate mechanical type measuring instruments such as dial gauges, micrometres and pressure gauges, tachometer etc. At end of this course the students can calibrate measuring instrument to maintain the devices in working condition.

II. COURSES OBJECTIVES:

The students will try to learn

- I. The various sensors, transducers, and measurement systems used for pressure, temperature, flow, displacement, and vibration.
- II. Calibration, testing, and performance evaluation of instrumentation and control components.
- III. How to analyze experimental data, interpret results, and apply control system concepts to real-time engineering problems.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

- CO1 Calibrate and use basic sensors and transducers such as strain gauges, RTDs, thermocouples, LVDTs, and pressure sensors.
- CO2 Measure and analyze physical parameters including pressure, temperature, flow rate, displacement, and vibration using appropriate instruments.
- CO3 Interpret static and dynamic characteristics of measurement systems and evaluate experimental errors.
- CO4 Apply control system fundamentals in experimental setups involving feedback and instrumentation
- CO5 Conduct experiments systematically, record observations accurately, and prepare technical laboratory reports.
- CO6 Demonstrate safe laboratory practices and effective teamwork while handling instrumentation and control systems.

IV. COURSE CONTENT:

EXCERCISE-1: CALIBRATION OF STRAIN GAUGE

To calibrate a strain gauge using known loads and determine the relationship between strain and output voltage.

EXCERCISE-2: CALIBRATION OF PRESSURE GAUGE

To calibrate a pressure gauge using a dead weight pressure tester and compare standard and measured pressures.

EXCERCISE-3: STUDY OF McLEOD GAUGE

To study the construction, working principle, and application of a McLeod gauge for vacuum pressure measurement.

EXCERCISE-4: CALIBRATION OF THERMOCOUPLE

To calibrate a thermocouple by comparing its emf output with a standard temperature measuring device.

EXCERCISE-5: CALIBRATION OF RESISTANCE TEMPERATURE DETECTOR (RTD)

To calibrate an RTD and establish the relationship between resistance and temperature.

EXCERCISE-6: CALIBRATION OF CAPACITIVE TRANSDUCER

To calibrate a capacitive transducer and determine the variation of capacitance with displacement.

EXCERCISE-7: CALIBRATION OF LVDT (LINEAR VARIABLE DIFFERENTIAL TRANSFORMER)

To calibrate an LVDT and establish the relationship between linear displacement and output voltage.

EXCERCISE-8: CALIBRATION OF PHOTO-ELECTRIC PICKUP

To calibrate a photo-electric pickup and measure rotational speed using optical sensing.

EXCERCISE-9: CALIBRATION OF MAGNETIC PICKUP

To calibrate a magnetic pickup and measure speed of rotating components.

EXCERCISE-10: CALIBRATION OF ROTAMETER FOR FLOW MEASUREMENT

To calibrate a rotameter by comparing actual discharge with indicated flow rate.

EXCERCISE-11: STUDY AND CALIBRATION OF VIBROMETER

To study the working of a vibrometer and measure vibration parameters such as displacement, velocity, and acceleration.

EXCERCISE-12: CALIBRATION OF PRESSURE TRANSDUCER

To calibrate a pressure transducer and determine the relationship between applied pressure and output signal.

EXCERCISE-13: CALIBRATION OF DISPLACEMENT TRANSDUCER

To calibrate a displacement transducer and study its static characteristics.

EXCERCISE-14: STUDY OF DATA ACQUISITION SYSTEM (DAQ)

To study the construction, working, and applications of a data acquisition system used in instrumentation.

V. TEXT BOOKS:

1. "Electronic Instrumentation and Measurements" by W.D. Cooper and A.D. Helfrick, 19th Edition, 2023.
2. "Handbook of Modern Sensors: Physics, Designs, and Applications" by Jacob Fraden, 2021.

VI. REFERENCE BOOKS:

1. "Measurement and Instrumentation: Theory and Application" by A.K. Sawhney, 4th Edition, 2022.
2. "Instrumentation for Engineering Measurements" by James W. Dally, William F. Riley, and Kenneth G. McConnell, Dhanpat Rai & Sons, 2022.
3. "Modern Electronic Instrumentation and Measurement Techniques" by A.D. Helfrick and W.D. Cooper, 7th Edition, 2020.
4. HMT, "Production Technology", McGraw-Hill Education, 1st Edition, 2020.

VII. ELECTRONICS RESOURCES:

1. <https://elearn.nptel.ac.in/shop/iit-workshops/ongoing/additive-manufacturing-technologies->

- for-practicing-engineers/.
2. https://akanksha.iare.ac.in/index?route=course/details&course_id=94.

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Laboratory Manual
3. Laboratory Exercises