

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. in Electrical Engineering
Semester:	V
Course Code:	3EE501ME24
Course Title:	Advanced Measurement and Instrumentation
Course Type:	Department Elective-I
Year of Introduction:	2024 – 25

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

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

1. acquire knowledge on working and application of transducers and actuators (BL3)
2. select different measuring instruments as per the requirement (BL5)
3. comprehend the concept of data acquisition (BL4)
4. analyse circuits used in signal conditioning and telemetry (BL4)

Contents:

Teaching Hours: 45

Unit-1	Transducers & Actuators	08
	Classification of transducers and actuators, hall-effect transducers, piezo-electric transducers, photo-electric transducers, vibration transducers, stepper motor, servo motor, solenoids, bimetallic strip, torque sensors, flux measurement, optical sensors and other non-contact measurements	
Unit-2	Measuring Instruments	16
	MSO, DSO, Network Analysers, trivector meter, dielectric constant measurement, spectrum analyser, harmonic distortion analysers, Digital frequency meter, smart energy meter, analog and digital multimeter, power analyser, signal generator, probes, Tan δ , ratio meters, programmable power supplies	
Unit-3	Data Acquisition	10
	Data Acquisition system – basic components, single channel and multi-channel data acquisition system, digital input and output systems, data logging, general purpose interface bus (GPIB) instruments, sample and hold circuits, applications – CAN, USB, PCI express, communication buses for instrument controls, LAN, Ethernet	
Unit-4	Signal Conditioning & Telemetry	11
	Signal conditioning, instrumentation amplifiers, op-amp based 1 st order and 2 nd order filters, 4-20 mA signal transmission and current loop, data transmission and telemetry, Introduction to LabView	

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 practical/simulation based on the above Contents.

Suggested Reading:

1. E. W. Golding and F. C. Widdis, Electrical & Electronic Measurements & Instrumentation, Reem Publications Pvt. Ltd
2. A. K. Sawhney, A course in Electrical Measurement and Measuring Instruments, Dhanpat Rai & Sons, New Delhi. William Brogan, Modern Control Theory, Pearson Publications
3. B. G. Liptak, Instrument Engineer's Handbook Vol-2, CRC Press
4. A. D. Helfrick and W. D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall India
5. E. O. Doebelin, Measurement systems: Application & Design, McGraw-Hill Professional
6. D. Patranabis, Principles of Industrial Instrumentation, Tata Mcgraw Hill

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

	Title of Experiment	Hrs.
1.	To measure and visualize current and voltage using a hall-effect sensor.	2
2.	To analyse on-off control using thermoelectric sensors.	4
3.	To perform harmonic analysis of a.c. line current in a three-phase system.	2
4.	To measure various power components and power indices using trivector meter and power analysers.	4
5.	To realize the importance and applicability of various probes used with digital storage oscilloscopes.	2
6.	To import and export waveform and data points using digital storage oscilloscope.	2
7.	To implement various op-amp based filters for signal conditioning.	2
8.	To implement V-I and I-V converters for signal conditioning.	2
9.	To realize and implement basic data acquisition system using data loggers.	2
10.	To perform and test automation using LabView.	2

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

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