

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. in Electrical Engineering
Semester:	III
Course Code:	2EE501CC26
Course Title:	Electrical Measurements and Transducers
Course Type:	Core
Year of Introduction:	2023 – 24

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. relate with the concepts of measurement and measurement systems (BL2)
2. articulate the construction and working of various measuring instruments (BL3)
3. select measuring instruments based on practical applications (BL4)
4. acquire knowledge on working, importance and applications of various transducers (BL3)

Content:

Teaching Hours: 30

Unit-1	Concepts of Measurements and Instrumentation	03
	Introduction to measurement and instrumentation, Static and dynamic characteristics of instruments and instrumentation, errors in measurement	
Unit-2	Measurement of Resistance, Inductance and Capacitance	04
	Measurement of low, medium and high resistance, insulation resistance measurement, concepts of A. C. bridges for inductance measurement - Maxwell, Hay's, Anderson and Owen bridges; capacitance measurement – De'Sauty and Schering Bridge, measurement of frequency by Wien's bridge	
Unit-3	Potentiometers and Instrument Transformers	04
	Principle of D. C. potentiometer, direct reading potentiometers, accurate forms of potentiometers, A. C. potentiometer principle, types and applications of A. C. and D. C. potentiometers, current and potential transformers, burden, ratio and phase angle errors, current measurement using Rogowski coil	
Unit-4	Electrical Measuring Instruments	11
	Classification of analog instruments, operating forces, construction and principle of various analog measuring instruments, miscellaneous instruments like- power factor meter, frequency meters and synchroscope, introduction to digital measuring instruments, essentials of an electronic instruments, advantages of electronic instruments, types of electronic and digital voltmeters, signal sampling concept in digital instruments, true r.m.s. reading voltmeter, vector voltmeter, electronic multimeter, electronic energy meter, electronic and digital LCR meter, tachometer, introduction to smart energy meter and PMU	
Unit-5	Transducers	08
	Classification and selection criterion for transducers, basics of thermometry and thermosensitive sensors, capacitive, inductive and resistive type transducers for	

linear and angular displacement measurement, pressure transducer, flow and level transducer, force, torque, weight, strain, Piezo-electric transducers, Hall-effect devices: current and voltage sensors, RVD, CVD sensors, low power CTs, optical sensors, ultrasonic transducers, encoders, sensors in automotive industries

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 / simulations based on the above syllabus.

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.
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, Pearson / Prentice Hall of 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 :

Title of Experiment	Hrs.
1. To perform the procedure for extension of range for ammeter and voltmeter.	2
2. To analyze three phase reactive power using one wattmeter method.	2
3. To measure medium resistances using Wheatstone bridge.	2
4. To measure low resistance using Kelvin's double bridge.	2
5. To measure inductance by Anderson's and Hay's Bridge.	2
6. To measure capacitance by De-Sauty's bridge.	2
7. To test the performance of single phase induction type energy meter.	2
8. To obtain and analyze the response of various thermo sensitive sensors.	2
9. To understand and perform various methods for measurement of displacement.	2
10. To measure unknown weight using strain gauge.	2
11. To analyze and apply different optical transducers for light intensity measurement.	2
12. To measure speed of rotating object using optical transducers.	2

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

w.e.f. academic year 2023 - 24 and onwards