

NIRMA UNIVERSITY
Institute of Technology
B.Tech. in Electrical Engineering
Semester – IV

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Course Code	2EE402
Course Title	Electrical Measurements and Transducers

Course Learning Outcomes (CLO):

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

1. understand the concepts of measurement and measurement systems
2. comprehend construction and working of various analog and digital instruments
3. acquire knowledge on working, importance and applications of various transducers
4. appreciate the relevance of data acquisition system and its application in electrical engineering

Syllabus:

Teaching Hours: 30

Unit-1: Concepts of Measurements and Instrumentation 02

Introduction to measurement and instrumentation, Static and dynamic characteristics of instruments and instrumentation.

Unit-2: Measurement of Resistance, Inductance and Capacitance 05

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, Ratio and phase angle errors, Design considerations and testing.

Unit-4: Analog Electromechanical Instruments 04

Classification of analog instruments, Operating forces, Construction and Principle of Operation of Permanent magnet moving coil, Moving iron, Dynamometer type, Induction type, Electrostatic type instruments, Electrodynamometer type wattmeter, Measurement of active and reactive power, Energy meter for A.C. circuits, Induction type energy meter, Miscellaneous instruments like- Power factor meter, Frequency meters and Synchroscope, Calibration of analog measuring instruments.

Unit-5: Electronic and Digital Instruments 05

Introduction, 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.

Unit-6: Transducers**04**

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 elements, Piezo-electric transducers, Piezo-electric accelerometers, Hall-effect devices, Optical sensors, Ultrasonic transducers.

Unit-7: Data Acquisition Systems**06**

Basics of ADC and DAC, Digital methods of measurements, Introduction to DAQ systems, PC based measurement techniques, Graphical methods of measurement, Introduction to SCADA.

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 Experiments:

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

Suggested Readings:

1. A. K. Sawhney, A course in Electrical Measurement and Measuring Instruments, Dhanpat Rai & Sons, New Delhi.
2. E. W. Golding and F. C. Widdis, Electrical & Electronic Measurements & Instrumentation, Reem Publications Pvt. Ltd.
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.

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

W.e.f. academic year 2019-20 and onwards