

Instrumentation Engineering

1.1 Course Number: ECE323

1.2 Contact Hours: 3-0-0 Credits: 9

1.3 Semester-offered: 4th Year-Even

1.4 Prerequisite:

1.5 Syllabus Committee Member: Dr. Umakant Dhar Dwivedi, Dr. Shivanshu Shrivastava, Dr. Amarish Dubey, Dr. Sajal Agarwal, and Dr. Abhishek Kumar Singh.

2. **Objective:** To understand the working principle of different measuring instruments and technical solutions to handle different errors. To learn the architecture and working principle of advanced measuring instrument and their applications.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Introductory instrumentation system	Units and standards, calibration methods, Standards of measurement, classification of errors, error analysis, static characteristics – Accuracy, precision, sensitivity, linearity, resolution, hysteresis, threshold, input impedance, loading effect etc., dynamic characteristics.	6
2	Electronic meters	Introduction, Digital Voltmeter - Ramp type, Dual slope type, integrating type, successive approximations type, resolution and sensitivity of digital meters & general specifications of a digital voltmeter, LCRQ meter, Transistor tester, Analog pH meter, digital frequency meter, digital measurement of time, digital tachometer, digital phase meter, digital capacitance meter, automation in digital instrument.	9
3	Bridges and measuring instruments	Principle of operation of galvanometers, PMMC, Moving iron instrument DC bridges: Introduction, Wheatstone's bridge, Kelvin bridge, guarded Wheatstone bridge AC bridges: Condition for bridge balance, Maxwell bridge, Hay bridge, Schering bridge, Wein bridge, Wagner ground connection.	9

4	Signal generators	Fixed and variable audio frequency oscillators, AF sine and square wave generator, Function generator, square and pulse generator, random noise generator, sweep generator, video pattern generator, colour bar generator, beat frequency oscillator (BFO).	8
5	Transducers	Instrumentation – general aspects, classification of transducers, basic requirements of transducers, passive transducers - strain gauge, thermistor, Hall-Effect transducer, LVDT, and active transducers – piezoelectric and thermocouple	8
		Total	40

4. Readings

4.1 Textbook:

1. Albert D. Hellfrick, William Cooper: Modern Electronic Instrumentation & Measurements Techniques, Prentice Hall of India Ltd-2003
2. David Buchla, Wayne Melachlan: Applied Electronic Instrumentation & Measurements, Prentice Hall-1992
3. Sawhney A. K.: A course in Electrical and Electronic Measurements and Instrumentation, Dhanapat Rai and Sons, New Delhi, 1995.

4.2 Reference Books

1. Oliver B. H. & Cag J. M.: Electronic Measurements & Instrumentation, McGrawHill- 1992
2. H. S. Kalsi: Electronic Instrumentation, Tata McGraw Hill, 1999
3. A. J. Bouwens: Digital Instrumentation, Tata McGrawHill
4. C. S. Rangan, G. R. Sharma, V. S. V. Mani: Instrumentation devices and system, 2nd edition --Tata McGraw Hill Publication
5. B.S. Sonde, Transducers and display systems, Tata McGraw Hill, New Delhi 1979.

5. **Outcome of the Course:** On completion of this course, the students will be able to: Learn standards and errors and basics of different types of measuring instruments to measure different electrical quantities apply their knowledge to measure electrical quantities using standard analog and digital measuring instruments. Measure different electrical parameters using conventional bridges and acquire data through digital measuring instruments and interpret the data.