

Core IX

Basic Instrumentation

Course Outcomes

- Conceptual understanding of different measurement of electronic circuit with measuring devices. CO-2: Basic understanding of CRO and its applications.
- Basic understanding of signal generators and its analysis
- Basic understanding of digital instruments and their applications.
- To Apply the acquired knowledge of different electronic measurement-based instruments in Experiments

Unit I

- **Basic of Measurement:** Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects.
- **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.
- **Electronic Voltmeter:** Advantage over conventional multi meter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance.
- **AC milli voltmeter:** Type of AC milli voltmeters: Amplifier- rectifier, and rectifier-amplifier. Block diagram ac milli voltmeter, specifications and their significance.

Unit II

- **Cathode Ray Oscilloscope:** Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only no mathematical treatment), brief discussion on screen phosphor, visual persistence and chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance.
- **Applications of CRO:** (1) Study of Wave Form, (2) Measurement of Voltage, Current, Frequency and Phase Difference.
- Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

Unit III

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators, pulse generator, and function generator, Brief idea for testing, specifications, Distortion factor meter, wave analysis.

Unit IV

- **Digital Instruments:** Principle and working of digital meters, Comparison of analog and digital instruments, Characteristics of a digital meter, Working principles of digital voltmeter.
- **Digital Multimeter:** Block diagram and working of a digital multimeter, Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time-base stability, accuracy and resolution.

LAB: Credit-1

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment.
4. Use of Digital multimeter/VTVM for measuring voltages.
5. Circuit tracing of Laboratory electronic equipment.
6. Winding a coil /transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit.
9. Balancing of bridges.

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.

2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q-meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/universal bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)
More emphasis should be given on hands-on experiments.

Text Books:

- ✓ *A Text Books book of electrical technology- B.L. Theraja (S.Chand Publishing)*
- ✓ *Digital circuits and systems Venugopal (Tata McGraw Hill)*

Reference Books :

- ✓ *Digital Electronics-Subrata Ghoshal (Cengage Learning)*
- ✓ *Electronic Devices and circuits - S. Salivahanan and N. S.Kumar (Tata Mc- GrawHill)*
- ✓ *Electronic Devices-Thomas L. Floyd (Pearson)*

Additional Reference Books for Practical papers :

1. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop (Asia Publishing House)
2. Practical Physics-B.B.Swain (Kitab Mahal)
3. Practical Physics-B.Ghosh (Vol. I and II)
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P.Khandelwal (Vani Publication)
5. B.Sc. Practical Physics- C.L.Arora (S.Chand Publishing)
6. B.Sc. Practical Physics H. Singh and P.S. Hemne (S. Chand Publishing)