

EC-3005 MEASUREMENTS AND INSTRUMENTATION

COURSE OBJECTIVE:

This course is electronics based course dealing with measurements and instrumentation designed for students. The objectives of this course are to introduce students to the use of various electrical/electronic instruments, their construction, applications, and principles of operation, standards and units of measurements and provide students with opportunities to develop basic skills in the design of electronic equipments.

COURSE CONTENTS:

Accuracy and Precision, Sensitivity, Linearity, Resolution, Hysteresis, Loading Effect. Measurements of Current, Voltage, Power and Impedance: DC and AC Ammeter, DC Voltmeter-Chopper type and solid-state, AC voltmeter using Rectifier. Average, RMS, Peak responding voltmeters, Multi-meter, Power meter, Bolometer and Calorimeter.

Different parts of CRO, Block diagram, Electrostatic focusing, Electrostatic deflection, Post deflection acceleration. Screen for CRTs, Graticules, Vertical and Horizontal deflection system, Time base circuit, Oscilloscope Probes, Applications of CRO, Special purpose CROs- Multi input, Dual trace, Dual beam, Sampling, Storage (Analog and Digital) Oscilloscope.

Maxwell's bridge (Inductance and Inductance-Capacitance), Hay's bridge, Schering bridge (High voltage and Relative permittivity), Wein bridge. Impedance measurement by Q-meter.

Non-Electrical Quantities (Transducer): Classification of Transducers, Strain gauge, Displacement Transducer-Linear Variable Differential Transformer (LVDT) and Rotary Variable Differential Transformer (RVDT), Temperature Transducer- Resistance Temperature Detector (RTD), Thermistor, Thermocouple, Piezo-electric transducer, Optical Transducer- Photo emissive, Photo conductive, Photo voltaic, Photo-diode, Photo Transistor.

Signal and Function Generators, Sweep Frequency Generator, Pulse and Square Wave Generator, Beat Frequency Oscillator, Digital display system and indicators, Classification of Displays, Display devices: Light Emitting diodes (LED) and Liquid Crystal Display(LCD).

Advantages of Digital Instrument over Analog Instrument, Digital-to-analog conversion (DAC) - Variable resistive type, R-2R ladder Type, Binary ladder, Weighted converter using Op-amp and transistor, Practical DAC. Analog-to-digital Conversion (ADC) -Ramp Technique, Dual Slope Integrating Type, Integrating Type (voltage to frequency), Successive Approximations. Digital voltmeters and multi-meters, Resolution and sensitivity of digital multi-meter.

TEXTBOOKS

1. H.S. Kalsi: Electronics Instrumentation, TMH
2. A.K. Sawhney: Instrumentation and Measurements, Dhanpat Rai and Co.

REFERENCES:

1. Oliver: electronic Measurements introduction TMH
2. Helfric & Cooper: Modern Electronic Instrumentation and Measurement Techniques, Pearson.
3. Ghosh: introduction to measurements and instrumentation 4th edition PHI
4. Bell: electronic Instrumentation and Measurement oxford press.
5. Banerjee: electrical and electronics Measurement 2nd PHI.
6. Anand: electronics and Instrumentation technology, PHI.

COURSE OUTPUT:

Upon successful completion of this course, the student will be able to:

Identify electronics/ electrical instruments, their use, peculiar errors associated with the instruments and how to minimize such errors.

Explain the industrial and laboratory applications of such instruments.

Service and maintain such instruments in case of damage or misuse.

Understand the basic design techniques of electronic equipment.

List of Experiments:

1. Study of Cathode Ray Oscilloscope and Function Generator.
2. Study of displacement measurement by LVDT.
3. Force measurement by strain gauge.
4. Measurement of Capacitor using Q-meter.
5. Measurement of Self-induction using Q-meter.
6. Temperature measurement by thermistor, RTD and thermocouple.
7. Study of optical Transducers: Photo conductive, Photo voltaic, Photo-diode, Photo-Transistor.
8. Design of digital to analog converter, R-2R ladder Type and analysis of its characteristics.