EE 204: MEASUREMENT & INSTRUMENTATION (3-1-2 : 5)

Module 1: Indicating and Integrating Instruments

General features – Construction and principle of operation of moving coil, electrodynamometer, moving iron, Induction, and Electrostatic type indicating instruments. Deflecting, controlling and damping torques. Extension of instrument ranges using shunt, multipliers, Dynamic behaviour of PMMC instrument and improvement of transient response. Principle of operation of the thermoelectric, rectifier type instruments.

Module 2: Measurement of Resistance, Inductance and Capacitance

General four arm bridge network, Kelvin's double bridge, Maxwell, Anderson, De-Sauty, Wien bridge, Schering bridge networks, Wagner earthling device.

Module 3: Instrument Transformers

Theory of current and voltage transformer, ratio error and phase angle, burden, turns compensation performance characteristics, testing and applications of CT and PT

Module 4: Performance Characteristics of Measurement Systems

Elements of generalized measurement system, input-output configuration of instruments and measurement systems, methods of correction for interfering and modifying inputs, static performance characteristics of measurement system, noise, signal to noise ratio, errors in measurement

Module 5: Transducers

Classification of transducers, passive transducers: resistive, inductive and capacitive transducers, active transducers: thermocouple, piezoelectric transducer, photoelectric, transducer, taco-generator, basic signal conditioning circuits for transducers

Module 5: Electronic Meters and Oscilloscope

DC amplifier voltmeter, AC voltmeter using rectifiers, true RMS responding voltmeter, Hall effect wattmeter, Oscilloscope block diagram, CRT and its circuits, vertical deflection systems, delay line, multiple trace, horizontal deflection system, oscilloscope probes. Special Oscilloscopes: Sampling oscilloscope, storage oscilloscope.

Suggested list of Laboratory Experiments:

1. Calibration of A.C. energy meter (a) direct loading, (b) phantom loading
2. Characteristics of a given RTD, Thermistor etc.
3. Curve fitting and modelling of measuring Instrument
4. Displacement measurement by Linear Variable Displacement Transducer (LVDT)
5. Study of Strain Gauge Transducer Characteristics and determination of Gauge Factor
6. Measurement of angular speed, use of Stroboscope
7. Measurement of low resistance using Kelvin Double Bridge
8. Study of temperature measurement and control of a closed loop process.
9. Measurement of Inductance by Anderson Bridge
10. Measurement of Capacitance by Schering Bridge
11. Measurement of Frequency by Wien Bridge.

Text Books

1. Sawhney A K : A course in Electrical & Electronic Measurements & Instruments; Dhanpat rai and sons
2. Heltrick A.D. & Cooper W.D. : Modern Electronic Instrumentation & Measuring Instruments; Wheeler

Reference Books:

1. D Patranabis: Principle of Industrial Instrumentation, Tata McGraw-Hill
2. Kalsi H.S.: Electronic Instrumentation; Tata McGraw hill
3. Ernest O. Doebelin: Measurement systems, Tata-McGraw Hill
4. David A Bell: Electronic Instrumentation and measurement, Prentice Hall of India
5. Rangan, Sharma C.S.: Instrumentation Devices & Systems; Tata McGraw Hill