EX - 303 Electrical Instrumentation

Unit I

Measurement and error, Accuracy and precision, sensitivity resolution, Error & Error analysis, Effect of temperature, Internal friction, Stray field, Hysterisis and Frequency variation & method of minimizing them, Loading effects, due to shunt connected and series connect ed instruments, calibration curve, Testing & calibration of instruments.

Galvanometers – Theory & operation of ballistic galvanometer, D'arsonal galvanometer, galvanometer motion & damping, Sensitivity, Flux meter, Vibration galvanometer, Spot deflection galvanometer. Definition of analog & digital instruments, Classification of analog instruments, their operating principle, Operating force, Types of supports, Damping, Controlling.

Unit II

Different types of Ammeter & Voltmeter – PMMC, MI, Electrodynamometer, Hotwire, Electrostatic, Induction, Rectifier, Ferro dynamic & Electro-thermic, Expression for control & deflection torque, their advantages, disadvantages & error, Extension of range of instruments using shunt & multiplier.

Unit III

Instrument transformers: Potential and current transformers, ratio and phase angle errors, testing of instrument transformers, Difference between CT and PT, errors and reduction of errors. **Measurement of power:** Power in AC and DC Circuit, Electrodynamometer type of wattmeter, Construction, theory, operation & error, Low power factor & UPF wattmeter, Double element and three element dynamometer wattmeter, Measurement of power in three phase circuit, one, two & three wattmeter method, Measurement of reactive power by single wattmeter, Measurement of power using CTs & PTs.

Unit IV

Measurement of Energy: Single phase induction type energy meter – construction & operation – driving and braking torques –errors & compensations – Testing by phantom loading and using

R.S.S. meter- Three phase energy meter – Tri-vector meter – Maximum demand meter, Ampere hour meter.

Potentiometer – DC potentiometer standardization – Lab type Crompton's potentiometer, application of DC potentiometer, AC polar type and coordinate type potentiometer, their construction and applications.

Unit V

Miscellaneous Instruments & Measurements: Power factor meter, Single phase and three phase Electro-dynamometer type & moving iron type.

Frequency meter – Vibrating reed, Resonance type & Weston type, Synchronoscope, Ohmmeter – series & stunt type, Multi-meter, Megger & Ratio meter.

Resistance Measurement – Classification of low, medium & high resistance – Voltmeter, Ammeter, Wheatstone Bridge, Kelvin's double bridge & loss of charge methods for resistance measurement,

Earth resistance measurement.

Magnetic Measurement – B-H Curve, Hysterisis Loop determination, Power loss in sheet metal – Lloyd Fischer square for measurement of power loss.

References:

1. E W Golding & F C Widdis; Electrical Measurement & Measuring Instruments; Wheeler Pub.
2. A.K. Sawhney; Electrical & Electronic Measurements & Instrument; Dhanpat Rai & Sons Pub.
3. Buckingham & Price; Electrical Measurements; Prentice Hall

List of experiments (Expandable):

1. Measurement of low resistance using Kelvin's Double bridge
2. Measurement of medium resistance using Wheatstone's bridge
3. Measurement of high resistance by loss of charge method
4. Measurement of Insulation resistance using Megger
5. Measurement of earth resistance by fall of potential method and verification by using earth tester
6. Measurement of power in a single phase ac circuit by 3 voltmeter/ 3 Ammeter method
7. Calibration of a dynamometer type of wattmeter with respect to a standard/Sub Standard wattmeter
8. Calibration of a induction type single phase energy meter
9. Calibration of a dynamometer type of wattmeter by Phantom Loading method
10. Measurements using Instrument Transformers
11. Study of various types of Indicating Instruments
12. Measurement of Power in three phase circuit by one, two & three wattmeters.