

ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Pre-requisite: Basic Electrical & Electronics Engineering, Network theory & Electromagnetic fields.

Course objectives:

- To introduce the basic principles of all measuring instruments
- To deal with the measurement of voltage, current, Power factor, power, energy, phase and frequency.
- To measure the resistance, inductance and capacitance by using various bridges.
- To introduce the basic principles of Transducers used for measurement of displacement, velocity, angular velocity.

UNIT- I: (~9 Lecture Hours)

Classification - deflecting, control and damping torques -Construction and principle of operation of moving coil, moving iron and electrostatic voltmeters and ammeters- extension of ranges.

UNIT- II: (~9 Lecture Hours)

Potentiometers: DC Potentiometers - Basic Slide wire and Crompton's potentiometer - standardization - Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization - applications.

Instrument Transformer: CT and PT - Ratio and phase angle errors

Cathode Ray Oscilloscope: Dual trace and dual beam oscilloscope, digital oscilloscope, oscilloscope as test and measuring instrument(Elementary treatment only), measurement of phase of amplitude, phase and frequency using CRO.

UNIT -III: (~9 Lecture Hours)

Measurement of Power: Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques - Extension of range of wattmeter using instrument transformers - Measurement of active and reactive powers in balanced and unbalanced systems.

Measurement of Energy: Single phase induction type energy meter - driving and braking torques - errors and compensations - testing by phantom loading using R.S.S. meter and Three phase energy meter.

Power Factor Measurement, Frequency Meter and Synchroscope.

14) R. Sasubramanian

14) RMY

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12) G. Anand

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10) J. S. S.

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| 1) N. Mallesh Reddy | 4) S. S. S. | 7) Anand |
| 2) D. S. S. | 5) | 8) K. S. |
| 3) E. S. | 6) S. S. | 9) S. S. |

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UNIT - IV: (~8 Lecture Hours)

DC Bridges: Measurement of low, medium and high resistance using Kelvin's bridge, Kelvin's double bridge, Wheatstone bridge, Carey Foster bridge, loss of charge method.

AC Bridges: Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge - Owen's bridge. Measurement of capacitance and loss angle - De-Sauty's Bridge- Schering Bridge

Measurement of frequency-Wien's bridge.

UNIT-V: (~9 Lecture Hours)

Transducers: Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezo-electric transducers, photovoltaic, photo conductive cells, and photo diodes.

Measurement of strain, Gauge sensitivity, Displacement, Velocity, Angular Velocity, Torque measurement by Strain Gauge only.

TEXT BOOKS:

1. E.W.Golding, F.C.Widdis, "Electrical Measurements and measuring Instruments", 3rd Edition, Reem Publications Pvt Ltd., 2011.
2. A. K. Sawhney, "A course on Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai & Co. Publications, 2015.
3. G.K.Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2014.

REFERENCE BOOKS:

1. R.K.Rajput, "Electrical & Electronic Measurements & Instrumentation", S. Chand and Company Ltd., 2008.
2. Reissland.M.U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Ltd, 1st Edition, 2010.
3. S.C.Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.

Course Outcomes: After completion of this lab the student is able to

1. Acquire the knowledge about the measuring instruments for measurement of voltage, current, power, energy, CRO.
2. Analyze the extension of range of measuring instruments and Different types of errors and their reduction techniques, CT and PT, Potentiometers.
3. Evaluate power factor and frequency, phase sequence using power factor meter, frequency meter and synchroscope.

14) R. Balasubramaniam

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12) G. Anand

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15) M. S. ...

13) S. ...

11) P. ...

1) N. Malle Reddy
 2) T. ...
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4. Measure the resistance, inductance and capacitance by using various bridges and phase and frequency using CRO.
5. Acquire the knowledge about Transducers and measurement of displacement, velocity, angular velocity using strain gauge
6. Apply the conceptual thing to real world electrical and electronics problems and applications

- 1) N. Malle Reddy
- 2) T. Subbalakshmi
- 3) E.M.
- 4) S. Srinivasulu
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