22EE302 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Hours Per Week :

| L | Т | Р | С |
|---|---|---|---|
| 3 | 0 | 2 | 4 |

PREREQUISITE KNOWLEDGE: Basic Electrical and Electronics Engineering, Electric circuits.

COURSE DESCRIPTION AND OBJECTIVES:

This course provides adequate knowledge of various instruments for measuring electrical quantities. The objective of course is to understand basic laws governing the operation and working of instruments and their equivalent circuits used for the measurement of voltage, current, power, energy, frequency and phase angle.

MODULE-1

12L+0T+8P=20 Hours

ELECTRICAL MEASURING INSTRUMENTS:

Analog Ammeters and Voltmeters : PMMC and MI Instruments, Construction, Torque Equation, Range Extension, Effect of temperature, Classification, Errors, Advantages and Disadvantages.

Analog Wattmeter's and Power Factor Meters : Power and Power Factor, Electrodynamometer type wattmeter, power factor meter, Construction, theory, Shape of scale, torque equation, Advantages and disadvantages, active and reactive power measurement in single phase, Measurement in three phase.

Analog Energy Meter : Single phase induction type energy meters, construction, theory, Operation, lag adjustments, Max Demand meters/indicators, Measurement of VAH and VARh.

UNIT-2

UNIT-1

MEASUREMENT OF CIRCUIT PARAMETERS:

Measurement of Resistance, Inductance and Capacitance : Classification of resistance, Methods of measuring low, Medium and high resistance, Carey Foster's bridge, Kelvin's double bridge, Loss of charge method, DC Crompton's potentiometer, Measurement of inductance - Quality Factor, Maxwell's bridge; Measurement of capacitance and loss angle - Desauty bridge, Wien's bridge.

Instrument Transformers: Need for instrument transformers, CT and PT, Ratio and phase angle errors (Definition and Phasor diagram only).

PRACTICES:

- Calculation of unknown impedance by using Anderson's bridge.
- Calculation of unknown resistance by using Kelvin's double bridge.
- Calculation of unknown capacitance by using Schering Bridge.
- Measurement of choke coil parameters.
- Estimation of ratio error in case of current transformer.
- Estimation of ratio error in case of potential transformer.



Source: https:// dir.indiamart.com/ impcat/electricalmeasuringinstruments.html

TEDO

12L+0T+8P=20 Hours

MODULE –2

SKILLS:

- Select appropriate instrument for measuring given quantity.
- Extend the range of ammeter and voltmeter.
- Calculate the energy consumed by domestic load.
- Design Kelvin's double bridge and determine the unknown resistance.
- ✓ Design Maxwell Bridge and determine the unknown impedance.

TRANSDUCERS:

Measurement of Temperature, RTD, Thermistors, LVDT, Strain Gauge, Piezoelectric Transducers, Digital Shaft Encoders, Tachometer, Hall effect sensors.

UNIT-2

UNIT-1

ELECTRONIC INSTRUMENTS:

Electronic Display Device, Digital Voltmeters, CRO, measurement of voltage and frequency, Lissajous Patterns, Plotting B-H curve of a magnetic material, Wave Analyzers, Harmonic Distortion Analyzer.

PRACTICES:

- LVDT and the capacitance pickup Characteristics and Calibration.
- Calibration of LPF wattmeter by Phantom loading test.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

| CO No. | Course Outcomes | Blooms Level | Module No. | Mapping with POs |
|-----------|--|-----------------|---------------|---------------------|
| 1 | Apply of electronic measuring instruments to various applications | Apply | 2 | 1,2,9,11 |
| 2 | Compare performance of MC, MI and Dynamom- eter types of measuring instruments, Energy meters and CRO. | Analyse | 1 | 1,2,9,11 |
| 3 | Select the circuit parameters using AC and DC bridges. | Apply | 1 | 1,2,9,11 |
| 4 | Analyze the errors in CTs and PTs. | Analyze | 1 | 1,2,9,11 |
| 5 | Select transducers for the measurement of tem- perature, displacement and strain. | Apply | 2 | 1,2,9,11 |

TEXT BOOKS:

- 1. J. B. Gupta: A course in Electrical and Electronic Measurements and Instrumentation, 13/E, Kataria and Sons 2009.
- 2. A. K. Sawhney: A course in Electrical Measurements Electronic Measurements Instrumentation, Edition 11, Dhanpat Rai and Sons 2012.

REFERENCE BOOKS:

- 1. W.D. Coopers and Helfrick, Modern Electronic instrumentation and Measurements Techniques, Prentice Hall of India Pvt. Ltd, 2009.
- 2. E.W. Gowlding and F.C.Widdis, Electrical Measurements and Measuring Instruments 5/e, Wheeler Publications 2002.

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