

COURSE TITLE : ELECTRICAL MEASURING INSTRUMENTS

COURSE CODE : 3032

COURSE CATEGORY : B

PERIODS/WEEK : 5

PERIODS/SEMESTER : 75

CREDITS : 5

TIME SCHEDULE

MODULE	TOPICS	PERIODS
1	Theory and Classification of Measuring Instruments	19
2	Measurement of Power and Energy	19
3	Measurement of Resistance, Inductance and Capacitance	19
4	Special Purpose Measuring Instruments	18
Total		75

Course Outcome:

Sl.	Sub	On completion of this course the student will be able:
1	1	To understand various types of electrical measuring instruments.
	2	To understand the theory of operation.
2	1	To comprehend with the construction and working of wattmeter.
	2	To comprehend with construction and working of energy meter.
3	1	To comprehend with the various methods for measurement of resistance.
	2	To comprehend with the methods for measurements of inductance and capacitance
4	1	To know various types of special purpose measuring instruments used for electrical measurements.
	2	To understand the working of digital meters for electrical measurements.

Specific Outcome:

MODULE I Theory and classification of measuring instruments

1.1.0 To understand various types of electrical measuring instruments.

- 1.1.1 To list various types of electrical measuring instruments.
- 1.1.2 To illustrate the mechanism for the production of deflecting torque.
- 1.1.3 To illustrate the mechanism for the production of controlling torque.
- 1.1.4 To illustrate the mechanism for the production of damping torque.
- 1.1.5 To state the effects of control and damping torque.

1.2.0 To understand the theory of operation.

- 1.2.1 To describe the construction of permanent magnet moving coil instrument.
- 1.2.2 To describe the working of permanent magnet moving coil instrument
- 1.2.3 To describe the construction of moving iron instruments.
- 1.2.4 To describe the working of moving iron instruments.
- 1.2.5 To describe the extension of the range of ammeter and voltmeter.
- 1.2.6 To distinguish between moving iron and moving coil instruments.
- 1.2.7 To state the applications of MI and MC instruments.
- 1.2.8 To explain how the rectifier type ammeter and voltmeter works.
- 1.2.9 To list the sources of error in measuring instruments and find remedies.

MODULE II Measurement of power and energy

2.1.0 To comprehend with the construction and working of wattmeter.

- 2.1.1 To draw the construction details of dynamometer type wattmeter.
- 2.1.2 To explain the principles of operation of dynamometer type wattmeter with neat sketch.
- 2.1.3 To identify the sources of errors in dynamometer type instruments.
- 2.1.4 To illustrate the correction factor and theory of compensated wattmeter.
- 2.1.5 To determine the multiplication factor of wattmeter.

2.2.0 To comprehend with construction and working of energy meter.

- 2.2.1 To describe the construction of single phase induction type energy meter.
- 2.2.2 To describe the working of single phase induction type energy meter
- 2.2.3 To identify the sources of errors in induction type energy meter.
- 2.2.4 To draw the schematic diagram of three phase energy meter.
- 2.2.5 To calibrate the energy meter and wattmeter.
- 2.2.6 To draw the connection diagram for the measurement of three phase power by two wattmeter method.

MODULE III Measurement of resistance, inductance and capacitance

3.1.0 To comprehend with the various methods for measurement of resistance.

- 3.1.1 To categorize the resistance in low, medium and high.
- 3.1.2 To describe the methods of resistance measurement by voltmeter ammeter method
- 3.1.3 To describe the methods of resistance measurement by potentiometer method.
- 3.1.4 To describe the methods for measurement of medium resistance by Wheat stone's bridge.
- 3.1.5 To derive the value of unknown resistance using above bridge.
- 3.1.6 To draw the circuit diagram of insulation Megger.
- 3.1.7 To describe the working principle of insulation Megger
- 3.1.8 To describe the working principle of earth Megger.
- 3.1.9 To distinguish between insulation Megger and earth Megger.
- 3.1.10 To list the range of earth resistance of various electrical installations viz. domestic, substation and generating station.
- 3.1.11 To describe the procedure of measurement of earth resistance by earth Megger and the fall of Potential method.
- 3.1.12 To explain different methods for locating cable fault.

3.2.0 To comprehend with the methods for measurements of inductance and capacitance

- 3.2.1 To describe the construction of bridges(Maxwell Bridge & Anderson bridge)
- 3.2.2 To explain the Working of bridges(Maxwell Bridge & Anderson bridge)
- 3.2.3 To describe the measurements of inductance using bridge.
- 3.2.4 To describe the measurements of capacitance using bridges.

MODULE IV Special purpose measuring instruments

4.1.0 To know various types of special purpose measuring instruments used for electrical measurements.

- 4.1.1 To describe the working of reed type and indicating type frequency meter.
- 4.1.2 To explain the single phase and three phase power factor meter.
- 4.1.3 To explain the connections of phase sequence indicator and synchroscope.
- 4.1.4 To describe the principle and operation maximum demand indicator
- 4.1.5 To Explain about TOD meter.
- 4.1.6 To describe the working principle of CRO with block diagram.
- 4.1.7 To list the applications of CRO.

4.2.0 To understand the working of digital meters for electrical measurements.

- 4.2.1 To describe the working of digital voltmeter.
- 4.2.2 To describe the block diagram of digital frequency meter.
- 4.2.3 To distinguish between analog and digital meters.

CONTENT DETAILS

MODULE – I

Classification and theory of Indicating Instruments - Classification of measuring instruments-Essential torques of indicating instruments – deflecting - controlling and damping torque - working principle of permanent magnet moving coil, dynamometer type and moving iron type instruments –torque equations-comparison of MC and MI instruments- Rectifier type instruments. Extension of range of DC voltmeter and ammeter – calculate values of shunt and multiplier– multi range instruments. Common errors in instruments and their remedies.

MODULE – II

Measurement of Power and Energy - Construction of dynamometer type wattmeter – common errors and their remedies- multiplication factor –Working principle of single phase induction type energy meter – construction- common errors and their remedies. Construction of poly phase energy meters –2 elements and 3 element type. Calibration of energy meter by direct loading and phantom loading. TOD meter –functions-method of connection and use.

MODULE – III

Measurement of Resistance, Inductance and capacitance. Wheat stone bridge -simple problems. Difficulties in the measurement of high resistance– insulation Megger – working principle of Megger-measurement of earth resistance and soil resistivity by earth tester. Localization of cable fault- Varley and Murray loop methods. Bridges-Maxwell’s bridge-Schering bridge. LCR meter- applications

MODULE – IV

Instruments for special measurements - Measurement of frequency –working of vibrating reed type and indicating type frequency meters. Measurement of power factor –working principle of PF meters-connection diagram of single phase and three phase PF meters. Working principle and connection diagram of synchroscope. Working principle and connection diagram of phase sequence indicator. Ramp type digital voltmeters-block diagram -working principle. Cathode ray oscilloscope-classification- block diagram of digital oscilloscope – applications of CRO - Observation of waveforms measurement of – voltage - frequency - time period - phase and phase angle.

REFERENCE BOOKS

1. A.K Sawhney. Electrical and Electronics measurements and Instrumentation: Dhanapath Ray & co.
2. J.B Gupta. Electrical measurements and measuring instruments: S K Kataria & sons.
3. R K Rajput. Electrical measurements and measuring instruments: S Chand & co.
4. Edward William Golding, Frederick Charles Widdis. Electrical measurements and measuring instruments: Pitman