Daffodil Institute of Technology

Diploma-in-Electrical Technology

6th semester

Responsible Teacher: Hasan Murad Munna (Jr. Instructor of Electrical Technology)

66762 ELECTRICAL & ELECTRONIC MEASUREMENTS – II T P C

2 3 3

AIMS

To provide the student with opportunities to acquire knowledge, skills and attitude in the area of Electrical Measurement and Measuring Instruments with special emphasizes on:

- Extension of instrument range
- Operation of instrument transformer.
- Measurement of the resistance of various ranges.
- The concept of operation of meters for measurement of frequency and Power factor,

SHORT DESCRIPTION

Extension of instrument ranges: instrument range; Ammeter shunt, Voltmeter multiplier; Instrument transformer: construction and use of CT & PT; Measurement of resistance: Low resistance, Medium resistance and High resistance; Multimeter; Digital instrument; Frequency Meter: Principle of measurement, construction and operation; Energy factor meter: Construction and principles of operation; Digital energy factor meter;

DETAIL DESCRIPTION

Theory:

1 Understand extension of instrument range.

1.1 List different types of instruments for which extension is required.

1.2 Explain the principles and necessity for extension of instrument range.

1.3 Describe the ammeter shunt for DC circuit.

Rm

1.4 Express the deduction of the relation: Rsh □

N□1

1.5 Explain ammeter shunt for AC circuit.

1.6 Solve problems relating to ammeter shunt.

1.7 Describe voltmeter multiplier and the swamping resistance

1.8 Explain voltmeter multiplier for AC instrument.

1.9 Solve problems relating to voltmeter multiplier.

2 Perceive the concept of Instrument transformer.

2.1 Describe current transformer (CT) and potential transformer (PT).

2.2 List the applications of current transformer and potential transformer.

2.3 Explain the advantages and disadvantages of CT and PT.

2.4 Describe the burdens of instrument transformer.

2.5 Define Knee point, excitation curve and class of CT.

2.6 Compare instrument transformer with Power transformer.

3 Realize the concept of current transformer (CT) and potential transformer (PT).

3.1 Describe the construction of current transformer.

3.2 Draw and explain the connection and vector diagram of current transformer.

3.3 Determine actual current ratio, ratio error and phase angle error.

3.4 Explain the characteristics of current transformer.

3.5 Narrate the classes of accuracy in instrument transformer.

3.6 Outline the effect of open circuited secondary of current transformer.

3.7 Describe the construction and use of clip on ammeters.

3.8 Explain the construction of potential transformer.

3.9 Sketch and explain the connection diagram with line and vector diagram of PT.

3.10 Draw the circuit showing CT, PT and Watt meter with 1-phase and 3-phase load.

4 Recognize the measurement of resistance.

4.1 Classify resistance.

4.2 Explain low, medium and high range of resistance.

4.3 List the methods of measurement of low resistance.

4.4 Describe the measurement of low resistance by ammeter- voltmeter method.

4.5 Determine the low resistance by Kelvin's double bridge method.

4.6 Solve problems on Kelvin's double bridge method. 5 Interpret the measurement of medium resistance.

5.1 List the methods for measurement of medium resistance.

5.2 Describe Wheatstone bridge method to measure the medium resistance.

5.3 Mention the advantages of Wheatstone bridge method.

5.4 Discuss the precaution in measuring medium resistance by Wheatstone bridge method.

5.5 Solve problems related to Wheatstone bridge method. 6 Understand the measurement of high resistance.

6.1 Describe dielectric test of insulating materials.

6.2 List the methods to measure high resistance measurement.

6.3 Describe the guard wire method of measurement of high resistance.

6.4 Explain the construction and working principle of a Megger.

6.5 Describe the method of measurement of high resistance Using a Megger.

6.6 State the uses of Megger.

6.7 Describe measurement of earth resistance using earth tester.

7 Perceive the Multimeter.

7.1 Explain the circuit of analog Multimeter.

7.2 Describe the construction of analog Multimeter.

7.3 Specify the construction of digital Multimeter.

7.4 Describe the uses of Multimeter.

8 Illustrate the method of measurement of frequency and frequency meter

8.1 Name the methods of measuring frequency.

8.2 Explain the principle of mechanical resonance and electrical resonance.

8.3 Construct the variation of impedance of an inductive circuit with the variation of supply frequency.

8.4 Mention different types of frequency meter.

8.5 Explain the construction and working principle of electrical resonance frequency meter.

8.6 Describe the construction and working principle of Weston frequency meter. 9 Understand the operation of digital frequency meter.

9.1 Describe the principle of operation of digital frequency meter.

9.2 Sketch the block diagram of a digital frequency meter.

9.3 Describe each block of a digital frequency meter.

9.4 Describe the function of time base selector in digital frequency meter.

9.5 Draw and Explain the operation of logic diagram of a digital frequency meter.

10 Realize the construction and principle of operation of power factor meter.

10.1 List different types of energy factor meter.

10.2 Describe construction and principle of operation of single phase dynamometer type power factor meter.

10.3 Narrate the construction and principle of operation of three phase dynamometer type power factor meter.

10.4 Describe the principle of operation of digital power factor meter.

10.5 Draw the block diagram of a digital power factor meter.

10.6 Describe each block of a digital power factor meter.

11 Understand the principle of high voltage measurement and testing.

11.1 Describe the high voltage measurement of electrical quantities.

11.2 List the equipment for high voltage measurement.

11.3 Describe the sphere gap method of high voltage measurement.

11.4 Describe the potential divider method of high voltage measurement.

11.5 Mention the advantages of sphere gap method of high voltage measurement.

11.6 Mention the disadvantages of sphere gap method of high voltage measurement.

12 Understand the principle and operation of oscilloscope.

12.1 State the basic principle of oscilloscope.

12.2 Mention the types of oscilloscope.

12.3 Mention the important features of cathode ray oscilloscope

12.4 Describe the block diagram of oscilloscope.

12.5 Describe the operation of dual trace oscilloscope.

12.6 Describe the operation of digital oscilloscope.

12.7 Describe the Procedure of measurement voltage, current, phase & frequency using CRO.

12.8 Describe frequency and phase angle measurement using Lissagous Pattern.

Practical:

1 Determine the shunt resistance of an ammeter for extension of its range.

1.1 Sketch the circuit diagram for determining the shunt resistance of an ammeter.

1.2 Collect the tools, equipment and materials required.

1.3 Prepare the circuit according to the circuit diagram using proper equipment.

1.4 Check the equipment setting and connection before connecting Power supply.

1.5 Record the readings from the meter.

1.6 Calculate the value of shunt resistance.

2 Measure the value of resistance of a voltmeter multiplier.

2.1 Sketch the circuit diagram for determining the resistance of voltmeter multiplier.

2.2 Connect the tools, equipment and materials required.

2.3 Prepare the circuit according to the circuit diagram.

2.4 Check the circuit before connecting Power supply.

2.5 Record the reading from the meter.

2.6 Calculate the value of resistance of the multiplier. 3 Perform the handling of instrument transformer.

3.1 Select the current transformer and potential transformer.

3.2 Select required tools, equipment and materials.

3.3 Draw the circuit diagram.

3.4 Connect the equipment according to the circuit diagram.

3.5 Check all connection before supplying Power to the circuit.

3.6 Records reading from the meter and calculate the transformation ratio.

4 Prepare the excitation curve using CT (Current transformer).

4.1 Select the current transformer.

4.2 Select required tools, equipment and materials.

4.3 Draw the circuit diagram.

4.4 Connect the equipment according to the circuit diagram.

4.5 Check all connection before supplying Power to the circuit.

4.6 Record data by varying input current.

4.7 Plot the excitation curve.

4.8 Point out the Knee point and types of CT.

5 Measure of low resistance by Ammeter–Voltmeter method.

5.1 Draw the circuit diagram for the measurement of low resistance by ammeter voltmeter method.

5.2 Connect the tools, equipment and materials required.

5.3 Prepare the circuit according to the circuit diagram using proper equipment.

5.4 Check the circuit before connecting Power supply.

5.5 Record the meter readings.

5.6 Calculate the resistance from the meter readings.

6 Perform the measurement of earth resistance by earth tester.

6.1 Sketch the circuit diagram for the measurement of earth resistance by earth tester.

6.2 Select a earth tester and required tools, equipment and materials.

6.3 Connect the equipment according to the circuit diagram.

6.4 Measure the earth resistance from the reading of the earth tester. 7 Perform the measurement of medium resistance by Wheatstone bridge.

7.1 Draw the circuit diagram for measuring medium resistance by Wheatstone bridge.

7.2 Select tools, equipment and materials required.

7.3 Prepare the circuit according to the circuit diagram.

7.4 Check all the connection before connecting Power supply.

7.5 Record the meter readings.

7.6 Calculate the value of unknown resistance.

8 Perform the measurement of high resistance by a Megger.

8.1 Select a high resistance.

8.2 Select a Megger.

8.3 Connect the resistance with the Megger.

8.4 Measure the resistance from the reading of the Megger.

9 Measure the frequency by a frequency meter.

9.1 Sketch the circuit diagram.

9.2 Select a frequency meter.

9.3 Select tools, equipment and materials.

9.4 Connect the frequency meter to the supply or circuit whose frequency is to be measured.

9.5 Measure the supply frequency from the meter.

10 Perform the measurement of Power factor by a Power factor meter.

10.1 Sketch the circuit diagram for measurement of Power factor of a load by a Power factor meter.

10.2 Select the tools, equipment and materials required.

10.3 Prepare the circuit according to the circuit diagram by using proper equipment.

10.4 Check the circuit before connecting power supply.

10.5 Record power factor from the power factor meter.

11 Perform the measurement of voltage, current and frequency by cathode ray oscilloscope (CRO).

11.1 Draw the circuit diagram for the measurement of voltage, current and frequency by CRO.

11.2 Select the tools, equipment and materials required.

11.3 Connect the equipment setting and connection according to the circuit diagram.

11.4 Measure the voltage, current and frequency of the circuit by CRO.

11.5 Prepare a report on it.

REFERENCE BOOKS

1. Electrical Measurements & Measuring Instruments - Golding & Widdis.

2. A Course in Electrical & Electronic Measurements and Instrumentation

- A.K Sawhney

3. A Text Book of Electrical Technology (volume-I)

- B.L Theraja and A.K Theraja

4. Measurement of measuring Instrument

- J.B. Gupta