2023

ELECTRICAL AND ELECTRONIC MEASUREMENTS

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

Symbols have their usual significances.

1 a) How power is measured in a three phase system using wattmeters? Explain using diagrams.   7

    b) The phase voltage and current of a star-connected load is 230 V and 15 A. The power factor of load is 0.707 (lag). Assuming that the system is 3-wire and power is measured using two wattmeters, find the readings of wattmeters.   6

    c) What are the possible causes of error in an electrodynamometer wattmeter? Explain   7

2 a) Describe the construction and working of single phase energy meter using a suitable diagram.   10

    b) A meter constant of a single phase induction type energy meter is 720 revolutions per kWh. Calculate the load in kW if the meter makes nine revolutions in 30 seconds.   4

    c) How energy meters are tested using long period dial test? Explain using a diagram.   6

3 a) How the following parameters are measured using AC bridges?   7 + 7 = 14

      (i) Inductance, and (ii) Frequency

      Explain using suitable diagrams and relevant mathematical relations.

    b) The four arms of a bridge are:
Arm AB, consist of a capacitor of 0.4μF in parallel with 1kΩ resistance,
Arm BC, consist of a capacitor of 0.6μF,
Arm CD, consist of an unknown resistance in series with an unknown capacitor and
Arm DA, consist of a resistance of 300 Ω.

      Determine the unknown capacitance and dissipation factor.   6

4 a) Explain the deflecting force, controlling force and damping force   6

b) Explain, with the schematic diagram, the principle of operation of permanent magnet moving coil (PMMC) instrument.

10

Mention their advantages and disadvantages.

4

5 a) Explain, with the schematic diagram, the principle of operation of attraction type moving iron (MI) instrument.

10

Mention their advantages and disadvantages.

4

b) The inductance of a moving iron instrument is given by $L = 10 + 5\theta - \theta^2 \mu H$, where θ is the deflection in radian from zero position. The spring constant is 12×10^{-6} *Nm/rad*. Estimate the deflection for a current of 5A.

6

6 a) What are the methods for low resistance measurements?

2

b) Draw and explain the principle of operation of Kelvin Double Bridge method for low resistance measurement.

16

Why is it called "double bridge"?

2

7 Write short notes on any two of the following

10x2= 20

a) Extension of EMMC instrument as ammeter and voltmeter connection

b) Ammeter Voltmeter method

c) Loss of charge method for high resistance measurement

d) Current measurement using DC potentiometer