MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EE-402

ELECTRICAL & ELECTRONIC MEASUREMENT

Time Allotted : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) If the secondary winding of a current transformer is open circuited when connected in line
      a) low currents are induced in the secondary
      b) high voltages are induced in the secondary
      c) low voltages are induced in the secondary
      d) high currents are induced in the secondary.

   ii) In a Megger, the resistance to be measured is connected
      a) in series with the control coil
      b) in series with deflecting coil
      c) in parallel with the deflecting coil
      d) in parallel with the control coil.

iii) The example of integrating instrument is

a) moving coil meter

b) moving iron meter

c) tangent galvanometer

d) energy meter.

iv) Which bridge is preferred for measurement of inductance having high Q factor ?

a) Maxwell bridge

b) Hey's bridge

c) Owen's bridge

d) DeSauty's bridge.

v) The instrument, which gives the value of the quantity to be measured in term of instrument constant & its deflection, is called the

a) absolute instrument

b) secondary instrument

c) recording instrument

d) integrating instrument.

vi) When the strain of a wire gauge changes, it results in a change of

a) pressure b) temperature

c) inductance d) resistance.

vii) Creeping in an energy meter is prevented by

a) cutting a hole on the disc at one end

b) adjustment of shading bands

c) cutting two holes on the aluminium disc on opposite ends

d) adjustment of the inclined bands on the outer limbs of shunt magnet.

viii) The readings of which of the following metes are independent of waveform error ?

a) PMMC

b) Moving iron

c) Hot wire

d) both (a) and (c).

ix) Maxwell's inductance-capacitance bridge is used to measure

a) inductance of low Q coils

b) inductance of medium Q coils

c) inductance of high Q coils

d) capacitance of lossy capacitor.

x) Swamping resistance is a resistance which added to the moving coil of a meter to

a) Reduce the full scale current

b) Reduce the temperature error

c) Increase the sensitivity

d) None of these.

xi) In electrodynamometer-type wattmeters, pressure coil inductance produce error which is

a) constant irrespective of load power factor

b) higher low power factors of load

c) lower at low power factors of load

d) same at lagging and leading power factors of load.

xii) In an *AC* bridge, there have the following parameters :

Branch *AB* : Resistance R_1 is in series with inductance L_1

Branch *BC* : Resistance R_2 is in series with capacitance C_2

Branch *CD* : Resistance R_3 is in series with inductance L_3

Branch DA : Resistance R_4 is in series with capacitance C_4

An *AC* supply and a deflector are connected across *AC* and *BD* respectively. At balanced condition, what relations should be valid ?

a) $C_2C_4(R_1R_4 - R_2R_3) = (L_3C_4 - L_1C_4)$ and
$C_2C_4(R_2L_3 - R_4L_1) = 0 \cdot 00318(R_3C_4 - R_1C_2)$

b) $L_1L_3(R_1C_4 - R_3C_2) = (R_2L_3 - L_1R_4)$ and
$R_2L_3(C_2L_1 - R_1L_3) = 0 \cdot 023(R_4C_2 - R_2C_4)$

c) $L_2C_4(R_1R_2 - R_2R_4) = (L_1C_2 - L_3C_4)$ and
$R_2C_4(R_1L_3 - R_3L_1) = 0 \cdot 059(R_2C_4 - R_4C_2)$

d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Briefly compare between permanent magnet moving coil and permanent magnet moving iron instruments.

3. List out the advantages and disadvantages for both current transformer and potential transformer. $2\frac{1}{2} \times 2$

4. Explain the terms with their mathematical expression: accuracy, precision, resolution, speed of response, absolute and relative error.

5. Analyze modified Kelvin double bridge with their proper circuit and phasor diagram.

6. Give a presentation about different usable measuring parameters with their relation and measuring units in electrical engineering as a tabular format.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Draw the equivalent circuit & phasor diagram of a current transformer.

   b) A bar-type CT has 400 turns in the secondary winding. The impedance of the secondary circuit is $(2 + j1 \cdot 5)$ ohm. With 4A flowing in the secondary MMF is 80A and the iron loss in 1W. Determine ratio and phase-angle errors. $5 + 5 + 5$

8. a) Explain the functional block diagram of CRO with neat diagram.

b) What is Lissagous figure ? Explain how phase & frequency can be measured using this figures.

c) What are the differences between dual beam CRO & dual trace CRO ? What is the function of delay line ? 6 + (2 + 3) + (3 + 1)

9. a) Explain with the help of phasor diagram, how unknown inductance can be measured using Anderson's Bridge.

b) Justify/correct the statement :

Maxwell's bridge is more suitable than Hay's bridge for measuring self inductance of coils with high Q.

c) A 230 V single phase watt hour meter records a constant load of 10A for 4 hours at unity power factor. If the meter disc makes 2760 revolutions during this period, what is the meter constant in terms of revolutions per unit ? Calculate the load power factor if the number of revolutions made by the meter is 1104 when recording 5A at 230 V for 6 hours. 6 + 3 + 6

10. a) Deduce the expression of torque of electrodynamometer type instrument.

b) What do you mean by sensitivity of PMMC instrument ? Why sensitivity of electrodynamometer type instrument is low ?

c) Why the scale of moving iron instrument is cramped at lower end ?

d) List the different sources of error in electrodynamometer type wattmeters ?

e) Why is the compensating coil used in electrodynmometer type wattmeters ?

6 + 3 + 2 + 2 + 2

11. Write short notes on any *three* of the following : 3 × 5

a) Digital Multimeter

b) Rectifier type instrument

c) *Q*-meter

d) Piezoelectric transducer

e) LVDT.