CS/B.TECH/EE/EEE/ICE/PWE/EVEN/SEM-4/EE-402/2015-16

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EE-402

ELECTRICAL AND ELECTRONICS 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) Which bridge is used to measure inductance of high Q inductor ?

   a) Maxwell bridge

   b) Hay bridge

   c) Anderson bridge

   d) Wien bridge.

   ii) In measurement systems, which of the following static characteristics are desirable ?

   a) Sensitivity   b) Accuracy

   c) Reproducibility   d) All of these.

   iii) For the measurement of frequency the suitable bridge is

   a) Wien bridge   b) Schering bridge

   c) Hay's bridge   d) None of these.

   iv) The deflecting torque of a moving iron instrument is proportional to

   a) I b) I^2

   c) $I^{1/2}$ d) $I^{3/2}$.

   v) In PMMC the scale is

   a) Logarithm

   b) Exponential

   c) Uniformly divided

   d) Non-linear.

   vi) Burden of a CT is expressed in terms of

   a) secondary winding current

   b) *VA* rating of the transformer

   c) Power and power factor of the secondary winding circuit

   d) Impedance of secondary winding circuit.

vii) Kelvin's double bridge is called 'double' because

   a) It has double the accuracy of a Wheatstone bridge

   b) Its maximum scale range is double that of a Wheatstone bridge

   c) It can measure two unknown resistances simultaneously, i.e., double the capacity of a Wheatstone bridge

   d) It has two additional ratio arms, i.e., double the number of ratio arms as compared to a Wheatstone bridge.

viii) LVDT is a

   a) Capacitive transducer

   b) Resistive transducer

   c) Inductive transducer

   d) None of these.

ix) A 1 mA ammeter has a resistance of 100 ohm. It is to be converted to a 1 A ammeter. The value of shunt resistance is

   a) $0.001 \; \Omega$ b) $0.1001 \; \Omega$

   c) $100000 \; \Omega$ d) $100 \; \Omega$.

x) Piezoelectric transducers are

   a) Passive transducer

   b) Active transducer

   c) Inverse transducer

   d) Both of (b) and (c).

xi) Horizontally mounted moving iron instrument use

   a) eddy current damping

   b) electromagnetic damping

   c) fluid friction damping

   d) air friction damping.

xii) Which of these bridges have high Q-factor and is preferred for measurement of inductance ?

   a) Maxwell bridge

   b) Hay's bridge

   c) Owen's bridge

   d) De sauty bridge.

xiii) Which of the following instruments can be used to measure 100 kV ac voltage ?

   a) PMMC voltmeter

   b) moving iron voltmeter

   c) electrostatic voltmeter

   d) hot wire instrument.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. Describe with suitable schematic diagram, the Varley Loop test for localizing earth fault in low voltage cables.   2 + 3

3. Explain why Maxwell's Inductance-Capacitance Bridge is not suitable for measurement of inductor values with Q-factor.

4. Explain the construction of CRT with proper diagram.

5. What are the different methods of damping in indicating instruments ?

6. Why the secondary winding of a CT should never be open circuited with its primary still energized ?

7. Why is it necessary to have lag adjustment devices in induction type energy meters ? Draw and explain in brief. operation of such arrangements in a single phase energy meter. $1 + 4$

GROUP – C

(Long Answer Type Questions)

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

8. a) Derive the equations of balance for an Anderson's bridge. Draw the phasor diagram for condition under balance.

   b) The four arms of a bridge are the following :

   Arm ab : an imperfect capacitor C1 with an equivalent series resistance of r1.

   Arm bc : a non inductive resistance R3.

   Arm cd : a non inductive resistance R4.

   Arm da : an imperfect capacitor C2 with an equivalent series resistance of r2. in series with a resistance R2.

   A supply of 450 Hz is given between terminals a and c and the detector is connected between b and d. At balance : R2 = 4·8 Ω. R3 = 2 K Ω. R4 = 2·85 KΩ. C2 = 0·5 μF and r2 = 0·4 Ω.

   Calculate the value of C1. r1 and also calculate dissipation factor of this capacitor. Deduce the expression used. $(5 + 2) + 8$

9. a) Draw and explain different blocks of a CRO. Write the operating principle of a CRT.

   b) What are Lissajous patterns ? How do we measure phase and frequency of ac quantity with the help of a CRO ? $(7 + 3) + (1 + 4)$

10. Draw and explain the nature of equivalent circuit and corresponding phasor diagram of a potential transformer. Derive expressions for the corresponding ratio error and phase-angle error. $5 + 10$

11. a) Write briefly about the construction of an electrodynamic type instrument.

    b) Derive the torque equation of the instrument when an alternative current is passed through the coil.

    c) List the principle errors of this type of instrument. $5 + 7 + 3$

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12. Write short notes on any *three* of the following :

$$3 \times 5 = 15$$

a) LVDT

b) Megger

c) Digital Voltmeter

d) Q-meter

e) Creeping and Phantom loading

f) Difference between CT and PT.

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