WEST BENGAL UNIVERSITY OF TECHNOLOGY

EE-402

ELECTRICAL & ELECTRONIC MEASUREMENT

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable. All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. 10×1 = 10

(i) Creeping is observed in
(A) Watt-hour meter (B) Wattmeter
(C) Ammeter (D) Power factor meter

(ii) Electrodynamic - type instruments can be used as
(A) standard instrument
(B) transfer instrument
(C) both as standard and transfer instrument
(D) indicator type instrument

(iii) In spring controlled MI, the scale is
(A) uniform
(B) cramped at lower end and extended at upper end
(C) extended at lower end and cramped at upper end
(D) cramped at both lower and upper end

(iv) 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

(v) A megger is used for measurement of
(A) low valued resistance (B) high valued resistance
(C) medium valued resistance (D) all the above

(vi) The secondary of a CT is -
(A) never left open circuited (B) never left short circuited
(C) always kept open circuited (D) none of these

(vii) The high torque by weight ratio in an analog indicating instrument indicate
(A) high friction loss (B) low friction loss
(C) slow response (D) fast response

(viii) Wagner's earth device are used in AC bridge circuit for
(A) eliminating the effect of earth capacitance
(B) eliminating the effect of inter-component capacitance
(C) eliminating the effect of stray magnetic field
(D) shielding the bridge element

(ix) Frequency can be measured using
(A) Maxwell bridge
(B) Schering bridge
(C) Wien's bridge
(D) Heaviside-Campbell bridge

(x) LVDT is used to measure
(A) Displacement (B) Temperature
(C) pH value (D) Intensity of light

(xi) Aquadag coating is used in a CRO to collect
(A) primary electrons
(B) secondary emission electrons
(C) both (A) and (B)
(D) none of these

(xii) Calibration of DC potentiometer is done with the help of standard cell of voltage

(A) 1.5 volts (B) 1.01864 volts

(C) 1.001864 volts (D) 1.0864 volts

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. Show that the driving torque in a moving iron instrument is given by $T_D = \frac{1}{2} I^2 \frac{dL}{d\theta}$. (Where the symbols have usual meaning.)

3. What are the advantages of instrument transformers over a 'shunt' or 'multiplier'?

4. Derive the balance equations for Schering Bridge for measurement of capacitance?

5. What are the difficulties encountered in measuring high resistance? What is guard circuit?

6. Describe various operating forces needed for proper operation of analog Indicating instrument.

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) Describe with a neat diagram, the Wien's bridge method for measuring unknown frequency. Draw its phasor diagram. 5+3+7

(b) The arms of a four arm bridge abcd, supplied with sinusoidal voltage, have the following values:

arm ab: A resistance of 200 Ω in parallel with a capacitance 1 μ F.

arm bc: 400 Ω resistance

arm cd: 1000 Ω resistance

arm da: A resistance R_2 in series with a 2 μF capacitance.

Determine the value of R_2 and the frequency at which the bridge will balance.

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8. (a) Draw the circuit diagram for DC potentiometer and explain how it works. 15

(b) How can potentiometer be used for (i) calibration of voltmeter and (ii) calibration of wattmeter?

(c) State the possible sources of error if the Wheatstone bridge is used to measure low resistance.

9. (a) Draw the equivalent circuit and phasor diagram of a current transformer. 8+4+3

(b) Derive the expression for ratio and phase angle errors.

(c) Write the difference between CT and PT?

10. (a) Describe in brief the construction and operation of a single-phase induction type Energy meter. 8+4+3

(b) What are the errors in induction type energy meter?

(c) The meter constant of a 230 V, 10 A watt-hour meter is 1800 revolutions per kWh. The meter is tested at half load and rated voltage and unity power factor. The meter is found to make 80 revolutions in 138 s. Determine the meter error at half load.

11. (a) For what specific purpose, shunts are used in ammeters and multipliers are used in voltmeters? 2+3+7+3

(b) PMMC instruments can be used only for DC applications. Why?

(c) Develop the torque equation of PMMC instrument.

(d) A permanent magnet moving coil instrument has a coil of dimensions 15 mm × 12mm. The flux density in the air gap is 1.8×10^{-3} Wb/m^2 and the spring constant is 0.14×10^{-6} Nm/rad. Determine the number of turns required to produce an angular deflection of 90 degrees when a current of 5 mA is flowing through it.

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