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B.E. / B.Tech. DEGREE EXAMINATION NOV 2018

Third Semester

Electronics and Instrumentation Engineering

14UEI305 – ELECTRICAL MEASUREMENTS

(Regulation 2014)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 1 = 10 Marks)

1. Air friction damping should not be used where the deflecting torque in the instrument is produced due to

    (a) magnetic field   (b) electrostatic field
    (c) thermo-electric emf   (d) none of these

2. The relative damping in a galvanometer is 0.8. Its logarithmic decrement is approximately

    (a) 0.48   (b) 1.25   (c) 4.19   (d) -4.19

3. In a single phase induction meter, in order to obtain true value of energy, the shunt magnetic flux should lag behind the applied voltage by

    (a) 90 degrees   (b) 0 degrees   (c) 60 degrees   (d) 180 degrees

4. Creeping in a Single phase induction type energy meter may be due to

    (a) overcompensation for friction   (b) overvoltage
    (c) vibrations   (d) all of the above

5. A current transformer has a rating of 100/5A. Its magnetizing and loss components of the exciting current are 1A and 0.6A respectively and secondary winding burden is purely resistive, its transformation ratio at rated current is:

    (a) 20.12   (b) 20.2   (c) 200.2   (d) none of the above

6. The standardization of A.C potentiometer is done by

   (a) Directly using a.c standard voltage sources
   (b) Using d.c standard sources and transfer instruments
   (c) Using d.c standard and D'Arsonval galvanometer
   (d) Using a.c standard sources and transfer instruments

7. A Wheatstone bridge cannot be used for precision measurements because errors are introduced into an account of

   (a) Resistance of connecting leads   (b) Thermo-electric emfs
   (c) Contact resistances   (d) All the above

8. The value of resistances of an earthing electrode depends upon

   (a) shape and material of electrode
   (b) depth to which electrode is driven into earth
   (c) specific resistances of soil
   (d) value of electrode

9. The equations under balance conditions for a bridge are: $R_1 = R_2R_3/R_4$ and $L_1 = R_2R_3C_4$ where R_1 and L_1 are respectively unknown resistances and inductances

   (a) R_2 and R_3 should be chosen as variable
   (b) R_2 and C_4 should be chosen as variable
   (c) R_4 and C_4 should be chosen as variable
   (d) R_3 and C_4 should be chosen as variable

10. The frequency can be measured using

   (a) Maxwell's bridge   (b) Campbell's bridge
   (c) Wein's bridge   (d) Anderson's bridge

PART - B (5 x 2 = 10 Marks)

11. Justify how deflection is proportional to square of RMS value of operating current in Moving Iron Instruments.

12. Draw two different circuits for measuring power and state the difference between the circuits.

13. A simple slide wire is used for measurement of current in a circuit. The voltage drop across a standard resistor is balanced at 75 *cm*. If the standard cell emf is 1.45*V* balanced at 50 *cm,* find current through the resistor.

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14. Design a Wheatstone bridge whose values are $P = 1000\ \Omega$, $Q = 100\Omega$, $R = 2005\Omega$ and $S = 200\Omega$. The battery emf is $5V$ with negligible resistance with negligible galvanometer resistance. Calculate the current flowing through the galvanometer.

15. State the balance equation used in A.C bridge methods.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Explain the principle of working of thermocouple type instruments. Draw the diagram to illustrate the working of contact and non contact type thermo elements. (8)

    (ii) Describe the constructional details of Electrodynamometer type instrument with its phasor diagram and torque equation. (8)

Or

    (b) Give a detailed account of PMMC type instruments. (16)

17. (a) With neat diagram, explain the working of an electrodynamometer type Wattmeter. Derive an expression for deflection torque and mention its significance. (16)

Or

    (b) Point out why the phase of shunt is made exactly in 90 *degree* out of phase with applied voltage to produce deflecting torque exactly proportional to power. (16)

18. (a) Discuss the construction and working of drysdale polar type potentiometer. (16)

Or

    (b) (i) Draw the Equivalent circuit and phasor diagram of current transformer and also derive the expression for ratio and phase angle errors. (8)

    (ii) A current transformer with a primary has a 300 turns in its secondary winding. A resistance and reactance of secondary circuit are 1.5Ω and 1.0Ω respectively. The magnetizing mmf is $100A$ and Iron loss is $1.2\ W$ with secondary winding current is $5A$. Find ratio and phase angle errors. (8)

19. (a) Write short notes on the following methods of measuring resistances:
    (i) Ammeter-Voltmeter method
    (ii) Substitution method (16)

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(b) What is the importance of the value of earth resistance? What are the factors influencing it? Discuss the methods used for measurement of earth resistance. (16)

20. (a) (i) Describe the working of an Anderson's bridge. Derive the equation of balance. (8)

(ii) Explain the measurement of inductance using Maxwell - Wein's bridge circuit. (8)

Or

(b) (i) What are the sources of errors in AC bridges? Explain the precautions taken for Elimination. (8)

(ii) The bridge is balanced at 1000 Hz. It has following components Arm $AB = 0.2\mu F$ Pure capacitance and arm $BC = 500\Omega$ resistance arm $DA = 300\Omega$ resistance parallel with $0.1\mu F$ Capacitance. Find the constants of arm CD, Considering as a series circuit. (8)

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