ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER – 2006
ELECTRICAL AND ELECTRONICS MEASUREMENT
SEMESTER – 3

Time : 3 Hours]   [Full Marks : 70

GROUP – A
(Multiple Choice Questions)

1.   Choose the correct answers of the following :   10 × 1 = 10

   i)   The torque produced in a wattmeter is proportional to

   a)   the average value of currents in two coils

   b)   the r.m.s. value of currents in the two coils

   c)   the average value of the supply voltage

   d)   none of these.

   ii)   The ratio error in the current transformers is largely dependent upon

   a)   iron loss component of magnetising current

   b)   magnetising component of the magnetising current

   c)   both (a) and (b)

   d)   either (a) or (b).

   iii) Murray loop test is used for location of

   a)   short circuit fault on a cable

   b)   ground fault on a cable

   c)   both ground fault and short circuit fault

   d)   open circuit fault.

   iv)   LVDT is used to measure

   a)   displacement   b)   temperature

   c)   pH value   d)   intensity of light.

   v)   Creeping is observed in

   a)   watt-hourmeter   b)   wattmeter

   c)   ammeter   d)   power factor meter.

33283

vi) The household energymeter is

a) an integrating instrument   b) an indicating instrument

c) a recording instrument   d) none of these.

vii) In a CRT the focusing anode is located

a) between pre-accelerating and accelerating anodes

b) after accelerating anode

c) before pre-accelerating anode

d) none of these.

viii) Which of the following instruments has the highest frequency range with accuracy within reasonable limits ?

a) Moving iron   b) Electrodynamometer

c) Thermocouple   d) Rectifier.

ix) A 1 mA d'Arsonval galvanometer has a resistance of 100 Ω . It is to be converted to a 10 V voltmeter. The value of multiplier resistance is

a) 999 Ω   b) 9999 Ω

c) 9900 Ω   d) 990 Ω.

x) Which of the following bridges is preferred for the measurement of inductance having high Q-factor ?

a) Maxwell bridge   b) Hay bridge

c) Owen bridge   d) DeSauty's bridge.

GROUP – B

(Short Answer Questions)

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

2. Explain the difference between Dynamometer type wattmeter and induction type wattmeter.

3. 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 their usual meaning.

33283

4. Name and explain, how the different torques are produced in a permanent magnet moving coil instrument.

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

6. Why can we not use a conventional Wheatstone bridge for measurement of low resistance ? How can we measure low resistance ?

GROUP – C

(Long Answer Questions)

Answer any *three* questions. $3 \times 15 = 45$

7. a) Derive the equations of balance for an Anderson's bridge. Draw the phasor diagram for condition under balance.   5 + 2

   b) The four arms of a bridge are :

   arm ab : an imperfect capacitor C_1 with an equivalent series resistance of r_1,

   arm bc : a non-inductive resistance R_3,

   arm cd : a non-inductive resistance R_4,

   arm da : an imperfect capacitor C_2 with an equivalent series resistance of r_2, series with a resistance R_2.

   A supply of 450 Hz is given between terminals a and c and the detector is connected between b & d.

   At balance : $R_2 = 4 \cdot 8 \, \Omega$, $R_3 = 2 \, k\Omega$, $R_4 = 2 \cdot 85 \, k\Omega$, $C_2 = 0 \cdot 5 \, \mu F$ & $r_2 = 0 \cdot 4 \, \Omega$.

   Calculate the value of C_1, r_1 & also calculate dissipation factor of this capacitor. Deduce the expression used.   3 + 5

8. a) Describe in brief the construction and working principle of a single phase induction type energymeter.   8

   b) What is phantom loading ?   3

   c) A single phase kWhr meter makes 500 revolutions per kWhr. It is found on testing as making 40 revolutions in 58·1 seconds at 5 kW full load. Find out the percentage error.   4

33283

9. a) Draw and explain different blocks of a CRO. Write the operating principle of a CRT. 8 + 3

    b) How do we measure phase and frequency of a.c. quantity with the help of a CRO ? 4

10. Draw the equivalent circuit and phasor diagram of a current transformer. Derive the expression for ratio and phase angle errors. 15

11. a) Draw the diagram of a laboratory type (Crompton's) d.c. potentiometer and explain how 1·0186 V is measured with this potentiometer. 6

    b) How can potentiometer be used for

        i)   calibration of a voltmeter

        ii) calibration of a wattmeter ? 6

    c) In the measurement of a low resistance by means of a potentiometer, the following readings were obtained :

        Voltage drop across low resistance under test : 0·83942 V

        Voltage drop across a standard resistance connected in series with the unknown : 1·01575 V.

        If the value of the standard resistance is 0·10014 Ω , find the value of unknown resistance. 3

12. Write notes on any *three* of the following : 3 × 5 = 15

    i)   Frequency counter

    ii) Digital multimeter

    iii) Q meter

    iv) Megger

    v)   Rectifier type of deflecting instruments.

32283