



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 :

 $10 \times 1 = 10$

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

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|-----------------|------------------------|
| a) displacement | b) temperature |
| c) pH value | d) intensity of light. |

v) Creeping is observed in

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|-------------------|------------------------|
| a) watt-hourmeter | b) wattmeter |
| c) ammeter | d) power factor meter. |



- 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 100Ω . It is to be converted to a 10 V voltmeter. The value of multiplier resistance is
- a) 999Ω b) 9999Ω
- c) 9900Ω d) 990Ω .
- 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

$$T_D = \frac{1}{2} I^2 \frac{dL}{d\theta}, \text{ where the symbols have their usual meaning.}$$



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 × 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 : $R_2 = 4.8 \Omega$, $R_3 = 2 \text{ k}\Omega$, $R_4 = 2.85 \text{ k}\Omega$, $C_2 = 0.5 \mu\text{F}$ & $r_2 = 0.4 \Omega$.

 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



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 0.10014Ω , 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.
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