ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER – 2008
ELECTRICAL & ELECTRONICS MEASUREMENT
SEMESTER – 3

Time : 3 Hours] [Full Marks : 70

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Swamping resistance is a resistance which added to the moving coil of a meter to

a) reduce the full scale current b) reduce temperature error

c) increase the sensitivity d) none of these. ☐

ii) A d.c. voltmeter has a sensitivity of 1000 ohm/volt. When it measures half full scale in 100 V range, the current through the voltmeter is

a) 100 mA b) 1 mA

c) 0·5 mA d) 50 mA. ☐

iii) LVDT is used to measure

a) displacement b) temperature

c) pH value d) intensity of light. ☐

iv) Creeping is observed in

a) Watt-hour meter b) Watt meter

c) Ammeter d) Power factor meter. ☐

v) A megger is used to measure

a) voltage b) current

c) insulation resistance d) none of these. ☐

vi) Frequency can be measured by

a) Maxwell's bridge b) Scharing bridge

c) Wien's bridge d) Campbell bridge.

vii) In an electrodynamometer type wattmeter

a) current coil is fixed b) pressure coil is fixed

c) both of these are fixed d) both of these are movable.

viii) The scale of a PMMC instrument is

a) uniform b) cramped

c) cramped at the ends d) none of these.

ix) The heater wire of a thermocouple instrument is made of very thin wire in order to

a) have high value of resistance

b) reduce skin effect

c) reduce the weight of the instrument

d) none of these.

x) The secondary winding of a CT is always kept

a) open circuited b) short circuited

c) shorted with an ammeter d) shorted with a voltmeter.

xi) 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 Type Questions)

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

2. What is phantom loading ? Explain with an example how it is more advantageous than testing with direct loading ?

3. Derive an expression for the torque in a moving iron instrument.

4. Explain the principle of operation of thermo-electric instruments.

5. Describe the construction and working principle of a storage oscilloscope.

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

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following questions. 3 × 15 = 45

7. a) Write briefly about the construction of an electrodynamometer type instrument.

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

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

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

   b) What is Blondel's theorem ?

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

9. 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 :

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 the terminals *a* and *c* and the detector is connected between *b* and *d*.

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

Calculate the value of C_1, r_1 & also calculate dissipation factor of this capacitor.

Deduce the expression used. 5 + 2 + 8

10. a) Explain the principle of working of any digital voltmeter.

b) Why are FETs used in differential amplifier type of electronic voltmeter ? Draw and explain the equivalent circuit of such a voltmeter.

c) An electronic voltmeter has the following parameters :

R_d = 50 kΩ, a.c. drain resistance = 100 kΩ, transconductance = 0·005 mho. If the meter has a resistance of 50 ohm and a full deflection current of 5 mA, What voltage must be applied to the gate of one FET to produce full scale deflection current if the gate of the other FET is grounded ?

11. Write short notes on any three of the following : 3 × 5

a) Frequency counter

b) Megger

c) Digital multimeter

d) Frequency and phase measurement by oscilloscope.

e) Ratio and phase angle error of potential transformer.

END