

**2013**

**ELECTRICAL & ELECTRONIC MEASUREMENT**

*Time Allotted : 3 Hours Full Marks : 70*

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

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

10 × 1 = 10

- i) When the potentiometer is balanced, the current through the battery under test is
- a) same as through the supply battery
  - b) 1/10th of that through the supply battery.
  - c) zero
  - d) half through the supply battery.
- ii) If the secondary winding of a current transformer is open circuited when connected in line
- a) low currents are induced in the secondary
  - b) high voltages are induced in the secondary
  - c) low voltages are induced in the secondary
  - d) high currents are induced in the secondary.
- iii) The balance obtained from a Wheatstone bridge
- a) depends on the value of the supply voltage
  - b) independent of the supply voltage from the battery
  - c) depends on the resistor used
  - d) none of these.
- iv) In a Megger, the resistance to be measured is connected
- a) in series with the control coil
  - b) in series with deflecting coil

- c) in parallel with the deflecting coil
- d) in parallel with the control coil.
- v) The example of integrating instrument is
  - a) moving coil meter
  - b) moving iron meter
  - c) tangent galvanometer
  - d) energy meter.
- vi) A wattmeter is marked 15 A/30A, 300V/600V and its scale is marked up to 4500 watt. When the meter is connected for 30A, 1600V, the pointer indicates 2000 watts. The actual power in the circuit is
  - a) 2000 W b) 40000 W
  - c) 8000 W d) none of these.
- vii) Which bridge is preferred for measurement of inductance having high Q factor ?
  - a) Maxwell bridge b) Hey's bridge
  - c) Owen's bridge d) De Sauty bridge.
- viii) Creeping in an energy meter is prevented by
  - a) cutting a hole on the disc at one end
  - b) adjustment of shading bands
  - c) cutting two holes on the aluminium disc on opposite ends.
  - d) adjustment of the inclined bands on the outer limbs of shunt magnets.
- ix) The instrument, which gives the value of the quantity to be measured in terms of instrument constant & its deflection, is called the
  - a) absolute instrument
  - b) secondary instrument
  - c) recording instrument
  - d) integrating instrument.
- x) When the strain of a wire gauge changes, it results in a

change of

- a) pressure b) temperature
- c) inductance d) resistance.

xi) The deflection system of an oscilloscope works on the principle of

- a) electrostatic b) electromagnetic
- c) thermionic d) magnetic induction.

xii) The readings of which of the following meters are independent of waveform error ?

- a) Moving coil b) Moving iron
- c) Hot wire d) Both (a) & (c)

### **GROUP – B**

#### **( Short Answer Type Questions )**

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

- 2. a) What are absolute & secondary instruments ?
- b) Why is damping required in a measuring instrument ?

3 + 2

3. a) State the need for using instrument transformers in a.c. circuits ?

b) Why is the secondary winding of an instrument transformer usually earthed ?

4. Explain how a low resistance is measured by a potentiometer.

5. Define gauge factor of a strain gage & obtain its expression.

6. Explain how the phase & frequency of an a.c. quantity are measured with CRO.

### **GROUP – C**

#### **( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) Draw the equivalent circuit & phasor diagram of a current transformer.

b) Derive the expression of ratio & phase angle error.

c) In a certain current transformer, the following data is obtained. Nominal ratio = 25/5A, Turn ratio = 3, primary turns = 40, secondary turns = 120, secondary resistance =  $0.16\Omega$ , secondary reactance =  $0.195\Omega$ , secondary burden = 15 VA, Burden power factor = 0.7, secondary terminal voltage = 3V. Find ratio & phase angle errors. The magnetising and loss ampere turns corresponding to an emf of 4.26V are 13 & 10.1 respectively. 5 + 5 + 5

8. a) Explain the working of Anderson's bridge with a neat sketch. Derive the required expression for obtaining the unknown inductance.

b) A Wheatstone bridge has the following resistances :  $AB = 200\Omega$ ,  $BC = 20\Omega$ ,  $CD = 8\Omega$  &  $DA = 100\Omega$ . A galvanometer of  $40\Omega$  is connected across BD. Find the current through the galvanometer when 20V is applied across A.C. 9 + 6

9. a) Describe with neat sketch the principle of operation of d.c. permanent magnet moving coil type instrument. Explain how the deflecting torque, control torque & damping torque are obtained in the same instrument.

b) Why moving iron instruments always have non-uniform scales ?

c) A moving coil voltmeter with resistance of  $10\Omega$  gives full scale deflection with a potential difference of 45 mV. The coil has 100 turns, an effective depth of 3cm & a width of 2.5 cm. The controlling torque exerted by the spring is 0.5 gm. cm. Calculate the flux density in the air gap. 7 + 3 + 5

10. a) Explain with a neat sketch, the working of an a.c. potentiometer.

b) Discuss its use for the calibration of –

i) an Ammeter, ii) a Wattmeter. 7 + 8

11. Write short notes on any *three* of the following

a) Temperature transducers

b) Digital voltmeter.

c) Double beam CRO

d) Wattmeter errors.

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