Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/EE(N)/EEE(N)/ICE(N)/PWE(N)/SEM-4/EE-402/2013

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 : $10 \times 1 = 10$

   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 in

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 boridge.

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 gange & 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 terns = 40, secondary turns = 120, secondary resistance = 0·16z, secondary reactance = 0·195Ω, 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 are13 & 10·1 respectively. 5 + 5 + 5

8. a) Explain the worming 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 = 200Ω, BC = 20Ω, CD = 8Ω & DA = 100Ω. A galvanometer of 40Ω 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 deftecting 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 10Ω 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.