Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (ECE-OLD)/SEM-3/EI-302/2012-13

2012

ELECTRONIC MEASUREMENT & INSTRUMENTATION

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) Which of the following instruments can be used to measure 100 kV *a.c.* voltage ?

      a) PMMC voltmeter

      b) Moving iron voltmeter

      c) Electrostatic voltameter

      d) Hot wire instrument.

   ii) Creeping is the phenomenon which occurs in

      a) voltmeter b) wattmeter

      c) energymeter d) varmeter.

iii) A 100 : 5 current transformer is used in conjunction with a 5 amp ammeter. If the latter reads 2·5 amps, the line current will be

a) $2{\cdot}5 \times 5/100$ A b) $2{\cdot}5 \times (5/100)^2$ A

c) $2{\cdot}5 \times (100/5)^2$ A d) $2{\cdot}5 \times 100/5$ A.

iv) A transducer converts

a) mechanical energy into electrical energy

b) mechanical displacement into electrical signal

c) one form of energy into another form of energy

d) electrical energy into mechanical energy.

v) RTD is used generally for its

a) linearity b) sensitivity

c) accuracy d) speed of response.

vi) When a 50 Hz sinusoidal signal is applied to the *Y* plates of CRO while keeping the time base signal on the *X* plates off, the trace on the screen of the CRO will be

a) horizontal line b) vertical line

c) a spot d) sinusoidal waveform.

vii) A digital voltmeter must have

a) A/D converter b) D/A converter

c) oscillator pulses d) both (a) & (c).

viii) In a three phase four wire circuit power can be measured by

a) one wattmeter b) four wattmeters

c) two wattmeters d) three wattmeters.

ix) A thermistor exhibits

a) only a negative change of resistance with increase in temperature.

b) only a positive change of resistance with increase in temperature.

c) either a positive or negative change of resistance with increase of temperature depending upon the type of material.

d) none of these.

x) For measurement of low impedance by *Q* meter the component is connected in

a) parallel b) series

c) direct d) none of these.

xi) A 50 micro-ampere meter movement has 500 ohm resistance. What shunt resistance is required to extend the range to 250 micro-ampere ?

a) 111·1 ohm b) 125 ohm

c) 250 ohm d) 50 ohm.

xii) The bridge by which inductance is measured in terms of capacitance and resistance is called

a) Maxwell-Wien bridge b) Wien bridge

c) Anderson bridge d) Schering bridge.

GROUP – B
(Short Answer Type Questions)

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

2. What are the functions of deflecting, controlling and damping torques in measuring instruments ? What do you mean by dead beat condition of an instrument ? Which instrument is best suited for measurement of *d.c.* voltage ? What kind of damping is employed here ? 3 + 1 + 1

3. With the help of a block diagram explain the working principle of wave analyzer that is suitable for high frequency (MHz) range.

4. A moving coil instrument has the following data :

   Number of turns = 100, width of coil = 20 mm, depth of coil = 30 mm, flux density in the air gap = 0·1 Wb/m^2. Calculate the deflecting torque when carrying a current of 10 mA. Also calculate the deflection if the control spring constant is 2×10^{-6} Nm/degree.

5. a) What is the basic difference between accuracy and precision ?

   b) A 0 – 10 amp ammeter has a guaranteed accuracy of 1% of FSD. Calculate the percentage limiting error when the reading is 8A.

   c) What is linearity ? 2 + 2 + 1

6. State and explain in brief the working principle of LVDT.

GROUP – C
(Long Answer Type Questions)

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

7. a) What are the possible sources of error if the Wheatstone bridge is used to measure low resistance ?

   b) Explain with the relevant circuit diagram, the principle of measurement of low resistance by Kelvin's double bridge. Show that the condition of balance is independent of the lead resistance. Up to what low value can it measure ?

   c) Describe with a neat diagram, the Wein's bridge method for measurement of unknown frequency.

   3 + 7 + 5

8. a) What is piezoelectric sensor ?

   b) How temperature can be measured by optical pyrometer ?

   c) What is RTD ?

   d) How can you measure pressure by using Bourdon tube ? 1 + 6 + 2 + 6

9. a) Draw the block diagram of CRO and explain the function of different blocks.

   b) What are Lissajous' figures ? Explain how phase and frequency can be measured using these figures ?

11 + 1 + 3

10. a) What are the different standard inputs for studying the dynamic response of a system ? Define and sketch them.

   b) A thermocouple with time constant 0.3 sec and a static sensitivity of 0·05 mV/°C is suddenly immersed in a bath of hot oil, which is at 105°C. The initial temperature of the thermocouple measuring and reference junction was 25°C.

      i) What is the output at t = 0·1, 0.3 and 1·0 sec ?

      ii) Suggest a method of reducing time constant to 0·05 sec.

   c) What do you mean by 'dynamic characteristics' of a measurement system ?

4 + 6 + 5

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

a) *Q*-meter

b) Digital multimeter

c) Wave analyzer

d) Strain gauge

e) Localisation of cable faults.