Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (ECE)/SEM-3/EI-302/2009-10

2009
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 × 1 = 10

   i) Kelvin double bridge and Wheatstone bridge can measure

      a) low resistance

      b) medium resistance

      c) low and medium resistance respectively

      d) medium and low resistance respectively.

   ii) Systematic error are

      a) instrumental errors b) environmental errors

      c) random errors d) both (a) & (b).

iii) Frequency can be measured by using

a) Maxwell's bridge b) Schering bridge

c) Wien's bridge d) Anderson bridge.

iv) The most commonly used null detector in power frequency AC brdige is a

a) D'Arsonval galvanometer

b) Vibration galvanometer

c) Ballastic galvanometer

d) Tachometer.

v) Which of the following instruments is not suitable for measurement of X_L/R of coil ?

a) Maxwell's Bridge b) Hay bridge

c) Q-Meter d) Schering Bridge.

vi) Thermistor is used for measurement of

a) temperature b) pressure

c) flow d) displacement.

vii) LVDT

a) converts linear motion into electrical signal

b) translates electrical signal into linear motion

c) helps in measuring temperature

d) can be used to sense angular displacement.

viii) DVM is the abbreviation of the

a) digital voltmeter

b) digital volume meter

c) divider voltage meter

d) digital vacuum meter.

ix) Electrostatic type instruments are primarily used as

a) ammeters b) wattmeters

c) voltmeters d) ohmmeters.

x) A pyrometer is calibrated between 200 – 1000° C. Its span is

a) 800° C b) 200° C

c) 1000° C d) 1200° C.

xi) Aquadag coating is used in a CRO to collect

a) primary electrons

b) secondary emission electrons

c) both (a) & (b)

d) none of these.

xii) An instrument is said to be deadbeat when it is

a) critically damped b) overdamped

c) underdapmed d) none of these.

GROUP – B
(Short Answer Type Questions)

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

2. a) Explain the terms Accuracy and Precision and give their mathematical form also.

   b) The current through a resistor is 2·5 A, but the measurement yields a value of 2·45 A. Calculate the percentage errors of the measurement. 5

3. a) What is Thermocouple ?

   b) What is Seaback effect ?

   c) How Peltier effect is differ from Seaback effect ? 1 + 2 + 2

4. a) What is Q-meter ?

   b) Why is actual Q greater than circuit Q ? 4 + 1

5. What is piezoelectric effect ? Mention some applications of it. Name two piezoelectric materials. 2 + 1 + 2

6. a) "Drift is desirable." — Is it correct or not ? Explain.

   b) What are the differences between accuracy and precision ? $2\frac{1}{2} + 2\frac{1}{2}$

GROUP – C

(Long Answer Type Questions)

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

7. a) Explain the physical significance of Bernoulli's theorem in measurement of flow.

   b) Describe the working principle of capacitive level sensor.

   c) What are the advantages of 3-wire RTD measuring circuit over 2-wire RTD measuring circuit ? Explain with proper circuit diagram and explanation.

   d) With proper schematic diagram, explain the operation of venturi tube. Mention its advantages over orifice meter.

   6 + 4 + 2 + 3

8. a) Describe the working principle and construction of PMMC instrument.

   b) Derive the equation of angular deflection if the instrument is spring controlled.

   c) Explain why PMMC instruments cannot be used in AC measurement.

   d) 'Lower range of the scale is cramped for AC measuring meters.' — Explain with proper graphical representation.

   5 + 4 + 2 + 4

9. a) Write short notes on hot cathode ionization gauge. 6

b) The resistance of a strain gauge at no-load condition is 120 ohm with area of cross-section of the wire 0·1 mm and length of 122 metres. Calculate the area of cross-section of the wire when it is elongated to give 140 ohm with applied pressure and its new length. 5

c) Calculate the induced *emf* in an electromagnetic flowmeter due to the flow of conductive fluid in a pipe with inner diameter of 2·75 cm. The flux density B = 6 Mv sec/cm^2 and volume flow rate Q = 2500 cm^3/min. 4

10. a) What is the resolution of a $3\frac{1}{2}$ digit display on 1 V and 10 V ranges ?

b) Explain briefly the operation of dual slope integration type DVM.

c) Explain the principle of operation of LVDT.

d) A thermistor has a temperature coefficient of resistance of – 5% over temperature range 25° C to 50° C. Determine the resistance of thermistor at 35° C if the resistance of the thermistor at 25° C is 120 Ω.

3 + 5 + 5 + 2

11. a) State the Blondel's Theorem. Draw and explain the power measurement in three-phase, two-wattmeter method.

b) What are the differences between Heterostatic and Idiostatic instruments ?

c) An absolute electrostatic instrument has a movable circular plate 80 mm in diameter. If the distance between the plates during a measurement if 4 mm, find the potential difference when the force of attraction 2×10^{-3} N. The dielectric is air, having a permittivity of $8{\cdot}85 \times 10^{-12}$ F/m. 2 + 5 + 4 + 4

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

a) Successive approximation type digital voltmeter

b) Frequency counter

c) Signal generator

d) Errors

e) Electrodynamometer type instrument

f) Sweeps on CRO.