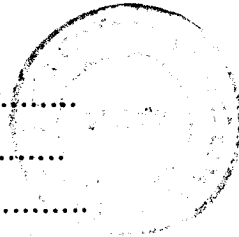


Name :

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 bridge is a
- a) D'Arsonval galvanometer
 - b) Vibration galvanometer
 - c) Ballistic 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 $200 - 1000^{\circ} \text{C}$. 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) underdamped
- d) none of these.

GROUP - B
(Short Answer Type Questions)

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

2. a) Explain the terms Accuracy and Precision and give their mathematical form also. 5
- 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. $3 \times 15 = 45$

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 $B = 6 \text{ Mv sec/cm}^2$ and volume flow rate $Q = 2500 \text{ cm}^3/\text{min}$. 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 is 4 mm, find the potential difference when the force of attraction is 2×10^{-3} N. The dielectric is air, having a permittivity of 8.85×10^{-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.
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