Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(ECE)/SEM-3/EI-302/2010-11

2010-11

ELECTRONIC MEASUREMENT AND 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) Themocouple transducer is used for

a) Temperature measurement

b) Velocity and vibration measurement

c) Pressure measurement

d) Acceleration measurement.

ii) The LVDT usually has two secondaries in

a) series addition b) series opposition

c) parallel addition d) parallel opposition.

iii) Systematic error are

a) Instrumental errors b) Environmental errors

c) Random errors d) both (A) and (B).

iv) Which of the following briedges is preferred for the measurement of inductance having high Q-factor ?

a) Maxwel's bridge b) Hay bridge

c) Owen bridge d) De Sauty's bridge.

v) A digital voltmeter measures

a) peak value b) peak to peak value

c) rms value d) average value.

vi) The gauge factor is defined as

a) $(\Delta L/L) / (\Delta R/R)$ b) $(\Delta R/R) / (\Delta L/L)$

c) $(\Delta R/R) / (\Delta D/D)$ d) $(\Delta R/R) / (\Delta \rho/\rho)$.

vii) Creeping is observed in

a) watt-hourmeter b) wattmeter

c) ammeter d) voltmeter.

viii) A spectrum analyzer displays

a) different frequency amplitudes w.r.t. time

b) peak-peak amplitude of modulating signal

c) different signal amplitudes w.r.t. frequency

d) Lissajous figures.

ix) The resolution of a 3 & (1/2) digit DVM having a basic range of 2 volts is

a) 2V b) 1 mV

c) 0·25 V d) 0·125 V.

x) A megger is used to measure

a) voltage b) current

c) insulation resistance d) none of these.

xi) Frequency can be measured by

a) Maxwell's bridge b) Wein's bridge

c) Campbell bridge d) Scharing bridge.

xii) The principle of operation of Q-meter is based on

a) self inductance b) mutual inductance

c) series resonance d) parallel resonance.

GROUP – B

(Short Answer Type Questions)

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

2. a) State the working principle of PMMC instrument.

   b) Describe the method of damping used in this instrument. 2 + 3

3. a) What is Strain gauge ?

   b) Derive the expression of gauge factor of a resistance wire strain gauge. 1 + 4

4. Explain how Wein's bridge can be used for measurement of unknown frequencies. Derive the expression for frequency in terms of bridge parameters. 3 + 2

5. 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} N-m/degrees. 5

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

7. a) What is the function of spectrum analyzer ?

   b) What is the purpose of function generator ? Draw the block diagram of function generator. 1 + 1 + 3

GROUP – C

(Long Answer Type Questions)

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

8. a) Define Point Accuracy.

   b) Describe the available techniques of Linearity with suitable diagram.

   c) A set of independent 10 measurements were made to determine the weight of a lead shot. The weights in gm were as follows :

   1.570, 1.597, 1.591, 1.562, 1.577, 1.580, 1.564, 1·586, 1.550, 1.575.

   Determine the arithmetic mean, average deviation, standard deviation, variance, probable error of one reading and probable error of the mean. 2 + 5 + 8

9. a) Explain the functional block diagram of CRO with neat diagram.

   b) What is Lissagous figure ? Explain how phase and frequency can be measured using this figures.

   c) What are the differences between CRO dual beam and dual trace ? What is the function of delay line ?

   7 + (1 + 3) + (3 + 1)

10. a) Draw and explain briefly the various blocks of Digital Multimeter.

   b) A $3\frac{1}{2}$ digit multimeter has an accuracy of ± 0.5% reading ± 0.5 counts. If the meter reads 2mA on a full scale of 20 mA, what is the worst case error in reading ?

   c) With the help of a functional block diagram, explain the working principle of a swept TRF spectrum analyzer.

   6 + 3 + 6

11. a) What are the kinds of errors that can occur while measuring low resistance using Wheatstone's bridge ?

   b) State why FETs are used in differential amplifier type of electronic voltmeter.

   c) Explain why compensating coil is used in Electrodynamometer wattmeter ?

   d) Explain how range extension can be achieved in moving coil instruments. 3 + 3 + 5 + 4

12. Describe how unknown capacitors can be measured using De Sauty's bridge. What are the limitations of this bridge and how can they be overcome by using a modified De Sauty's bridge ? Draw the relevent phasor diagrams. 7 + 8

13. Write short notes on any *three* of the following : 3 × 5 = 15

    a) Q-meter

    b) Signal Generator

    c) DC-potentiometer

    d) Dual Slope ADC

    e) Thermistors

    f) Wattmeter.