MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EC-605C

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 the following : $10 \times 1 = 10$

   i) In modern electronic meters, FET or MOSFET is preferred over BJT as
      a) it offers high loading effect
      b) its input impedance is high and does not change with range switch
      c) its input impedance is low
      d) it is cheaper.

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   ii) A digital voltmeter has a read-out range from 0 to 9999. When full scale reading is 9.999V, the resolution of the full scale reading is
      a) 0.001 b) 1000
      c) 3 digit d) 1 mV.

   iii) The purpose of the synchronizing control in CRO is to
      a) focus the spot on the screen
      b) lock the display of signal
      c) adjust the amplitude of display
      d) control the intensity of spot.

   iv) The circuit generally used in digital instruments to convert sine waves into rectangular pulses is
      a) Sawtooth generator
      b) Differential amplifier
      c) Sample and hold circuit
      d) Schmitt trigger.

v) A megger is used to measure

a) voltage

b) current

c) insulation resistance

d) none of these.

vi) Energy meter is an

a) integrating instrument

b) recording instrument

c) indicating instrument

d) none of these.

vii) Frequency counter converts time cycle into

a) pulse b) rectangular wave

c) triangular wave d) none of these.

viii) In a $3\frac{1}{2}$ digit voltmeter, the largest number that can be used is

a) 0999 b) 1999

c) 4999 d) 9999.

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ix) The smallest change in a measured variable to which an instrument will respond is

a) Resolution b) Precision

c) Sensitivity d) Accuracy.

x) Maxwell's bridge can be used for measurement of inductance with

a) high Q factor

b) very low Q factor

c) medium Q factor

d) wide range of Q factor variations.

GROUP – B

(Short Answer Type Questions)

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

2. Define the terms accuracy, precision, resolution, sensitivity and error.
3. What is chopper amplifier ? How does it work for D.C. amplification ?
4. Describe the working principle of Kelvin double bridge.
5. Draw the block diagram of basic function generator. Explain briefly. 2 + 3
6. Draw and explain the working principle of "True rms meter".
7. Define wave analyzer. Draw the block diagram of heterodyne wave analyze and briefly explain it. 1 + 4

GROUP – C
(Long Answer Type Questions)

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

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

   b) What is Lissajous 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)

9. a) What are the different types of wave analyzer ? What are the applications of wave analyzer ? Define 'harmonic distortion' and the term 'total harmonic distortion'.

   b) Explain principle of operation of chopper type *dc* voltmeter.

   c) Explain the difference between series and shunt type ohm meter. (1 + 3 + 2 + 2) + 4 + 3

10. a) Explain how Wein's bridge can be used for measurement of unknown frequencies. Derive the expression for frequency in terms of bridge parameters.

   b) Find the equivalent parallel resistance and capacitance that cause a Wein bridge to balance with the following component values. $R_1 = 3.1k\Omega$, $C_1 = 5.2\mu F$, $R_2 = 25k\Omega$, $f = 2.5$ Hz, $R_4 = 100k\Omega$.

   c) The expected value of the voltage across a resistor is 80V. However, the measurement gives a value of 79V. Calculate (i) absolute error, (ii) % error, (iii) relative accuracy and (iv) % of accuracy.

   5 + 5 + 5

11. a) What are the advantages of digital instruments over the analog one ?

   b) Mention different types of digital voltmeter. Explain how voltage is measured by a ramp type digital voltmeter. Draw necessary diagram.

   c) What are the basic elements of a Data Acquisition System ? Explain with necessary diagram.

   3 + (2 + 5) + 5

12. a) Describe the construction and working principle of repulsion type moving iron instrument. What kind of damping is employed here ? Why the scale is cramped at the lower end in moving iron instrument ?

b) Establish the equation of deflecting torque in Moving Iron instrument.

c) Moving coil instrument has the following data :

Number of turns : 100, Width of the coil = 20 mm, depth of the coil = 30 mm, flux density in the air gap = 0.1 Wb/m^2. Calculate the deflecting torque when carrying a current of 10mA. Also calculate the deflection if the control spring constant is 2×10^{-6} Nm/degree. (5 + 1 + 1) + 5 + 3

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

a) Q-meter

b) Spectrum analyzer

c) Frequency counter

d) Error in measurement system

e) Digital multimeter.