ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER - 2007

ELECTRONIC MEASUREMENT AND INSTRUMENTATION

SEMESTER - 3

Time : 3 Hours] [Full Marks : 70

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) A 1MA ammeter has a resistance of 100Ω. It is to be converted to a 1A ammeter. The value of shunt resistance is

a) 0·001 Ω b) 0·1001 Ω

c) 100000 Ω d) 100 Ω. ☐

ii) A meggar is used for measurement of

a) low resistance

b) medium resistance

c) high valued resistance, particularly insulation resistance

d) all of these. ☐

iii) Moving iron type of instrument can be used as

a) standard instrument for calibration of other instruments

b) transfer type instruments

c) indicator type instruments as on panels

d) all of these. ☐

iv) Thermocouple instruments can be used for the frequency range

a) upto 100 Hz b) upto 5000 Hz

c) upto 1 MHz d) 50 MHz and above. ☐

v) A Wheatstone bridge can not be used for precision measurement because errors are introduced due to

a) resistance of connecting leads b) thermoelectric emf
c) contact resistance d) all of these.

vi) In an instrument the smallest measurable input is known as

a) threshold b) resolution
c) dead zone d) none of these.

vii) Electrostatic type instruments are primarily used as

a) ammeters b) wattmeters
c) voltmeters d) ohmmeters.

viii) Optical pyrometer is used to measure

a) light intensity
b) low temperature
c) high temperature
d) light intensity and high temperature.

ix) While sensing linear displacement a capacitive transducer makes use of

a) change of distance between the plates
b) variation in the coverage area of the plates
c) change of relative permittivity
d) none of these.

x) The secondary of C.T. is

a) never left short circuited b) never left open circuited
c) always keep open circuited d) none of these.

xi) A bridge is used for measuring an unknown inductance in terms of a known capacitance and resistance. That bridge is

a) Maxwell's L/C b) Hays
c) Owen d) Anderson.

xii) Thermistor is used for measurement of

a) temperature b) pressure

c) flow d) displacement. ☐

xiii) For measurement of low impedance by Q-meter the component is connected in

a) parallel b) series

c) direct d) none of these. ☐

xiv) Piezoelectric transducers are

a) passive transducer b) active transducer

c) inverse transducer d) both of (b) & (c). ☐

xv) Aquadag coating is used in a CRO to collect

a) primary electrons b) secondary emission electrons

c) both of (a) & (b) d) none of these. ☐

GROUP – B

(Short Answer Type Questions)

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

2. a) What is the percentage error in the measurement of kinetic energy of a body if percentage errors in the measurement of mass and speed are 2% and 3% respectively ?

b) A 0-10A ammeter has a guaranteed accuracy of 1% of FSD. Calculate the percentage limiting error when the reading is 5 A.

c) Calculate the sensitivity of the meter of rating 50 μA. 2 + 2 + 1

3. Derive the expression of deflection of the electron in an electrostatic deflection system. 5

4. Prove that in a 3-phase 3 wire polyphase system, 2 watt meter method of total power measurement is valid for both balanced and unbalanced loads. 5

5. Derive the balance equations of Hays bridge for measurement of inductance. 5

6. Explain why compensating coil is used in electrodynamometer wattmeter. 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions from the following. $3 \times 15 = 45$

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. Upto what low value it can 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 Bourdontube ? 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.

END