

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech(EE)/SEM-3/EE-302/2009-10**

**2009**

**ELECTRICAL & ELECTRONICS MEASUREMENT**

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 :

$$10 \times 1 = 10$$

- i) A Wheatstone bridge cannot be used for precision measurements because errors due to
  - a) resistance of connecting leads
  - b) thermo-electric emf
  - c) contact resistance
  - d) all of these.
- ii) Maxwell's inductance-capacitance bridge is
  - a) Low  $Q$  coils
  - b) Medium  $Q$  coils
  - c) High  $Q$  coils
  - d) Low and Medium  $Q$  coils.

- iii) Electrodynamic type instruments can be used as
- a) standard instruments only
  - b) transfer instruments only
  - c) both standard and transfer instruments
  - d) indicator type instruments.
- iv) Megger is used for the measurement of
- a) low resistance                      b) medium resistance
  - c) high resistance                      d) none of these.
- v) The time base of a CRO is developed by
- a) squared waveform                      b) saw-tooth waveform
  - c) sine waveform                      d) none of these.
- vi) In an electrodynamic type wattmeter
- a) the current coil is made fixed
  - b) the pressure coil is made fixed
  - c) any of the current or pressure coil can be made fixed
  - d) both coils are movable.
- vii) In a CRT, the focusing anode is located
- a) between pre-accelerating and accelerating anode
  - b) after accelerating anode
  - c) before pre-accelerating anode
  - d) none of these.

- viii) An aquadag is used in a CRO to collect
- a) primary electrons
  - b) secondary emission electrons
  - c) both primary and secondary emission electrons
  - d) none of these.
- ix) LVDT is a
- a) capacitive transducer
  - b) resistive transducer
  - c) inductive transducer
  - d) none of these.
- x) Which of the following devices cannot be used to measure pressure ?
- a) Strain gauge                      b) LVDT
  - c) Piezoelectric crystal        d) Pyrometer.
- xi) The torque/weight ratio of a Dynamometer instrument is
- a) small                                b) high
  - c) medium                              d) none of these.

**GROUP - B**

**( Short Answer Type Questions )**

Answer any *three* of the following.

3 × 5 = 15

2. Show that the driving torque in a moving iron instrument is given by  $T_d = \frac{1}{2} i^2 \frac{dL}{d\theta}$  where symbols have thier usual meaning.
3. What difficulties are encountered in measuring high resistance ? What is a guard circuit ?
4. What are the absolute and secondary instruments ? What are the advantages of electronic instruments ?
5. Explain the procedure of measurement of high voltage by d.c. potentiometer.
6. How can you measure the phase difference between two sinusoidal signals using a CRO ?

**GROUP - C**

**( Long Answer Type Questions )**

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

7. a) Develop the torque equation of Moving Coil Instrument. 8
- b) A moving coil ammeter has a fixed shunt of  $0.02 \Omega$  with a coil resistance of  $R = 1000 \Omega$  and a potential difference of 500 mV across it. Full scale deflection is obtained.
- i) To what shunted current does it corresponds ?
  - ii) Calculate the value of  $R$  to give full scale deflection when shunted current  $I$  is
    - 20 amp
    - 60 amp
  - iii) With what value of  $R$  is 45% deflection obtained with  $I = 100 \text{ A}$  ? 5
- c) Draw the circuit diagram of an Electrodynamic wattmeter with power labelling. 2
8. a) Draw the diagram of laboratory type ( Cormpton's ) D.C. potentiometer. What is meant by standardization of potentiometer ? 6
- b) How can a potentiometer be used
- i) for calibration of a voltmeter
  - ii) for calibration of a wattmeter ? 6
- c) Voltage drop across the low resistance under test is 0.83942 V. Voltage drop across a standard resistance connected in series with the unknown is 1.01575. If the value of standard resistance is  $1.0014 \Omega$ . Calculate the value of unknown resistance. 3

9. a) What are the advantages and disadvantages of electro-dynamometer type instruments ? 8

b) A simple shunted ammeter using a basic meter movement with an internal resistance of  $1800\ \Omega$  and a full scale deflection current of  $100\ \mu\text{A}$  is connected in a circuit and gives reading of  $3.5\ \text{mA}$  on its  $5\ \text{mA}$  scale. The reading is checked with a recently calibrated d.c. ammeter which gives a reading of  $4.1\ \text{mA}$ . The implication is that the ammeter has a faulty shunt on its  $5\ \text{mA}$  range. Calculate

i) the actual value of faulty shunt

ii) the current shunt for the  $5\ \text{mA}$  range. 7

10. a) Draw the equivalent circuit and phasor diagram of a current transformer.

b) Derive the expression for the ratio and phase angle errors.

c) Explain the difference between CT and PT. 4 + 8 + 3

11. a) Draw the block diagram of a CRO and explain different of the function of the different blocks. 8
- b) What are the function of Time-base generator in CRO ? 3
- c) What are Lissajous figures ? Explain how phase and frequency can be measured using these figures. 1 + 3
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