Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/(EEE)Old/PWE(O)/BME(O)/EE(O)/SEM-3/EE-302/2012-13

2012

ELECTRICAL AND 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 × 1 = 10

i) A set of readings has a wide range and therefore it has

a) low precision b) high precision

c) low accuracy d) high accuracy.

ii) Electrostatic type instruments are primarily used as

a) ammeters b) wattmeters

c) voltmeters d) ohmmeters.

iii) Which meter has the highest accuracy in the prescribed limit of frequency range ?

a) PMMC

b) Moving iron

c) Electrodynamometer

d) Rectifier.

iv) The burden of C.T. is expressed in terms of

a) secondary winding current

b) VA rating of transformer

c) Voltage, current and power factor of secondary winding circuit

d) none of these.

v) High resistances are provided with a guard terminal. This guard terminal is used to

a) bypass the leakage current

b) guard the resistance against the stray electrostatic fields

c) guard the resistance against overloads

d) none of these.

vi) When a potentiometer is used for measurement of voltage of an unknown source, the power consumed in the circuit of the unknown source under null conditions

a) is very high b) is high

c) is small d) is identically zero.

vii) Maxwell's inductance-capacitance bridge is used for measurement of inductance of

a) low Q coils b) medium Q coils

c) high Q coils d) low & medium Q coils.

viii) In electrodynamometer type wattmeters, current coils designed for carrying heavy currents use stranded wire or laminated conductors

a) to reduce iron losses

b) to reduce hysteresis losses

c) to reduce eddy current losses

d) all of these.

ix) Creeping in a single phase inductance type energy meter may be due to

a) over ocmpensation for friction

b) over voltage

c) vibration

d) all of these.

x) 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.

xi) Which one of the following is an active transducer ?

a) Strain gauge

b) Selsyn

c) Photovoltaic cell

d) Photo emissive cell.

GROUP – B
(Short Answer Type Questions)

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

2. Derive the expression $\theta = (G / K) I$ in PMMC instrument.

3. a) How is the current range of a PMMC instrument extended with the help of shunts ? 3

   b) FIND the multiplying power of a shunt of 200 ohm resistance used with a galvanometer of 1000 ohm resistance. Determine the value of shunt resistance to give a multiplying power of 50. 2

4. Draw the equivalent circuit and phasor diagram of a potential transformer.

5. Derive the expression for measurement of medium resistance by wheatstone bridge.

6. a) Explain the terms resolution and sensitivity of digital meters. 3

   b) What is the resolution of a $3\frac{1}{2}$ digit display ? Find the resolution of a $3\frac{1}{2}$ digit meter in case its range is 1V. 2

GROUP – C
(Long Answer Type Questions)

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

7. a) Define the terms accuracy, precision, resolution and speed of response. 2 + 2 + 2 + 2

   b) A 0-25 amps ammeter has a guaranteed accuracy of 1% of full scale reading. The current measured by this instrument is 10 amps. Determine the limiting error in percentage. 2

   c) State the three major categories of error. 5

8. Describe the constructional details, working principle and torque equation of an electrodynamometer type instrument.

9. a) Derive the equations of balance for an Schearing Bridge. Draw the phasor diagram for condition under balance. 5 + 2

   b) An *ac* bridge has the following constants :
   arm ab : capacitor C_1 in parallel with resistance R_1
   arm bc : capacitor of C_3
   arm cd : unknown capacitor C_x and resistance R_x in series.
   arm da : resistance R_2 .

   A supply is given between terminal *a* & *c* and detector is connected between *b* & *d*.
   At balance : $C_1 = 0.5\mu F$, $R_1 = 1K\Omega$, $R_2 = 2K\Omega$, $C_3 = 0.5\mu F$.

   Determine the value of unknown capacitance, unknown resistance and dissipation factor of this capacitor. Deduce the expression used. 3 + 5

10. a) Explain the construction of Bonded wire strain gauges and derive the expression of gauge factor. 3 + 3

b) Describe with neat sketches, the construction and working of LVDT. 6

c) Describe the method for measurement of temperature with use of RTDs. 3

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

a) Duel slope integrating type DVM

b) Wattmeter errors

c) Double beam CRO

d) Loading effect due to shunt and series connected instruments

e) Errors in current transformers.