Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(EEE/PWE/BME)/SEM-3/EE-302/2010-11

2010-11

ELECTRICAL & ELECTRONIC MEASUREMENTS

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) Which of the following instruments has the highest frequency range ?

a) Moving iron b) Electrodynamometer

c) Thermocouple d) Rectifier.

ii) The scale of a PMMC instrument is

a) uniform b) cramped

c) cramped at the ends d) none of these.

iii) Megger is used to measure resistance which is

a) low b) medium

c) high d) none of these.

iv) Ratio error in a CT is due to

a) secondary winding impedance

b) load impedance

c) no-load current

d) all of these.

v) In a 3-phase 4-wire circuit power can be measured by

a) one wattmeter b) four wattmeter

c) two wattmeter d) three wattmeter.

vi) Which of the following bridges is preferred for the measurement of inductance having high *Q*-factor ?

a) Maxwell bridge b) Hay bridge

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

vii) Calibration of a DC potentiometer is done with a standard cell having voltage

a) 1·5 volts b) 1·01864 volts

c) 1·001864 volts d) 1·0864 volts.

viii) The time base of a CRO is always developed by

a) sawtooth waveform

b) square waveform

c) sine waveform

d) output from a built-in clock.

ix) The secondary winding of a CT is a always kept

a) Short circuited

b) open circuited

c) Shorted with voltmeter

d) shorted with ammeter.

x) A 1 mA full-scale deflection ammeter has a resistance of 100 Ω. It is to be converted to a 1A ammeter. The value of the shunt resistance is

a) 0·001 Ω b) 10000 Ω

c) 0·1001 Ω d) 100 Ω.

xi) A virtual amplifier for a CRO can be designed for

a) only a high gain

b) only a broad band

c) a constant gain time bandwidth product

d) all of these.

xii) Thermocouple instruments can be used for the frequency range

a) upto 100 Hz b) upto 5000 Hz

c) upto 1 MHz d) 50 Hz and above.

xiii) Wagner's earth device is used an *a.c.* bridge circuit for

a) eliminating the effect of earth capacitance

b) eliminating the effect of inter-component capacitance

c) eliminating the effect of stray magnetic field

d) shielding the bridge element.

xiv) Turns compensation is used in CT primary for the reduction of

a) phase angle error

b) both ratio and phase angle errors

c) ratio error

d) none of these.

GROUP – B
(Short Answer Type Questions)

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

2. Define the terms :

   a) Accuracy

   b) Precision

   c) Speed of response

   d) Static error

   e) Dynamic range.

3. Derive an equation for the driving torque $\left[T_D = \frac{1}{2} I^2 \frac{dL}{d\theta} \right]$ of a moving iron instrument, where the symbols have their usual meaning.

4. Explain shortly the working principle of DVM.

5. How do we measure phase and frequency of *ac* quantity with the help of a CRO ?

6. Explain how power factor can be measured for 3-phase circuit having a balanced star connected load.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 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. Up to what low value can it measure ?

c) Describe with a neat diagram, the Wien bridge method for measurement of unknown frequency.

3 + 7 + 5

8. a) Draw a neat sketch for single phase energymeter and briefly describe the working principle. 3 + 4

b) What are creeping and phantom loading in an energymeter ? 2 + 2

c) The meter constant of a 230 volt, 10 A wattmeter is 1800 revolutions per kWh. The meter is tested at half-load and rated voltage and unity power factor. The meter is found to make 80 revolutions in 138 seconds. Determine the meter error at half-load. 4

9. a) Draw the equivalent circuit and phasor diagram of a current transformer. 8

b) Derive the expression for ratio and phase angle errors in CT. 5

c) What are the advantages of instrument transformer over shunts and multipliers. 2

10. a) What is the function of each of the following in a dual trace CRO ?

    i) Time-base generator

    ii) Focusing anode

    iii) Delay line.

    b) What are the Lissajous patterns ? Draw the Lissajous pattern for two sinusoidal input-voltages of equal amplitude and equal frequency with 90® phase between them.

    c) Explain briefly how you can measure frequency from Lissajous pattern on a CRO. 5 + 5 + 5

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

    a) Frequency counter

    b) D.C. potentiometer

    c) Rectifier type instrument

    d) Signal generator

    e) Wagner earthing device

    f) Electrostatic instrument.