Name : ……………………………………………………

Roll No. : …………………………………………………

Invigilator's Signature : ……………………………………

CS/B.Tech (EIE-O)/SEM-3/EE-302(EI)/2012-13
2012
ELECTRICAL MEASUREMENTS & INSTRUMENTS

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 × 1 = 10

     i)   The scale of moving iron instrument is

         a)   linear

         b)   non-linear

         c)   both linear and non-linear

         d)   none of these.

     ii)   Capacitance can be measured by

         a)   Maxwell's bridge   b)   De Sauty's bridge

         c)   Wheatstone bridge   d)   None of these.

3207 (O)   [Turn over

iii) The braking torque provided by a permanent magnet in a single phase energymeter is proportional to the

    a) square of the flux of the permanent magnet

    b) speed of the meter

    c) distance of the permanent magnet from the centre of the revolving disc

    d) all of these.

iv) Frequency can be measured by

    a) Maxwell's bridge

    b) Heaviside-Cambell bridge

    c) Schering bridge

    d) Wien's bridge.

v) Low resistance can be measured by

    a) Kelvin double bridge   b) Anderson bridge

    c) Schering bridge   d) Wheatstone bridge.

vi) Turns compensation is used in C.T. primary for the reduction of

    a) phase angle error

    b) both ratio and phase angle errors

    c) ratio error

    d) none of these.

vii) The secondary of a current transformer is

    a) never left open-circuited

    b) never left short-circuited

    c) always kept open-circuited

    d) none of these.

viii) Holes are drilled on opposite sides of disc of an induction type energymeter

    a) to avoid creep on no-load

    b) to balance the disc

    c) to dissipate the energy due to eddy current

    d) to increase the deflecting torque.

ix) Wagner's earth device is used in 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.

x) Thermocouple instruments can be used for the frequency range

    a) up to 100 Hz   b) up to 5000 Hz

    c) up to 1MHz   d) 50 Hz and above.

GROUP – B

(Short Answer Type Questions)

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

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

3. How can an unknown frequency be measured by an a.c. bridge ?

4. Desribe various operating forces needed for proper operation of an analog indicating instrument.

5. What are the advantages of an instrument transformer over a shunt or a multiplier ?

6. Explain the following terms :

   a) Linearity

   b) Sensitivity

   c) Reproducibility

   d) Precision.
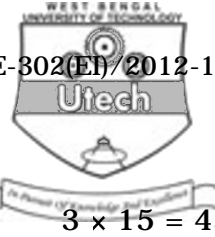
GROUP – C
(Long Answer Type Questions)
Answer any *three* of the following.   3 × 15 = 45

7. Write briefly about construction of an electrodynamometer type instrument. Derive the torque equation of the instrument when alternating current is passing through the coils. What are the main errors of this type of instrument ?

$$5 + 7 + 3$$

8. a) Draw the Anderson bridge and find out with the help of phasor diagram how the self inductance of a coil can be measured in terms of a standard capacitor.

   b) The four arms of a bridge are

   AB — an imperfect capacitor C_1 with an equivalent series resistance of r_1

   BC — a non-inductive resistance R_3

 CD — a non-inductive resistance R_4

   DA — an imperfect capacitor C_2 with an equivalent series resistance of r_2 in series with a resistance R_2.

   A supply of 450 Hz is given between terminals A and C and the detector is connected between B and D at balance :

   $R_2 = 4 \cdot 8$ ohm, $R_3 = 2000$ ohm, $R_4 = 2850$ ohm and $C_2 = 0 \cdot 5$ microfarad and $r_2 = 0 \cdot 4$ ohm.

   Calculate the value of C_1 and r_1 and also of the dissipating factor of this capacitor.   8 + 7
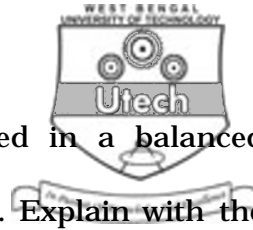
9. a) Explain how power can be measured in a balanced circuit with the help of 2 wattmeters. Explain with the help of a phasor diagram.

   b) In a 3-phase balanced load, the power is measured by 2-wattmeter method. The reading of the wattmeters are 8 kW and 3 kW (after reversing the current coil) respectively. Find (i) total power consumed by the load (ii) the power factor of the load. 15

10. a) Draw the equivalent circuit and phasor diagram of a current transformer. Derive the expression for the ratio error of C.T.

    b) The exciting current of a ring core C.T. is of ratio 1000/5 A. When operating at full primary current and with a secondary burden of non-inductive resistance of 1 ohm is 1 A at a power factor of 0·4, calculate the ratio error at full-load, assuming that there has been no compensation. 10 + 5

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

    i)   Localisation of cable fault by Murray's loop test

    ii)   Digital Multimeter

    iii) Transducers

    iv)   Measurement of capacitance by Shering bridge

    v)   Creep and lag adjustment in single phase induction
          type energymeter.

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