Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.TECH(EIE)/SEM-3/EE-302(EI)/2010-11

2010-11

ELECTRICAL MEASUREMENTS AND 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 any *ten* of the following :

$10 \times 1 = 10$

   i)   Moving iron type 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.

ii) Electrostatic type instruments are primarily used as

   a) Ammeter   b) Voltmeter

   c) Wattmeter   d) Ohmmeter.

iii) Low resistance can be measured by

   a) Wheatstone bridge   b) Kelvin's double bridge

   c) Maxwell's bridge   d) Wien-bridge.

iv) Calibration of DC potentiometer is done with the help of standard cell of voltage

   a) 1·5 volts   b) 1·01864 volts

   c) 1.001864 volts   d) 1.0864 volts.

v) Which of the following instruments can be used to measure 100 kV ac voltage ?

   a) PMMC voltmenter

   b) Moving iron voltmeter

   c) Electrostatic voltmenter

   d) Hot wire instrument.

vi) Creeping in a single phase induction type energymeter may be due to

    a) over-compensation for friction

    b) over-voltage

    c) vibration

    d) all of these.

vii) Which of the following instruments consumes maximum power during measurement ?

    a) PMMC instruments

    b) Hot wire instruments

    c) Thermocouple instruments

    d) Electrodynamometer instruments.

viii) Murray loop test is used for location of

    a) short circuit fault on a cable

    b) ground fault on a cable

    c) both (a) and (b)

    d) open circuit fault.

ix) Maxwell's Inductance Capacitance bridge is used for measurement of

   a) Low Q coils
   b) High Q coils

   c) Medium Q coils
   d) Low & High Q coils.

x) Insulation resistance can be measured by

   a) ammeter voltmeter method

   b) megger

   c) loss of charge method

   d) Wheatstone bridge.

xi) The resolution of a $3\frac{1}{2}$ digit DVM having a basic range of 2 volts is

   a) 2 V
   b) 1 mV

   c) 0.25 mV
   d) 0.125 mV.

xii) The power in a 3-phase, 4 wire circuit can be measured by using

   a) 2 wattmeters
   b) 4 wattmeters

   c) 3 wattmeters
   d) 1 wattmeter.

GROUP – B

(Short Answer Type Questions)

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

2. Determine the sensitivity of Whetstone bridge for four arms with equal resistance.

3. State the differences between current transformer and potential transformer.

4. How can you calibrate moving iron type ammeter and voltmeter using d.c. potentiometer ?

5. Derive the equation of balance for an Anderson's bridge. Draw the phasor diagram under balance condition. 3 + 2

6. Explain the operation of rectifier type deflection instrument.

7. Derive the expression for eddy current damping torque equation used in PMWC instrument.

GROUP – C

(Long Answer Type Questions)

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

8. a) Write briefly about construction of a moving iron instrument.

   b) Derive the torque equation of the instrument.

   c) A permanent magnet moving coil (PMMC) instrument has a full scale deflection of 90° for a current of 2A. The deflecting torque in a PMMC instrument is directly proportional to current in the moving coil. Find the value of current required for a deflection of 300° if the instrument is

   i) spring controlled and

   ii) gravity controlled. 5 + 5 + 5

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

   b) In a Murray loop test for ground fault on a 500 metre long cable having resistance of 1.6 Ω/km, the faulty cable is looped with a sound cable for same length and cross-section. If resistances of ratio arms are 3 : 1, calculate the distance of the fault from the test end.

   10 + 5

10. a) What are 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) The circuit for measurement of active resistance r_1 and self-inductance L_1 of a coil is a follows :

   Arm ab the unknown coil impedance in series with a resistance R_1

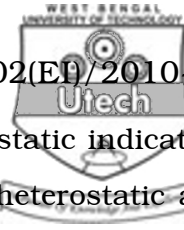   Arm bc a pure resistance R_3

   Arm cd a pure resistance R_4

   Arm da an inductor with self-inductance L_2 and internal resistance r_2.

   The bridge supply voltage is between a and c. Under balance condition R_1 = 1·36 Ω,

   $R_4 = R_3 = 100\ \Omega$, $r_2 = 32.7\Omega$, $L_2 = 47.8$ mH. Calculate L_1 and r_1.   3 + 7 + 5

11. a) Derive the angle of deflection of Electrostatic indicating instrument ? Draw and explain about heterostatic and ideostatic connection of electrodynamometer type indicating instument.

    b) What is phantom loading ? Explain with a suitable example. 10 + 5

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

    a) Power measurement using delta connection in 2-wattmeter method.

    b) Maxwell Bridge

    c) Megger

    d) Gravity control

    e) Thermal Type Instrument.

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