

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0209 Roll No.

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B. Tech.

(Semester-III) Theory Examination, 2011-12

Electrical Measurements and Measuring Instruments

Time : 3 Hours]

[Total Marks : 100

Note : Attempt questions from all Sections as per directions.

Section-A

Attempt all parts of this question : $2 \times 10 = 20$

1. (a) How the range of an electrostatic voltmeter can be extended by using a capacitor?
- (b) What is meant by burden of current transformer?
- (c) How true value of energy can be achieved by single phase induction motor?

- (d) How Maxwell's inductance-capacitance bridge is used for measurement of inductance?
- (e) A potentiometer is basically which type of instrument? Explain.
- (f) Mention salient features of self balancing potentiometers.
- (g) What is the principle of working of fluxmeter?
- (h) What is meant by systematic errors?
- (i) What are the desirable static characteristics in a measurement system?
- (j) What are the sources of error in Wattmeters?

Section-B

Answer *all* parts of this question. $6 \times 5 = 30$

2. (a) For a certain dynamometer ammeter, the mutual inductance M varies with deflection θ (expressed in degrees) as

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(2)

$M = -6 \cos(\theta + 30^\circ)$ mH. Find the deflecting torque produced by a direct current of 50 mA corresponding to a deflection of 60° .

- (b) Draw the equivalent circuit and phasor diagram of a current transformer.
- (c) Draw the circuit of Kelvin's double bridge used for measurement of low resistances. Derive the condition for balance.
- (d) A transformer is operated on 1000 V, 50 Hz and gives a total loss 1000 W, of which 700 W is due to hysteresis. If the transformer were to operate at 2000 V and 100 Hz. What would be losses due to hysteresis and eddy currents?
- (e) In a CRT, the distance between the deflecting plates is 1 cm, the length of the deflecting plates is 4.5 cm and the distance of the screen from the centre of the deflecting plates is 33 cm. If the accelerating voltage supply is 300 volts, calculate deflection sensitivity of the tube.

Section-C

Answer *all* questions of this Section. $10 \times 5 = 50$

3. Answer any two parts of the following :

(a) Explain, analog and digital modes of operation of instruments. Explain how the resolution of digital instruments can be increased.

(b) Explain, how an electrodynamic type instrument is able to measure the true rms value of a voltage as current irrespective of its waveform.

(c) Explain the working of electron resonance type power factor meters. Draw the phasor diagrams under different power factor conditions.

4. Answer any one part of the following :

(a) A current transformer with 5 primary turns has a secondary burden consisting of a resistance of 0.16Ω and an inductive

resistance of 0.12Ω . When the primary current is 200 A, the magnetizing current is 1.5 A and the iron loss current is 0.4 A. Determine any expressions used, the number of secondary turns needed to make the current ratio 100 : 1 and also the phase angle under these conditions.

- (b) Describe the working of a capacitive type potential transformer. Describe, how the transformation ratio can be made independent of the burden of the transformer.

5. Answer any two parts of the following :

- (a) Derive the equations of balance for an Anderson's bridge. Draw the phasor diagram for conditions under balance. Discuss the advantages and disadvantages of the bridge.

- (b) Describe the working of a low voltage Schering bridge. Derive the equations for capacitance and dissipation factor. Draw the phasor diagram of the bridge under conditions of balance.

(c) What are the different difficulties encountered in the measurement of high resistances? Explain, how these difficulties are overcome.

6. Answer any one part of the following :

(a) Describe the construction and working of a polar type potentiometer. How is it standardized? What are the functions of the transfer instrument and phase shifting transformer?

(b) Explain the method of reversals for experimental determination of hysteresis loop of a magnetic specimen.

7. Answer any two parts of the following :

(a) Describe the working principle of an integrating type digital voltmeter (DVM) with suitable diagram.

(b) Explain the term 'total harmonic distortion'. Describe the functioning of a total harmonic distortion meter.

(c) Describe, how the frequency and phase angle measurements can be made with the use of a CRO.

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