



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

PAPER ID : 0209

Roll No.

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**B.Tech****(SEM III) ODD SEMESTER THEORY EXAMINATION 2009-10  
ELECTRICAL MEAS. & MEASURING INSTRUMENTS**

Time : 3 Hours]

[Total Marks : 100

- Note :**
- (1) Attempt all questions.
  - (2) All questions carry equal marks.

1 Answer any **four** parts of the following : **5×4=20**

- (a) Enlist the differences between gross and systematic errors with suitable example.
- (b) Two resistances  $R_1$  and  $R_2$  are connected in parallel with  $R_1 = 10 \text{ k}\Omega \pm 5\%$  and  $R_2 = 5 \text{ k}\Omega \pm 10\%$ . Calculate the percentage error and range of combined resistance.
- (c) Explain the term "Standards" in measurement system. Also mention the various types of standards used in industry.
- (d) An electrostatic voltmeter reading upto 1 kV is controlled by a spring with spring constant of  $1 \times 10^{-7} \text{ N-m/degree}$  and has a full scale deflection of  $80^\circ$ . The capacitance at zero voltage is  $1 \times 10^{-11} \text{ Farad}$ . What is the capacitance when the pointer indicates 1 kV ?



- (e) Describe construction and working of electro-dynamometer type voltmeter.
- (f) An electrodynamic wattmeter has a pressure coil of resistance  $8\text{ k}\Omega$  and inductance of  $65\text{ mH}$ , which is connected directly across the load carrying current of  $8\text{ A}$  at voltage of  $230\text{ V}$ ,  $50\text{ Hz}$  and power factor of  $0.1$  lagging. Estimate the percentage error in wattmeter reading.
- 2 Attempt any **two** parts of the following :  $10 \times 2 = 20$
- (a) A current transformer of turn ratio  $1 : 200$  is rated as  $1000/5\text{ A}$ ,  $25\text{ VA}$ . The coreless and magnetizing component of the primary current are  $4\text{ A}$  and  $7.5\text{ A}$  under rated conditions. Determine the phase angle and ratio errors for the rate burden and rated secondary current at  $0.8\text{ pf}$  lagging and  $0.8\text{ pf}$  leading. Neglect the resistance and leakage reactance of secondary winding.
- (b) Explain construction and working of electro-mechanical type frequency meter. Enlist the merits and demerits of it from other frequency meter.
- (c) Draw an equivalent circuit and phasor diagram of potential transformer (PT). Derive the expression for its ratio and phase angle errors. How PT is used in extension of instrument range ?
- 3 Answer any **two** parts of the following :  $10 \times 2 = 20$
- (a) What are the problems associated with the measurement of low resistance and how are they overcome in Kelvin's double bridge ? Derive an expression for the unknown resistance in case of Kelvin's double bridge.



- (b) The four arms of Maxwell's capacitance bridge at balance are : arm AB, an unknown inductance  $L_1$ , having an inherent resistance  $R_1$ , arm BC, a non-inductive resistance of  $1000 \Omega$ , arm CD, a capacitor of  $0.5 \mu f$  in parallel with a resistance of  $1000 \Omega$ , arm DA, a resistance of  $1000 \Omega$ . Determine the value of  $R_1$  and  $L_1$ . Also derive the equations of balance for the bridge. Draw the phasor diagram of the bridge under balance conditions.
- (c) Describe the working of Schering's bridge for measurement of capacitance. Derive the equation for balance conditions and draw the phasor diagram under balance conditions.

4 Answer any **two** parts of the following :  $10 \times 2 = 20$

- (a) A ring specimen having a mean diameter of 0.3 meter and a cross-sectional area  $400 \text{ mm}^2$  has a primary winding of 80 turns wound uniformly. The secondary winding of 30 turns is connected to a flux meter having a constant of  $0.1 \times 10^{-3} \text{ Wb-turn/division}$ . A deflection of 46 divisions is observed when a current of 2 A is reversed in the primary winding. Calculate the relative permeability of iron specimen.
- (b) Explain the construction and principle of working of a co-ordinate a.c. potentiometer. Draw a diagram of scheme of connections of it and describe how ac potentiometer is standardized.



(c) Describe the following with the help of suitable diagram :

- (i) Calibration of a.c. wattmeter
- (ii) Hysteresis loop of magnetic specimen by method of reversals.

5 Answer any **three** parts of the following :  $6\frac{2}{3} \times 3 = 20$

- (a) Describe the construction and working of dual beam CRO using block diagram.
- (b) Describe the construction and working of power analyzer used in digital measurement.
- (c) A  $3\frac{1}{2}$  digit voltmeter is used for measuring voltage :
  - (i) Find the resolution of the meter.
  - (ii) How would a voltage of 15.45 V is displayed on 10 V scale ?
  - (iii) How would a voltage of 36.75 V is displayed on 100 V scale ?
- (d) With the help of circuit diagram, explain the functioning of a ramp type digital voltmeter.
- (e) Explain the various applications of CRO in management.

