NEW SCHEME

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Third Semester B.E. Degree Examination, January/February 2005

Common to IT,EC,BM/EE/TE/ML

Electrical & Electronic Measurements

Time: 3 hrs.] [Max.Marks : 100

Note: *1. Answer any FIVE full questions.*
2. Use SI system of units.

1. (a) The expression for eddy currents produced in a metallic former moving in the field of a permanent magnet is found as

$$I_T = k \cdot \frac{BlbA}{(2b+l)\rho}$$

where

$B \rightarrow$ flux density, $l \rightarrow$ length of the former, $b \rightarrow$ width of the former, $A \rightarrow$ area of the former, $\rho \rightarrow$ resistivity of conducting former and k is a constant. Starting from fundamentals, check for dimensional correctness of the expression and incorporate necessary corrections. (7 Marks)

(b) With usual notations, prove that $\frac{1}{(\mu\epsilon)^{1/2}}$ has the dimension of velocity, starting from fundamentals, in S.I. system of units. (7 Marks)

(c) Explain fall of potential method of measurement of earth resistance. (6 Marks)

2. (a) Derive the expression for the measurement of unknown resistance using Kelvin's double bridge. How the effect of connecting lead resistance is eliminated in this arrangement? (8 Marks)

(b) Derive the expression for the measurement of capacitance and loss angle of a lossy capacitor using Schering bridge. Draw the phasor diagram at balance condition. What modifications are introduced when the bridge is used at high voltages? (12 Marks)

3. (a) An a.c. bridge has the following branches arm ab : an unknown impedance (R_1, L_1) in series with a non inductive variable resistor r_1
arm bc : a non inductive resistor $R_3 = 100\Omega$
arm cd : a non inductive resistor $R_4 = 200\Omega$
arm da : a non inductive resistor $R_2 = 250\Omega$
arm de : a non inductive variable resistor r
arm ec : lossless capacitor $c = 1\mu F$, and
arm be : a detector.

An ac supply is connected between a & c. Calculate resistance R_1 and inductance L_1 under balance condition $r_1 = 43.1\Omega$ and $r = 229.7\Omega$. (6 Marks)

(b) What are the disadvantages of shunts and multipliers used in measurement systems. (4 Marks)

(c) Explain with a neat diagram and phasor diagram, the Silsbee's comparative deflection method of testing C.T. (10 Marks)

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4. (a) What are the differences between a CT and PT? (4 Marks)

   (b) Explain the operation of single phase induction type energy meter and show that the number of revolutions made by the disc is proportional to the energy consumed. (10 Marks)

   (c) A correctly adjusted, single phase $240V$, induction Watthour meter has a meter constant of 600 revolutions per KWH. Determine the speed of the disc for a current of 10A at a power factor of 0.8 lagging. (6 Marks)

5. (a) Explain any one type of power factor meter. (10 Marks)

   (b) Explain with neat figure, Weston frequency meter. (10 Marks)

6. (a) Explain with a block diagram the true RMS voltmeter. (7 Marks)

   (b) Explain with a block diagram, the working of digital voltmeter working with successive approximation principle. (8 Marks)

   (c) A coil with a resistance of 3 ohms is connected to the terminals of a Q meter in the direct measurement mode. Resonance occurs at an oscillator frequency of 5 MHz and resonating capacitance is of 100 PF. Calculate percentage error introduced by the insertion of a resistance of 0.1Ω. (5 Marks)

7. (a) Explain the working of LVDT used in displacement measurement. Why a phase sensitive detector is employed along with LVDT? (8 Marks)

   (b) Explain with a block diagram the essential functional blocks of a digital data acquisition system. Compare analog and digital data acquisition systems. (6 Marks)

   (c) The unstrained resistance of each of the four elements of the unbonded strain gauge is 120Ω. The strain gauge has a gauge factor of 3 and is subjected to a strain of 0.0001. If the indicator is a high impedance voltmeter, calculate the reading of this voltmeter for a battery voltage of 10 Volts. (6 Marks)

8. (a) Explain fibre optic power measurement. (7 Marks)

   (b) Write a note on the sources and detectors used in fibre optic measurements. (6 Marks)

   (c) Explain with a block diagram, interfacing of frequency counter with IEEE 488 Bus. (7 Marks)

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