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**Third Semester B.E. Degree Examination, May/June 2010**  
**Electrical Measurements**

Time: 3 hrs.

Max. Marks:100

*Note: Answer any FIVE full questions, selecting  
at least TWO questions from each part.*

**PART – A**

- 1 a. With usual notations, prove that  $\frac{1}{(\mu\epsilon)^{1/2}}$  has the dimensions of velocity, where  $\mu$  = permeability and  $\epsilon$  = permittivity. (05 Marks)
- b. The expression for eddy currents produced in a metallic former moving in the field of a permanent magnet is found as,
- $$I_e = \frac{KB/bA}{(2b+l)\rho}$$
- where B = flux density,  $l$  = length of former,  $b$  = width of former, A = Area of former,  $\rho$  = resistivity of conducting former and K = a constant.  
Check for dimensional correctness of the expression and incorporate necessary corrections using LMTI system of units. (07 Marks)
- c. Define bridge sensitivity of a galvanometer and hence obtain an expression for Wheatstone's bridge sensitivity ( $S_B$ ) in terms of voltage sensitivity. When will be  $S_B$  maximum? (08 Marks)
- 2 a. Derive the equation of balance for Anderson bridge. Also draw the phasor diagram. (10 Marks)
- b. Write a short note on Wagner earthing device. (04 Marks)
- c. An AC bridge is balanced at 2 kHz with the following components in each arm:  
Arm AB = 10 k $\Omega$   
Arm BC = 100  $\mu$ F in series with 100 k $\Omega$   
Arm AD = 50 k $\Omega$   
Find the unknown impedance  $R \pm jX$  in the arm DC, if the detector is between BD. (06 Marks)
- 3 a. What are shunts and multipliers? Derive an expression for both, with reference to meters used in electrical circuits. (06 Marks)
- b. Write a note on turns compensation used in CT and PT. (04 Marks)
- c. A current transformer with a bar primary has 300 turns in its secondary winding. The resistance and reactance of the secondary circuit are 1.5  $\Omega$  and 1.0  $\Omega$  respectively, including the transformer winding. With 5A flowing in the secondary winding, the magnetizing mmf is 100 AT and the core loss is 1.2 W. Determine the ratio and phase angle errors. (10 Marks)
- 4 a. Discuss with a block diagram, the principle of operation of an electronic energy meter. (06 Marks)
- b. Mention different errors present in induction type energy meter and suggest methods to minimize them. (08 Marks)
- c. An energymeter is designed to make 100 revolutions of the disc for one unit of energy. Calculate the number of revolutions made by it, when connected to a load carrying 40 A at 230 V and 0.4 pf for 1 hour. If it actually makes 360 revolutions, find the percentage error. (06 Marks)

## PART – B

- 5 a. With a block diagram, explain the principle of true RMS responding voltmeter. (06 Marks)  
b. Explain the operation of RAMP type digital voltmeter. (06 Marks)  
c. Explain the construction and operation of Weston frequency meter. (08 Marks)
- 6 a. What is a transducer? Briefly explain the procedure for selecting a transducer. (06 Marks)  
b. Explain with a neat sketch, the construction and working of linear variable differential transformer. (08 Marks)  
c. Derive an expression for gauge factor in terms of Poisson's ratio. (06 Marks)
- 7 a. With a block diagram, explain the working of digital storage oscilloscope. (08 Marks)  
b. Explain the front panel details of a dual trace oscilloscope. (06 Marks)  
c. Briefly explain photoconductive and photovoltaic cells. (06 Marks)
- 8 a. Explain with a block diagram, the essential functional operation of a digital data acquisition system. (08 Marks)  
b. With a neat sketch, explain the working of a X-Y recorder. (06 Marks)  
c. Write a note on LED and LCD display. (06 Marks)

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