NEW SCHEME

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Third Semester B.E. Degree Examination, July/August 2005

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

Electrical & Electronic Measurements

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

Note: *Answer any FIVE full questions.*

1. (a) Explain the usefulness of dimensional equations. **(5 Marks)**

(b) Prove dimensionally that $(\mu_0 \in_0)^{-1/2}$ has the dimensions of the velocity of light, where μ_0 is the permeability and $\in_0$ is the permittivity of free space. **(8 Marks)**

(c) The ratio arms of a wheatstone bridge are guaranteed to be accurate to $\pm 0.05\%$ and the rheostat arm to 0.1%. The ratio arms are set at $1.0k\Omega$ and the bridge is balanced with the rheostat arm set at 2324 Ohms. Determine the upper and lower limits of th e unknown resistance on the basis of the guarantees. **(7 Marks)**

2. (a) Write briefly on the significance of 'shields' used in AC bridge circuits. Hence discuss on the 'shielding' of resistors and capacitors of the circuit. **(6 Marks)**

(b) The circuit for measurement of effective resistance and self inductance of an iron-cored coil is an under : The arm AB an unknown impedance ; arm BC-a pure resistance of 10 Ohms ; arm CD-a loss free capacitance of $1\mu F$ and arm AD - a capacitance of 0.135 μF in series with a resistance of 842 ohms. Deriving the corresponding equations for the balanced bridge, obtain the values of the unknown components in arm AB. **(8 Marks)**

(c) What are shunts and multipliers? Derive an expression for both, with reference to the meters use din electrical circuits. **(6 Marks)**

3. (a) Derive from the equivalent circuit and vector diagram of a current transformer, the expressions for ratio error and phase angle error. **(10 Marks)**

(b) A potential transformer of ratio 1000/100 V has the following constants : primary resistance : 94.5Ω, secondary resistance : 0.86Ω, primary reactance : 66.2Ω ; total equivalent reactance of primary ; 110 Ω and I_O is 0.02 Amps at 0.4 power factor. Calculate the phase angle error at No-load. Also determine the secondary voltamperes at unity power factor corresponding to zero phase angle. **(10 Marks)**

4. (a) With a neat circuit arrangements, explain how the calibration of single phase induction type energy meter is carried out in laboratories. Explain the need for adjustments to be followed earlier to calibration analysis. **(12 Marks)**

(b) A three-phase integrating energy meter connected to a circuit of line voltage $-230 Volts$, current - 10 amperes at unit power factor has a constant of 5.5555 kWh per revolution. The time required by the disc for 150 revolutions is 38.5 seconds. The meter is normally used with a PT of ratio 22 kV/220V and a CT of ratio 1 kA/5A Determine the error expressed as a percentage of true energy. **(8 Marks)**

5. (a) Explain the principle of electronic energymeters. Hence arrive at the relative advantages gained when compared to the conventional energymeters. (7 Marks)

   (b) Explain the principle of successive approximation technique adopted in digital voltmeters. (6 Marks)

   (c) What is a Q meter? Discuss how the unknown components can be connected to its test terminals. (7 Marks)

6. (a) What is the principle of electric resistance strain gauge? Derive an expression for the gauge factor in terms of the Poisson's ratio. (8 Marks)

   (b) Explain the principle of displacement measurements using two differential transformers in a closed loop servo system. (6 Marks)

   (c) Write a note on digital to analog multiplexing. (6 Marks)

7. (a) Explain the timing relationship of signal in a IEEE-488 bus. (7 Marks)

   (b) Derive an expression for the critical angle for achieving total internal reflection in a fiber optic transmission system. (7 Marks)

   (c) Briefly discuss on the instruments used in computer controlled instrumentation. (6 Marks)

8. Write short notes on any FOUR of the following :

   (a) Megger

   (b) Low power factor Wattmeter

   (c) Weston frequency meter

   (d) Phase sequence indicator.

   (e) Fiber optic power meter.

(4×5=20 Marks)

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