

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-VII Examination-Nov/Dec.-2011

Subject code: 170803**Date: 24/11/2011****Subject Name: Electrical and Electronics Measuring Instruments****Time: 10.30 am-01.00 pm****Total marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Describe the various operating torque needed for proper operation of an analog indicating instrument. Draw the neat sketch & explain in detail of eddy current damping torque in analog instrument. **03+04**

(b) Explain the construction and working of an electrodynamic type of wattmeter. **04+03**

Q.2 (a) Derive the general torque equation for a moving iron type instrument. The inductance of a moving iron ammeter is given by the following expression. **04+03**

$$L = (20 + 10\theta - 2\theta^2) \mu\text{H}.$$

Where θ is deflection in radians. The spring constant is $24 \times 10^{-6} \text{ Nm/rad}$. Calculate the values of deflections for a current of 5A.

(b) Draw the phasor diagram & derive the expression for deflecting torque & braking torque in single phase induction type energy meter. **02+05**

OR

(b) A moving coil voltmeter with a resistance of 20Ω gives a full scale deflection of 120° , when a potential difference of 100mv is applied across it. The moving coil has dimensions of $30\text{mm} \times 25\text{mm}$ and is wound with 100 turns. The control spring constant is $0.375 \times 10^{-6} \text{ Nm/deg}$. Find the flux density in the air gap. Find also the diameter of copper wire of coil winding if 30% of instrument resistance is due to coil winding. The specific resistance of copper = $1.7 \times 10^{-8} \Omega \text{ m}$. **03+04**

Q.3 (a) Derive expression for unknown resistance in case of kelvin's double bridge. **07**

(b) State the application of schering bridge. Explain its working with circuit diagram & phasor diagram. Why earth screen is required in High voltage schering bridge? **02+02+03**

OR

Q.3 (a) Describe with the help of neat diagram the loss of charge method to determine the insulation resistance of a short length of cable and derive an expression for determination of insulation resistance. **03+04**

(b) The four arm of a maxwell's capacitance bridge at balance are : **03+02+02**
Arm ab, an unknown inductance L_1 having an inherent resistance R_1 , Arm bc, a non magnetic resistance of 1000Ω , Arm

cd, a capacitor of $0.5 \mu\text{F}$ in parallel with a resistance of 1000Ω , Arm da, a resistance of 1000Ω .

Derive the equations of balance for the bridge and determine the value of R_1 & L_1 . Draw the phasor diagram of the bridge under balance conditions.

- Q.4 (a)** A C.T has a primary & 200 turn secondary winding .The secondary supplies a current of 5A to a non inductive burden of 1Ω resistance. The requisite flux is set up in the core by an mmf of 80A. Frequency is 50Hz & net cross section area of the core is 1000 mm^2 ? **02+02+03**

Calculate the ratio & phase angle of the C.T. Also find the flux density in the core. Neglect the effect of magnetic leakage , iron losses and I^2R losses. (Page 398 AKS)

- (b)** Draw the equivalent circuit & phasor diagram of a potential transformer. Derive the expressions for its ratio and phase angle errors. **03+04**

OR

- Q.4 (a)** Explain with the help of neat diagram the working of a digital voltmeter. **02+05**

- (b)** Explain with the help of a block diagram the working of a spectrum analyzer ? Where are spectrum analyzers commonly used ? **04+03**

- Q.5 (a)** Draw the block diagram of storage oscilloscope and explain the working of each block. **03+04**

- (b)** What is signal conditioning and why is it required ? Draw a block diagram of a signal conditioning system and explain the functions of each block. **02+02+03**

OR

- Q.5 (a)** Explain the construction & principle of working of a linear voltage differential transformer. Explain how the magnitude and direction of the displacement of core of an L.V.D.T detected. **02+02+03**

- (b)** Explain the terms : **01 X**
 (i) Limiting error (ii) Accuracy (iii) Precision **07=07**
 (iv) Sensitivity (v) Reproducibility (vi) resolution (vii) relative error
