Subject Code: BEE-207

Roll No. | 2 | 0 | 2 |

Minor Test Examination 2025 - 26
B. Tech. II EE, Semester: III
Electrical Measurement and Measuring Instrument

Time: 2Hr. **Max Marks: 20**

Q1. Attempt any Two parts of the following. **Marks**

a) Discuss about the different functional elements of measurement system/instrument with an example. 4

b) Discuss the required properties of the materials used for spring, pivot & jewel of indicating type analog instrument. Also list the name of the materials individually. 4

c) The impedance of R-L circuit operating on a.c. is given by $Z = \sqrt{(R^2 + \omega^2 L^2)}$. The resistance R is known to be 100 Ω with an uncertainty of 5%, L is known to be 2 H with an uncertainty of 10% and ω is known exactly = $2\pi \times 50$. Determine the percentage uncertainty in the measurement of Z. 4

Q2. Attempt any Two parts of the following.

a) Define & explain the following: 3
(i) Dead Zone (ii) Static Sensitivity (iii) Instrument Efficiency

b) Properly classify different types of errors in measurement and instrumentation 3

c) A multi-meter has an input resistance of 25kΩ. is used to measure the voltage across a circuit having an output resistance of 1.0kΩ and an open circuit voltage of 12V. Find the error in measurement. 3

Q3. Attempt any Two parts of the following.

a) Explain construction, working principle of operation and derive torque equation the permanent magnet moving coil instrument. 3

b) The torque of an ammeter varies as the square of current through it. If a current of 5A produce deflection of 90^0, what deflection will occur for current of 3A when the instrument is: (i) Spring control (ii) Gravity control 3

c) In a spring controlled indicating instrument the control is exerted by two springs. The allowable maximum stress is 30 MN/m^2 and young's modulus of spring material is 120 GN/m^2. Determine the suitable dimension for spring if the deflection torque corresponding to full scale deflection of 90^0 is 1.2×10^{-3} Nm. Assume the width of spring as 0.6 mm.. 3

BEE-207

Roll No. 2 0

B. Tech.
(III SEM) ODD SEMESTER
ELECTRICAL ENGINEERING EXAMINATION 2025- 2026

Electrical Measurement and Measuring Instruments

Time: 3 Hrs. Max. Marks: 50

Note: Attempt all Questions. Each question carries equal marks. Each notation is given as standard format. If any data are missing or not given, then assume with proper justification.

1. Attempt any five parts of the following: (5×2=10)

(a) List different types of existing standards and explain the special feature of these standards

(b) Distinguish the difference between Liner Scale and Rectangular Hyperbolic Scale.

(c) Describe the construction and working of single phase Induction type Energy meter.

(d) Explain the limitation and disadvantages of rectifier type instruments.

(e) List different type of frequency meters. Discuss working of ratiometer type frequency meter.

(f) Prove that the true power = [{cosφ/cosβ.cos(φ-β)} × Actual wattmeter reading] where, cosφ = power factor of the circuit; $\beta = \tan^{-1}\{\omega L/R\}$; L and R are the inductance and resistance of the pressure coil of the wattmeter.

(g) An electrostatic voltmeter reading up to 2500V is controlled by a spring having torsion constant of 0.8×10^{-7} N-m per degree and has a full scale deflection of 90°. The capacitance at zero voltage is 12×10^{-12} F. Determine capacitance when the pointer indicates 2500V.

2. Attempt any two parts of the following: (2× 5 = 10)

(a) Define the following terms as applied to instrument transformers:
(i) Burden of an Instrument Transformer (ii) Actual Transformation Ratio
(iii) Nominal Transformation Ratio (iv) Turns Ratio (v) Ratio Correction Factor

(b) What is an instrument transformer? Derive an expression for ratio error and phase angle error of a current transformer.

(c) A 1000/5 A, 50 Hz current transformer has a secondary burden comprising a non-inductive impedance of 1.6 ohm. The primary winding has one turn. Calculate the flux in the core and ratio error at full load. Neglect leakage reactance and assume the iron loss in the core to be 1.5 W at full load. The magnetizing mmf is 100 A.

3. Attempt any two parts of the following: (2× 5 = 10)

(a) Explain Schering Bridge for measurement of unknown capacitance, and draw its phasor diagram at balance condition. What is dissipation factor? Calculate it using Schering Bridge.

(b) The four arms of a Maxwell's capacitance bridge at balance are: arm ab, an unknown inductance L1, having an inherent resistance R1; arm bc, a non-inductive resistance of 1 kΩ; arm cd, a capacitor of 0.5 μF in parallel with a resistance of 1 kΩ; arm da, a resistance of 1 kΩ. Derive the equations of balance for the bridge and determine the

values of R1 and L1. Draw the Phasor diagram of the bridge under balanced condition.

(c) Classify the different types of resistances and name the methods of measurement of all of them. Also explain the special features of low value resistance.

Attempt any two parts of the following: **(2× 5 = 10)**

(a) A magnetic core has hysteresis and eddy current losses of 20 W and 10 W, respectively, at a frequency of 50 Hz. If the frequency is increased to 100 Hz while keeping the flux density constant, calculate the new values of hysteresis and eddy current losses.

(b) Explain the method for measurement of iron losses and also discuss the methods to separate eddy current and hysteresis losses.

(c) Explain Lloyd- Fisher Square methods of measurement of Iron Losses. Also discuss its advantages, disadvantages and limitations.

Attempt any two parts of the following: **(2× 5 = 10)**

(a) Name different types of DVMs. Explain any one with relevant block diagrams and graphs.

(b) Draw the block diagram of a general purpose CRO and explain the function of the following controls (i) intensity (ii) focus (iii) horizontal and vertical positioning (iv) synchronization.

(c) What are Harmonic distortion analyzers and its type? Explain Heterodyne harmonic analyzer with neat block diagram.