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B TECH
(SEM-III) THEORY EXAMINATION 2020-21
ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Time: 3 Hours**Total Marks: 70****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 7 = 14**

a.	Explain the term Accuracy, Precision, Static Sensitivity, Resolution, Loading effect and Hysteresis effect.
b.	The measured value of a capacitor is 100.3 μF , whereas its true value is 99.4 μF . Determine the relative error.
c.	Draw the circuit of a Wheatstone bridge for measurement of unknown resistances and derive the condition for balance.
d.	Differentiate between CT and PT.
e.	Draw circuit diagram and phasor diagram of Anderson's bridge.
f.	Define the term nominal ratio of instrument transformer.
g.	What is meant by the term Pt-100?

SECTION B**2. Attempt any three of the following:****7 x 3 = 21**

a.	The torque of an ammeter varies as the square of the current through it. If a current of 5A produces a deflection of 900 what deflection will occur for a current of 3 A when the instrument is (i) spring controlled, (ii) Gravity controlled.
b.	Derive an expression for the unknown resistance measured using the loss of charge method.
c.	A bar-type CT has 300 turns in the secondary winding. An ammeter connected to the secondary has a resistance of 1 Ω and reactance of 0.8 Ω , and the secondary winding impedance is (0.5 + j0.6) Ω . The magnetizing MMF requirement for the core is 60 A and to supply the iron loss the current required is 25 A. (i) Find the primary winding current and also determine the ratio error when the ammeter in the secondary winding shows 5 A. (ii) How many turns should be reduced in the secondary to bring down ratio error to zero at this condition?
d.	What you mean by lissajous pattern? Explain the measurement of frequency and phase difference by CRO.
e.	The four arms of a bridge are connected as follows: Arm AB: A capacitor C1 with an equivalent series resistance r1 Arm BC: A non-inductive resistance R3 Arm CD: A non-inductive resistance R4 Arm DA: A capacitor C2 with an equivalent series resistance r2 in series with a resistance R2 A supply of 500 Hz is given between terminals A and C and the detector is connected between nodes B and D. At balance, R2 = 5 Ω , R3 = 1000 Ω , R4 = 3000 Ω , C2 = 0.3 μF and r2 = 0.25 Ω . Calculate the values of C1 and r1.

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SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a)	What are the different types of errors in a measurement? Explain briefly. The three resistors R ₁ , R ₂ and R ₃ have the following ratings: R ₁ = 25 Ω ± 4% , R ₂ = 65 Ω ± 4% , R ₃ = 45 Ω ± 4% Determine the following: (i) Limiting value of resultant resistance. (ii) % limiting error of series combination of resistance.
(b)	The inductance of a moving iron ammeter with a full-scale deflection of 900 at 1.5A, is given by the expression $L = 200 + 40\theta - 40\theta^2 - 0.3\theta^3$ μH where θ is deflection in radian from the zero position. Estimate the angular deflection of the pointer for a current of 1.0A.

4. Attempt any *one* part of the following: 7 x 1 = 7

(a)	Explain in detail about the various types of errors occurred in PMMC instrument.
(b)	Four arms of a Wheatstone bridge are as follows: AB = 150 Ω, BC = 15 Ω, CD = 6 Ω, DA = 60 Ω. A galvanometer with internal resistance of 25 Ω is connected between BD, while a battery of 20 V dc is connected between AC. Find the current through the galvanometer. Find the value of the resistance to be put on the arm DA so that the bridge is balanced.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a)	Explain the principle of working of a Kelvin's double bridge for measurement of unknown low resistances. Explain how the effects of contact resistance and resistance of leads are eliminated.
(b)	What you mean by piezoelectric effect? Give the name of material used for piezoelectric transducers. Derive the expression for voltage and charge sensitivity.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a)	What is an instrument transformer? Derive the transformation ratio of PT.
(b)	The exciting current of a CT of ratio 1000/5A , when operating at full primary current and with a secondary burden of non-inductive resistance of 1 ohm is 1A at power factor of 0.4. Calculate the phase difference between currents and ratio error at full load.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a)	Describe the working of ramp type and Dual slope type DVM with suitable diagram.
(b)	Write down the construction and working principle of a thermocouple. Describe the advantages and applications of thermocouple.