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

Time: 3 Hours**Total Marks: 100****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

Q no.	Question	Marks	CO
a.	What is measurement? Explain measurement system with appropriate block diagram.	2	1
b.	Differentiate between Accuracy and Precision.	2	1
c.	What is the difference between an ammeter and a voltmeter?	2	1
d.	What are the applications of bridge circuits?	2	2
e.	Draw the phasor diagram of hay's bridge.	2	2
f.	Explain the meaning of "burden" in case of instrument transformer.	2	3
g.	Explain the advantages of digital instruments over their analog counterpart.	2	4
h.	What you mean by smart sensor?	2	5
i.	What is the need of ADC in DAS?	2	4
j.	Why reference junction compensation is necessary in thermocouple?	2	5

SECTION B**2. Attempt any three of the following:**

Q no.	Question	Marks	CO
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.	10	2
b.	The inductance of a moving iron ammeter is given by the expression $L = 10 + 3\theta - \theta^2 / 4 \mu\text{H}$ where θ is deflection in radian from the zero position. The control spring torque is $25 * 10^{-6} \text{ N-m/rad}$. Estimate the angular deflection of the pointer for a current of 5.0A.	10	1
c.	What is an instrument transformer? Derive the transformation ratio of PT.	10	3
d.	Discuss the working of a wave analyzer.	10	4
e.	Explain the construction and working principle of LVDT.	10	5

SECTION C**3. Attempt any one part of the following:**

Q no.	Question	Marks	CO
a.	Explain the principle construction and operation of Attraction type moving iron instruments with neat diagram.	10	1
b.	Determine the dimensions of μ (r and L are radius and length, P1 and P2 are pressures and Q is flow). If $r = 0.5 \pm 0.01 \text{ mm}$; $P1 = 200 \pm 3 \text{ kPa}$; $P2 = 150 \pm 2 \text{ kPa}$; $Q = 4 * 10^{-7} \text{ m}^3/\text{s}$ and $L = 1\text{m}$. Calculate the absolute error in μ . Given expression is $\mu = \pi r^4 (P1 - P2) / 8QL$.	10	1



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4. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	A Maxwell's inductance-capacitance bridge is used to measure a unknown inductive impedance. The bridge constants at bridge balance are: Pure resistance arms = 2.5 k Ω and 50 k Ω . In between these two resistors, the third arm has a capacitor of value 0.012 μ F in series with a resistor of value 235 k Ω . Find the series equivalent of the unknown impedance.	10	2
b.	Derive an expression for the unknown high resistance measurement using the loss of charge method.	10	2

5. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	(i) Differentiate between CT and PT. (ii) Explain the characteristics of CT.	5 5	3
b.	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?	10	3

6. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	Describe the working of ramp type and Dual slope type DVM with suitable diagram.	10	4
b.	Explain with the help of a functional block diagram, the principle of operation of digital frequency meter.	10	4

7. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	Derive expression for gauge factor of strain gauge ,A resistance strain gauge with gauge factor 2 is fastened to steel subjected to stress 500 kg/sq. cm .if modulus of elasticity of steel is 2 *10 ⁶ kg/ cm ² ,calculate change in resistance if strain gauge element applied due to applied stress.	10	5
b.	(i) What is an electrical transducer? What are the basic requirements of a transducer? Give the classification of a transducer. (ii) Why is platinum considered most suitable material for RTDs for most laboratory work and for industrial material measurements of high accuracy?	10	5 5