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BTECH
(SEM III) THEORY EXAMINATION 2023-24
ELECTRICAL MEASUREMENTS & INSTRUMENTATION

TIME: 3HRS

M.MARKS: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

Q no.	Question	Marks	CO
a.	Explain the terms Loading effect and Hysteresis effect in measurement.	2	CO1
b.	Explain why the scale in the moving iron instrument is nonlinear.	2	CO1
c.	Enlist the errors found in Wheatstone Bridge.	2	CO2
d.	Draw the phasor diagram of Hay's bridge.	2	CO2
e.	Give applications of Instrument transformers.	2	CO3
f.	Define the burden of an instrument transformer.	2	CO3
g.	Draw the Lissajous pattern for a frequency ratio of 3:2.	2	CO4
h.	Draw the basic circuit of a digital counter.	2	CO4
i.	Differentiate between active and passive types of transducers with suitable examples.	2	CO5
j.	Compare Thermistor and thermocouple.	2	CO5

SECTION B

2. Attempt any three of the following:

Q no.	Question	Marks	CO
a.	Explain the principle, construction and operation of attraction-type moving iron instruments with a neat diagram.	10	CO1
b.	Derive the balance equation of Maxwell's Inductance - Capacitance Bridge along with its phasor diagram. Also, find the storage factor for the bridge.	10	CO2
c.	Draw the equivalent circuit and phasor diagram of the potential transformer. Derive the expression for ratio and phase angle.	10	CO3
d.	Describe the basic circuit of spectrum analyzer also explain different types of distortion caused by amplifiers.	10	CO4
e.	What is an electrical transducer? What are the basic requirements of a transducer? Give the classification of a transducer.	10	CO5

SECTION C

3. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	What is the error of an instrument? Discuss various types of Errors in measurement. The resistance value of three resistors are specified as $R_1 = 20 \Omega \pm 5\%$; $R_2 = 30 \Omega \pm 5\%$ and $R_3 = 50 \Omega \pm 5\%$. Determine the value of limiting error in ohms and percentage for the total equivalent resistance, if they are connected in parallel connections.	10	CO1
b.	Sketch the basic construction of a typical PMMC instrument & show how a PMMC instrument can be used as a DC voltmeter, and explain the circuit operation in detail.	10	CO1



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4. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	The four arms of a bridge are connected as follows: Arm AB: A capacitor C_1 with an equivalent series resistance r_1 Arm BC: A noninductive resistance R_3 Arm CD: A noninductive resistance R_4 Arm DA: A capacitor C_2 with an equivalent series resistance r_2 in series with a resistance R_2 A supply of 500 Hz is given between terminals A and C and the detector is connected between nodes B and D. At balance, $R_2 = 5 \Omega$, $R_3 = 1000 \Omega$, $R_4 = 3000 \Omega$, $C_2 = 0.3 \mu\text{F}$ and $r_2 = 0.25 \Omega$. Calculate the values of C_1 and r_1 , and also the dissipation factor of the capacitor.	10	CO2
b.	Explain the working principle of Kelvin's double bridge for the measurement of unknown low resistances. Explain how the effects of contact resistance and resistance of leads are eliminated.	10	CO2

5. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	Draw the equivalent circuit and phasor diagram of the current transformer. Derive the expression for ratio and phase angle.	10	CO3
b.	The exciting current of a ring core current transformer of ratio 1000/5A when operating at full primary current and with a secondary burden of non-inductive resistance of 10ohm is 1A at a power factor of 0.4, Calculate the phase displacement between primary and secondary winding currents and The ratio error at full load assuming that there has been no compensation.	10	CO3

6. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	Explain with the help of a functional block diagram, the principle of operation of a digital frequency meter.	10	CO4
b.	What are the types of digital voltmeters? Describe the working of Integrated-type DVM with a suitable diagram.	10	CO4

7. Attempt any one part of the following:

Q no.	Question	Marks	CO
a.	Explain the principle, construction, and working of strain gauge transducer and formulate the expression for gauge factor in terms of Poisson's ratio.	10	CO5
b.	Describe the construction and working of L.V.D.T with advantages and disadvantages.	10	CO5