Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2021

Programme Name: B.Tech Electrical Engg **Semester : V**
Course Name : Electrical Measurement & Instrumentation **Time : 03 hrs.**
Course Code : EPEG 2004 **Max. Marks : 100**
Nos. of page(s) : 2
Instructions: Attempt all the questions.

SECTION A **5Qx4=20**

S. No.		Marks	CO
Q1.	1. LVDT can be used for the measurement of……. 2. Self-generating transducers are……. 3. Piezoelectric crystals produced emf when…… 4. The gauge factor of a strain gauge is given as…….	**4**	**CO1**
Q2.	Define the following terms. 1. Accuracy 2. Precision 3. Dynamic Response 4. Resolution	**4**	**CO1**
Q3.	Discuss the types of errors occur in Instrument transformers.	**4**	**CO2**
Q4.	Differentiate between the following citing suitable examples. 1. Active and passive transducers 2. Primary and secondary transducers	4	**CO3**
Q5.	A DC source is represented by voltage source of 10V and with a resistance of 10Kohm in series. An ammeter of 50-ohm resistance is connected for measurement of current. Calculate the accuracy in measurement.	4	**CO4**

SECTION B **4Qx10=40**

Q6.	a) Draw the block diagram of general instrumentation system. Identify all the components and describe them in brief with their significance. b) In order to measure the power input and the power factor of an over-excited synchronous motor two wattmeters are used. If the meters indicate (-3.5kW) and (+8.0kW) respectively. Calculate: 1. Power factor of the motor 2. Power input to the motor	10	**CO1**

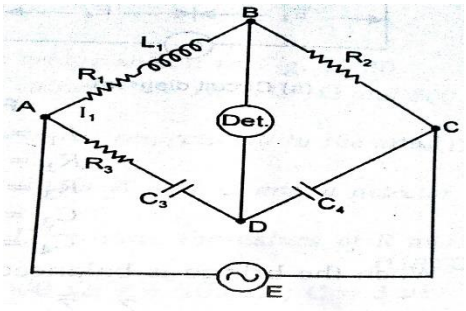
<table>
<tr><td>Q7.</td><td>a) Present the comparison of Current and Potential transformers.
b) Distinguish the moving coil and moving iron type of measuring instruments.</td><td>5+5</td><td>CO2</td></tr>
<tr><td>Q8.</td><td>Data acquisition system is very important process in measurement. Enumerate the objectives of DAS and draw its block diagram.</td><td>10</td><td>CO3</td></tr>
<tr><td>Q9.</td><td>The bridge shown in Figure: 1 is used to measure the properties of a sample of a sheet at 2 kHz. At balance, arm AB is the test specimen; arm BC is R_2 =100Ω; arm CD is C_4 = 0.1 µF and arm DA is R_3 =834Ω in series with C_3 = 0.124 µF.
1. Name the bridge and list the parameters that can be used by this bridge.
2. Derive the expression for the measurement of unknown variables.
3. Calculate the effective impedance of specimen under test conditions.
4. Calculate the Q factor of the specimen under test.
 

Figure:1</td><td>10</td><td>CO3</td></tr>
<tr><td>Q10.</td><td>Illustrate and compare the different types of temperature measuring devices and enumerate each of them in the tabular form given below.
<table><tr><td>S No</td><td>Temperature measuring devise</td><td>Principle of Operation</td><td>Specification Range</td><td>Merits</td><td>Classification</td></tr><tr><td>1.</td><td></td><td></td><td></td><td></td><td></td></tr></table></td><td>10</td><td>CO3</td></tr>
<tr><td colspan="3">SECTION C</td><td>2Qx20=40</td></tr>
<tr><td>Q11.</td><td>a) An Owen's bridge[ckt shown below] is used to measure the properties of a sample of steel sheet at 2-kHz. At balance condition , arm ab is test specimen ; arm bc is R3=100Ω ; arm cd is C4=0.l p.F and arm da is R2=834 n in series withC2 =0.124p.F Derive balance_ conditions and calculate the effective impedance of the specimen under test conditions.</td><td>12+8</td><td>CO4</td></tr>
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	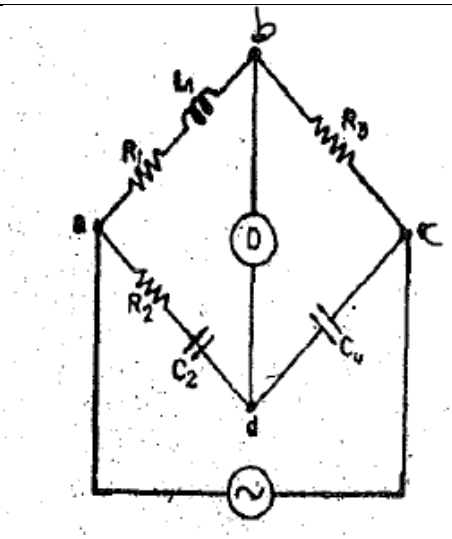 b) A current transformer with a bar primary has 250 turns in its secondary winding. The resistance and reactance of the secondary circuit are 1.4 Ω and 1.1 Ω respectively including the transformer winding. When 5A current flows in the secondary winding, the magnetizing mmf is 80AT and the iron loss is 1.1 W. Determine the following: 1. Ratio Error. 2. Phase Angle Error.		
Q12.	a) A single strain gauge having resistance of 120 Ω is mounted on a steel Cantilever beam at a distance of 0.15 m from the free end. An unknown force F applied at the free end produces a deflection of 12.7 mm of the free end. The change in Gauge resistance is found to be 0.152 Ω. The beam is 0.25 m long with a ·width of 20 mm and a depth of 3mm.. The Young's modulus for steel is 200 GN/m^2. Calculate the gauge factor. b) Describe the working principle and construction of capacitive transducers. Mention their applications. OR c) Describe how pressure or force/displacement is converted into electrical voltage with the help of inductive secondary transducers. d) A capacitive transducer uses two quartz diaphragms of area 750 mm^2 separated by a distance of 3.5mm. A pressure of 900 kN/m^2 when applied to the top diaphragm produces a deflection of 0.6mm. The capacitance is 370 pF when no pressure is applied to diaphragms. Find the value of capacitance after the application of a pressure of 900 kN/m^2	10+10	**CO4**