Total number of printed pages: 4 **Programme (UG)/ 3rd Semester/Paper Code: UIE303;**

2022

ELECTRICAL AND ELECTRONIC MEASUREMENTS

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. a) What are the difference between recording and integrating instruments? Give pertinent examples for each case. **2**

   b) Match the Column A with Column B **5**

Column-A	**Column-B**
i) Basically a potentiometer is a device for	*A. Thermocouple instrument*
ii) For measuring current at high frequency we should use	*B. Testing of capacitors*
iii) A Schering bridge can be used for the	*C. Measuring high currents and voltages*
iv) C.T. and P.T. are used for	*D. Ammeter and voltmeter*
v) In D.C. circuits, power is measured using	*E. Comparing two voltages*

   c) Explain the Sources of Errors in Bridge measurement. **5**

   d) State the role of guard wire and guard ring in the measurement of high resistance. **2**

   e) A basic slide-wire potentiometer has a working battery voltage of 3.0 volts with negligible resistance. The resistance of the slide-wire is 400 Ω and its length is 200 cm. A 200-cm scale is placed along the slide wire. The slide-wire has 1 mm scale divisions and it is possible to read up to 1/5 of a division. The instrument is standardized with 1.018 volt standard cell with sliding contact at the 101.8 cm mark on scale. **4**

   Calculate

   i) Working current

   ii) Resistance of series rheostat

   iii) Measurement range

   iv) Resolution of the instrument

   f) State the reasons why dc potentiometers cannot be used for ac measurement directly. **2**

2. a) How can shunts be used to increase a PMMC instrument's current range? **4**

b) Discuss the constructional details of a thermocouple-type instrument used at very high frequencies. Also list the benefits and drawbacks of them. **4+4**

c) A 500: 5 current transformer is used along with an ammeter. If ammeter reading is 3.9 A, estimate the line current. **4**

d) A moving-coil voltmeter has a resistance of 100 Ω. The scale is divided into 150 equal divisions. When a potential difference of 1 V is applied to the terminals of the voltmeter a deflection of 100 divisions is obtained. Explain how the instrument could be used for measuring up to 300 V. **4**

3. a) Detail the steps involved in a dc potentiometer's standardization. **5**

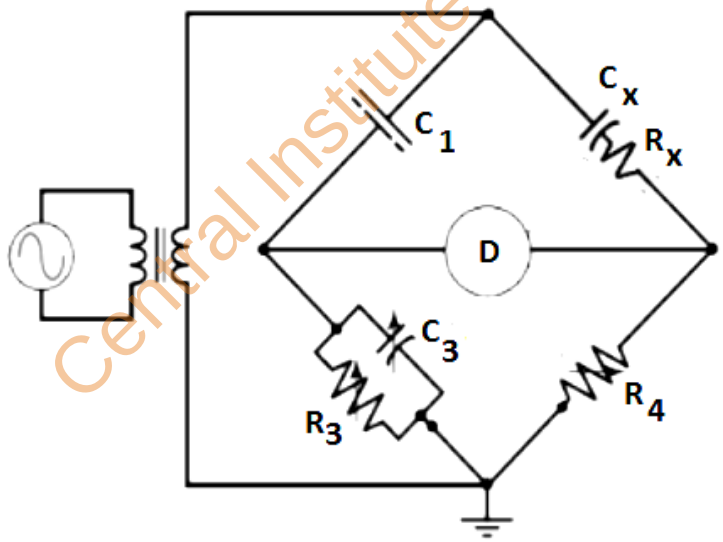
b) Describe the circuit diagram to measure the self-inductance of a coil using an ac potentiometer. **6**

c) A high voltage capacitor is investigated using the Schering bridge shown above. At balance, R3 = 1 KΩ , R4 = 10KΩ , C1= 0.1 μF, C3= 1200 pF **9**

(a) What is the value of unknown capacitance Cx (in μF) and Resistance Rx (in ohm)

(b) What is the dissipation factor of the unknown capacitor if supply frequency is 400 Hz.?

(c) If supply to the bridge is 1 KV at a frequency of 400 Hz, then find the voltage drop (in volt) across the variable arms R4 or R3 II C3)

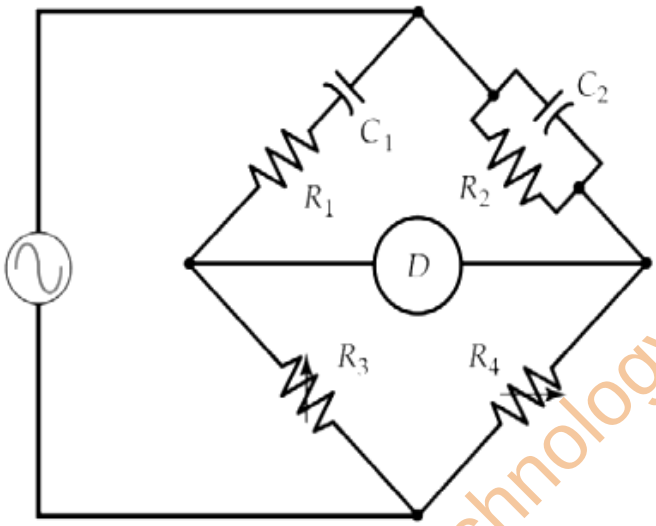


4. a) A highly sensitive galvanometer can detect a current as low as 0.1nA.This galvanometer is used in a Wheatstone bridge as a detector. Each arm of the bridge has a resistance of 1 KΩ. The input voltage applied to bridge is 20V. Calculate the smallest change in resistance which can be detected. Hint: The resistance of the galvanometer can be neglected as compared with the internal resistance of bridge. **7**

b) Explain the working and principle of Electro Dynamometer type wattmeter. Derive the equation of Power. **7**

c) Explain the Loss of charge method for measurement of High resistance. **6**

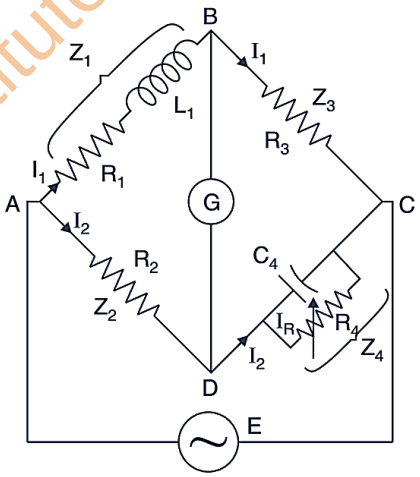
5. a) In the following bridge, R3 = 2 KΩ, R4 = 1 KΩ , C1= C2 = 0.1 µF. To get the bridge balanced at ω= 4000 rad/sec what should be the value of R1 and of R2. **5**



b) Illustrate using a diagram how the Megger insulation tester works. **7**

c) Describe the single phase Induction type energy meter's operation. Also, derive the equation for Energy. **8**

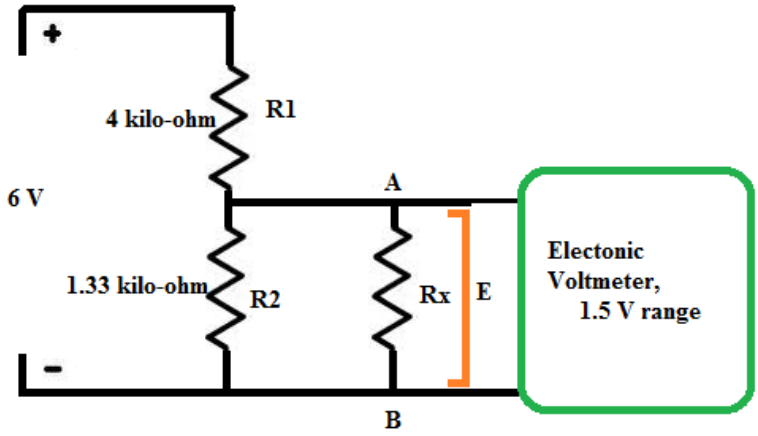
6. a) **7**



Draw the phasor Diagram of the AC Bridge circuit shown above.

b) A dynamometer type wattmeter with its voltage coil connected across the load side of the instrument reads 250 W. If the load voltage be 200 V, what power is being taken by the load? The voltage coil branch has resistance of 2000Ω. **7**

c) **6**



An Electronic voltmeter of 1.5V range. Calculate the voltage reading at i) Open circuit (Rx =∞), ii) Short circuit (Rx = 0) conditions, and iii) Rx = (R1 II R2).

7. Write Short Notes on: (any four) **5 x 4 = 20**

a) Hot wire instrument

b) Electrostatic instruments

c) Potential transformer

d) Series Ohmmeter

e) Polar Potentiometer