

Roll no.

National Institute of Technology, Delhi

Name of the Examination: B.Tech. (Mid Sem Exam)

March 2022

Branch : B.Tech (ECE)

Semester : IV

Title of the Course : Electronics Measurement and Instrumentation

Course Code : ECB 254

Time: 1 Hour 30 Minutes

Maximum Marks : 25

Note: All questions are compulsory.

- Q1. A Maxwell inductance bridge uses a standard capacitor of $C_3=0.1\mu\text{F}$ and operates at a supply frequency of 100 Hz. Balance is achieved when $R_1=1.26\text{ k}\Omega$, $R_3=470\text{ }\Omega$, and $R_4=500\text{ }\Omega$. Calculate the inductance and resistance of the measured inductor, and determine its Q factor. Explain the Maxwell Inductance and Maxwell Inductance Capacitance bridge with balance equations and their equivalent Phasor Diagram. [5 Marks]
- Q2. Calculate the maximum percentage error in the sum of two voltage measurements when $V_1=100\text{ V} \pm 1\%$ and $V_2=80\text{ V} \pm 5\%$. By using a "micrometer screw", the following readings were taken of a certain physical length: 1.001, 1.002, 0.999, 0.998, 1.000 all are in mm. Calculate the following; (i) Arithmetic mean, (ii) Average deviation (iii) Standard deviation, and (iv) Variance. [5 Marks]
- Q3. Define the Accuracy and Precision within application? An $820\text{ }\Omega$ resistance with an accuracy of $\pm 10\%$ carries a current of 10 mA. The current was measured by an analog ammeter on a 25 mA range with an accuracy of $\pm 2\%$, of full scale. Calculate the power dissipated in the resistor, and determine the accuracy of the result. The expected value of the voltage across a resistor is 80 V. However, the measurement gives a value of 79 V. Calculate (i) absolute error, (ii) % error (iii) relative accuracy, and (iv) % of accuracy [5 Marks]
- Q4. Explain Wheatstone bridge and derive the expression for bridge sensitivity. Each of the ratio arms of a laboratory type Wheatstone bridge has guaranteed accuracy of $\pm 0.05\%$, while the standard arm has a guaranteed accuracy of $\pm 0.1\%$. The ratio arms are both set at $100\text{ }\Omega$ and bridge is balanced with standard arm adjusted to $3154\text{ }\Omega$. Determine the upper and lower limits of the unknown resistance, based upon the guaranteed accuracies of the unknown bridge arms. The value of high resistance is measured by loss of charge method. A capacitor having a capacitor of $2.5\text{ }\mu\text{F}$ is charged to a potential of 500 V dc and is discharged through the high resistance. An electrostatic voltmeter, kept across the resistance, reads the voltage as 300 V at the end of 60 seconds. Calculate the high resistance [6 Marks]
- Q5. Identify the bridge used for measurement of inductance and explain the construction and operation of this bridge. In the AC bridge circuit shown in Fig. 1, the supply voltage is 20 V at 500 Hz. Arm ab is $0.25\text{ }\mu\text{F}$ pure capacitance; arm bc is $400\text{ }\Omega$ pure resistances and arm ad has a $120\text{ }\Omega$ resistance in parallel with a $0.15\text{ }\mu\text{F}$ capacitor. Find resistance and inductance or capacitance of the arm cd considering it as a series circuit. [4 Marks]

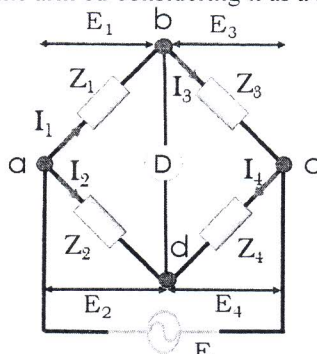


Fig.1 A. C. Bridge