Nepal College of Information Technology
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Tutorial #2
Submission Date: [redacted]

1) The schematic diagram of a Wheatstone bridge with values of the bridge elements as shown in the fig:1. The battery voltage is 5V and its internal resistance negligible. The galvanometer has a current sensitivity of 10mm/μA and an internal resistance of 100 Ω. Calculate the deflection of the galvanometer caused by the 5 Ω unbalance in arm BC.

(33.2mm)

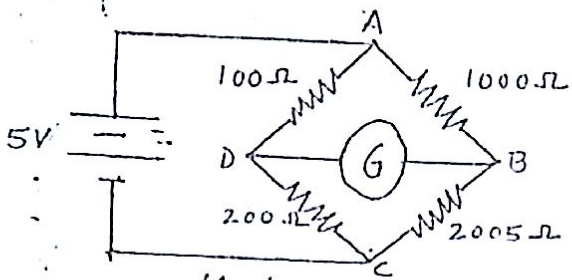

fig: 1

2) The galvanometer of Q.1 is replaced by one with an internal resistance of 500 Ω and a current sensitivity of 1mm/μA. Assuming that a deflection of 1mm can be observed on the galvanometer scale, determine if this new galvanometer is capable of detecting the 5 unbalance in arm BC of fig:1.

(2.24mm)

3) The impedances of the basic ac bridge of fig:2 are given as follows:

Z1=100Ω ∟80° (inductive impedance)
Z2= 250Ω
Z3= 400Ω ∟30° (inductive impedance)
Z4= unknown

Determine the constants of the unknown arm.

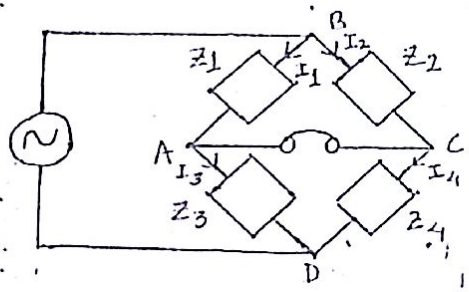

fig: 2.

4) The ac bridge of fig.2 is in balance with the following constants: arm AB, R = 450Ω; arm BC, R = 300Ω in series with C = 0.265 μF; arm CD, unknown; arm DA, R = 200Ω in series with L = 15.9 mH. The oscillator frequency is 1 kHz. Find the constants of arm CD.

(23.9mH)

5) The ac bridge of fig.2 is in balance with the following constants: arm AB, R = 2,000Ω in parallel with C = 0.047μF; arm BC, R = 1,000Ω in series with C = 0.47 μF; arm CD, unknown; arm DA, C = 0.5μF. The oscillator frequency is 1 kHz. Find the constants of arm CD.

6) A bridge is balanced at 1 kHz and has the following constants: arm AB, 0.2 μF pure capacitance; BC, 500Ω pure resistance; CD, unknown; DA, R = 300Ω in parallel with C = 0.1μF. Find the R and C or L constants of arm CD, considered as a series circuit.

(34.3 Ω, 29mH)

7) A 1,000Hz bridge has the following constants: arm AB, R = 1,000Ω in parallel C = 0.5μF; BC, R = 1,000Ω in series with C = 0.5μF; CD, L = 30 mH in series with R = 200Ω. Find the constants of arm DA to balance the bridge. Express the result as a pure R in series with a pure C or L and also as a pure R in parallel with a pure C or L.

8) Consider the circuit of fig.3 and determine whether or not the bridge is in complete balance. If not, show two ways in which it can be made to balance and specify numerical values for any additional components. Assume that bridge arm 4 is the unknown that cannot be modified.

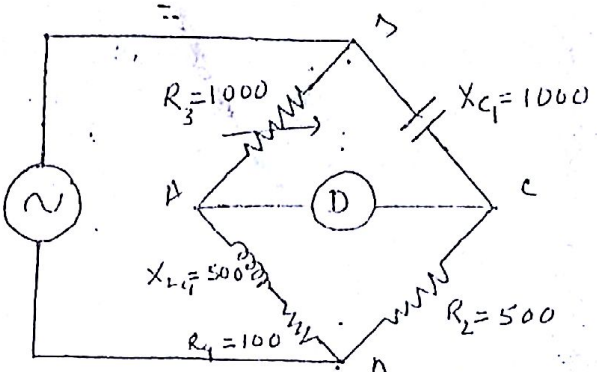

fig: 3

9) An ac bridge has in arm AB a pure capacitance of 0.2μF; in arm BC, a pure resistance of 500Ω; in arm CD, a series combination of R = 50Ω and L = 0.1 H. Arm DA consists of a capacitor C = 0.4μF in series with a variable resistor Rs, w = 5,000 rad/s.

a. Find the value of Rs to obtain bridge balance
b. Can complete balance be attained by the adjustment of Rs? If not, specify the position and value of an adjustable resistance to complete balance.

(1000Ω, 250Ω)

10) An ac bridge has the following constants; arm AB, R = 1,000Ω in parallel with C = 0.158 μF; BC, R = 1,000Ω; CD, R = 500Ω; DA, C = 0.636μF in series with an unknown resistance. Find the frequency for which this bridge is in balance and determine the value of the resistance in arm DA to produce this balance.

Q. What ~~is~~ do you mean by loading effect? Explain loading effect in terms of series and shunt (parallel) connected instruments.

$\frac{R}{1+j\omega RC}$

$R + \frac{1}{j\omega C}$

$\frac{R \times \frac{1}{j\omega C}}{R + \frac{1}{j\omega C}}$