INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY

Date: 29 Mar., 2023 Time: 1 Hour Total Marks: 30 No. of Students: 86

Quiz-2 (9.00 am to 10.00 am) Dept. of Avionics

Sub. No. **AV222**, Sub. Name: **INSTRUMENTATION AND MEASUREMENT**

2nd year B. Tech ECE and EP Students, *Answer All Questions*

Question 1 (7 Marks)

(a) A voltage-signal, X = Asin(400πt) is applied as the input to the circuit, shown in Fig. 1. The circuit should be designed such that its output (say, Y) obeys the following equation, and satisfy the conditions listed next.

$$Y = -X; X > 0$$
$$Y = 0; \ X < 0$$

Conditions:

(1) The circuit should work well even if the amplitude, A is small (in the order of mV).

(2) Single-opamp circuit should be used

(3) Opamp output should not get saturated, during the circuit operation.

Design the circuit so that it fulfils the aforementioned features. Plot a neat-labelled waveform of the output of the opamp of this circuit. Assume ideal opamps and diodes of cut-in voltage of 0.5 V.

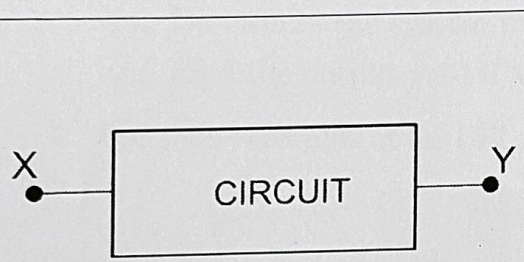

Fig. 1

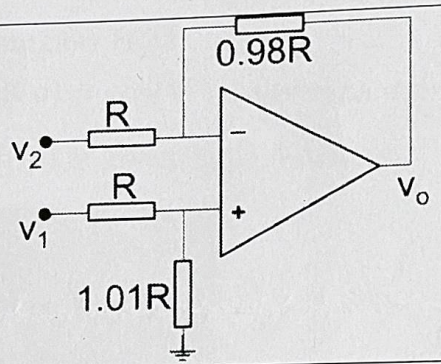

Fig. 2

Question 2 (8 Marks)

(a) Determine the CMRR (in dB) of the differential amplifier shown in Fig. 2. Assume ideal opamp.

(b) Realize and draw the circuit of an Instrumentation amplifier which uses the circuit in Fig. 2, two additional ideal opamps and 3 additional 10 kilo-ohm resistors. Find its overall CMRR (in dB).

Question 3 (10 Marks)

(a) Draw the schematic of a compensated wattmeter. Label its important parts.

(b) Discuss three important differences in the operation and characteristics of a C. T. when compared to a normal voltage transformer.

(c) Draw the circuit diagram of a Deboo's integrator. Mention its 1 merit over conventional integrator circuit.

Question 4 (5 Marks)

Mention whether the following statements are True or not. Give Reason for your answer.

(a) Slew-rate of an opamp can affect the working of a non-inverting amplifier, applied with a sine-wave input.

(b) Hall Effect sensors are fabricated from metals (and not semiconductors).

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