

# COEP Satellite Team Induction Questionnaire

## March 2022 Electronics Section

### General Instructions:

- A. Logical justification to answers is expected.
- B. **Final solution is not important, Your approach is!**
- C. It is **NOT** compulsory to answer all the questions but try to attempt questions even if you don't get the final answer.
- D. Use any source of information, but provide reference at the end of the solution.
- E. Physics section carries equal weightage for all the applicants.
- F. Answers should be submitted through  
<https://forms.gle/G7vhkzpcbhYscPSD8>
- G. The answers submitted on the Google form should be in a **single ".pdf"** document. A .zip file with photos/.pdf files of individual answers will **not** be accepted. You can scan / take photographs if you have handwritten some of the answers and convert it into .pdf format.
- H. Solutions in a **.txt file** will also be acceptable.
- I. Please make sure that you mention the following details on your answer sheet.
  - 1. **Name**
  - 2. **MIS**
  - 3. **Branch**
  - 4. **Gmail id** (If you don't have gmail account then please create one)
  - 5. **Contact number**
- J. Deadline for submission : **March 14 2022,11.59 p.m.**
- K. Preferred branches : E&TC, Electrical, Instrumentation and Control.
- L. Please feel free to Whatsapp or Call **Abhishek Salunke (8830723564)** or **Simran Manghwani (9307604662)** or **Hrishikesh Kembhavi (9307532602)** for any doubt.

## Physics:

1) The Men In black have intercepted and decoded a suspicious alien message:

"Earth is getting suspicious of our activities. Urgently contact code zero when the bases align next fastest."

On investigating further, it is found that the message came from a planet system having two planets orbiting around their common center of mass, located in the galaxy far far away.

In this planet system planet A has mass 25 times that of planet B. The rotation time is inversely proportional to the square root of their masses. The heavier planet has a new year every 10 days and completes orbit in 5760 hrs. Both the planets have Major communication bases which can directly communicate only when both the bases and the center of mass are collinear.

After How much time the Men in black will intercept the next message ?

One year = Time for the planet to orbit around the center of mass

One day = Time for the planet to rotate around itself once

2) At instant  $t = 0$ , a rod of mass  $m$ , length  $l$  is kept vertically on a completely frictionless surface and released.

a) Describe the motion of the following points with respect to your frame of reference as well as with respect to the center of mass frame of reference:

i) Lowest point

ii) Center of mass

iii) Highest point

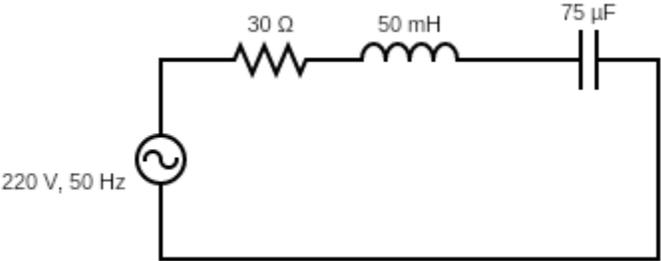
b) Is the motion combined with rotation and translation ?

c) Is there any movement of the lowest point in the vertical direction ?

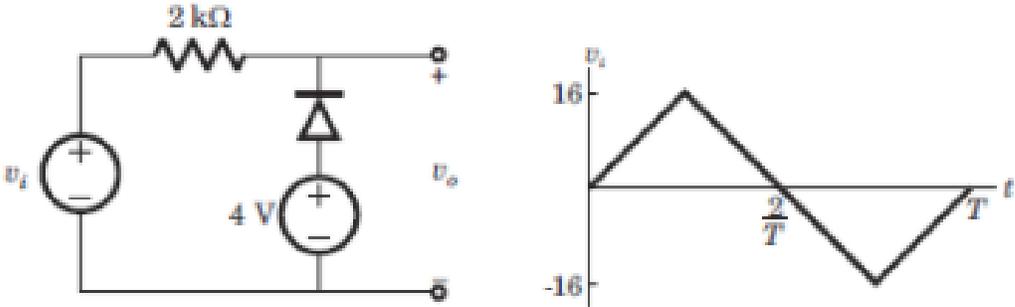
d) Is the center of mass Frame inertial?

**Electronics:**

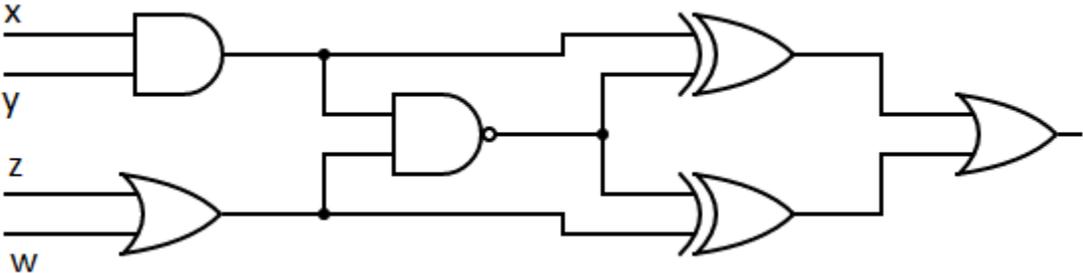
Q1. What is the nature of the load in the circuit shown below? Which circuit parameters should be changed to minimize the overall impedance of the circuit. What is the effect of the above result (minimum impedance) on the Power of the circuit?



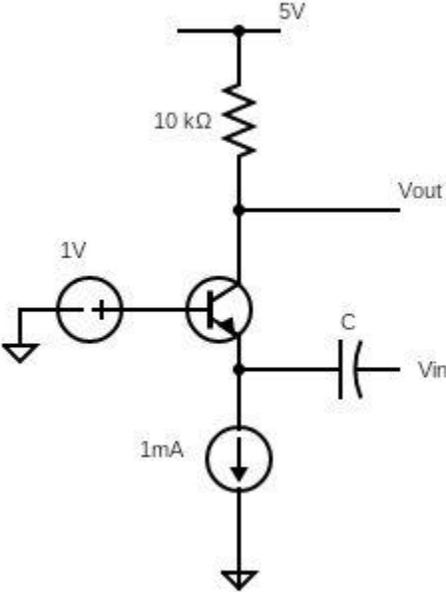
Q2. Draw the output waveform of a given circuit.



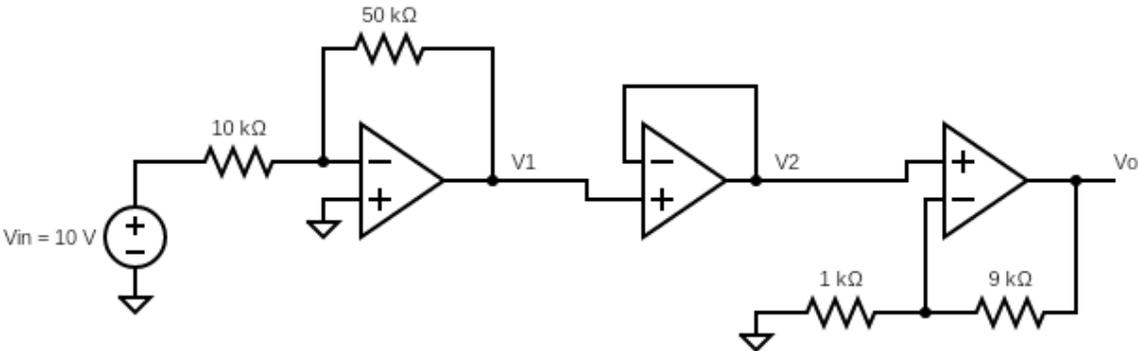
Q3. In the diagram given below suppose the propagation delay of each gate is 10ns. Calculate the overall delay in the circuit . Also draw a response waveform for the circuit.



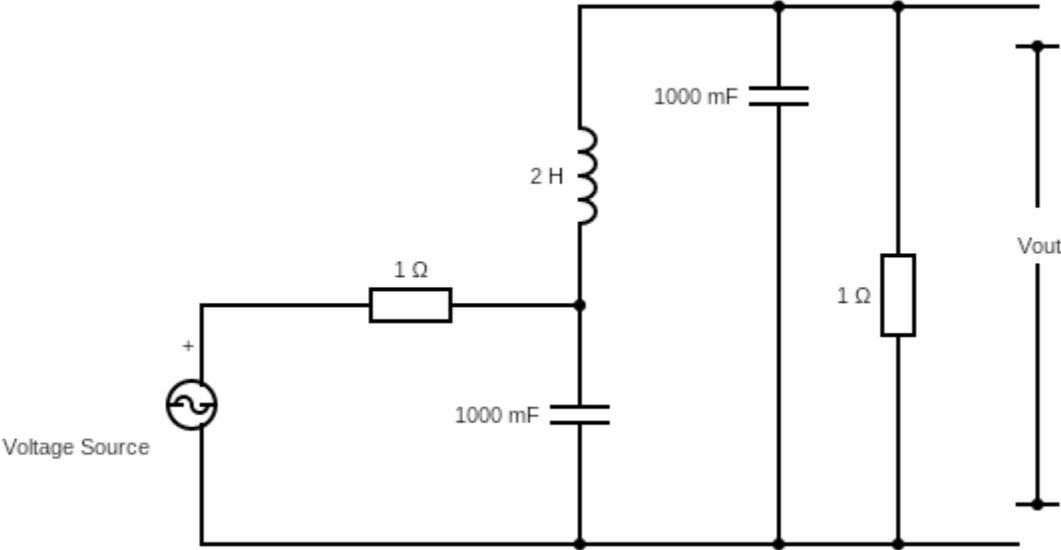
Q4. For very high values of  $\beta$ , find  $V_{out}/V_{in}$ . Assume  $V_{in}$  as Ac signal.

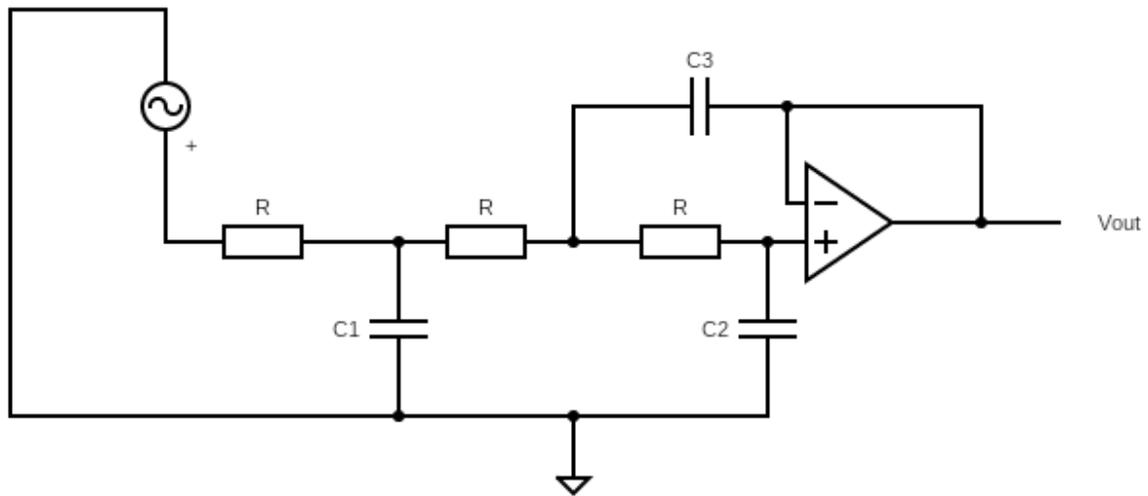


Q5. In the circuit given below , Calculate the voltage V1 , V2 and Vo . Also comment about the total gain (in terms of gain of each OP AMP) .

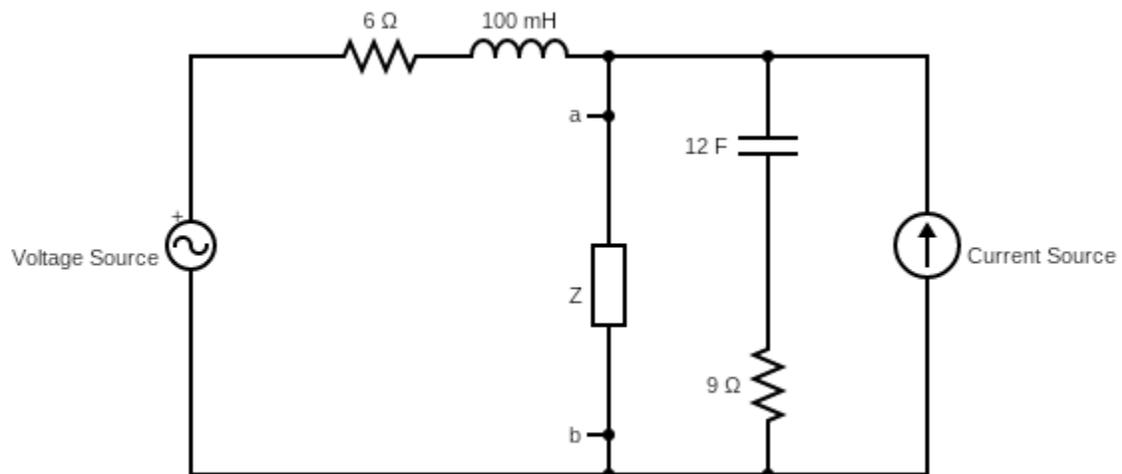


Q6. Given below are two circuits, Find how will the two circuits be approximately the same? If the two circuit are equal find their response when input to the circuit is  $25e^{-t}u(t)$   $R = 1\ \Omega$ ,  $C_1 = 1.394\text{ F}$ ,  $C_2 = 0.202\text{ F}$ , and  $C_3 = 3.551\text{ F}$



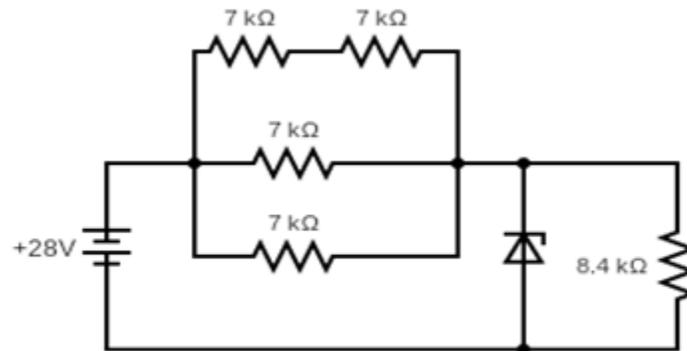


Q7. For the given circuit, Find the voltage across the Z element in the given circuit using Norton theorem, i.e. voltage between the point a and b. Voltage Source of 20V and current source of 0.4A.

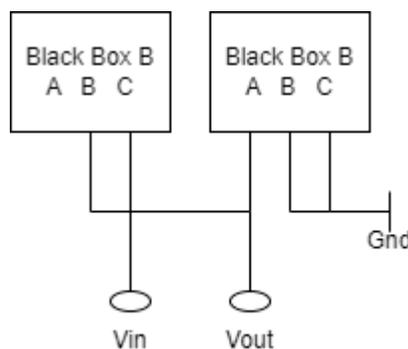


Q8. Look at the circuit given below which consists of 4 resistances 7 kilo ohm each and a Zener diode. A DC source providing a potential difference of 28V is applied to the circuit. When a load of 8.4 kilo ohm is connected to the circuit (shown in the diagram) calculate the current flowing through the Zener diode and mark the direction of the current.

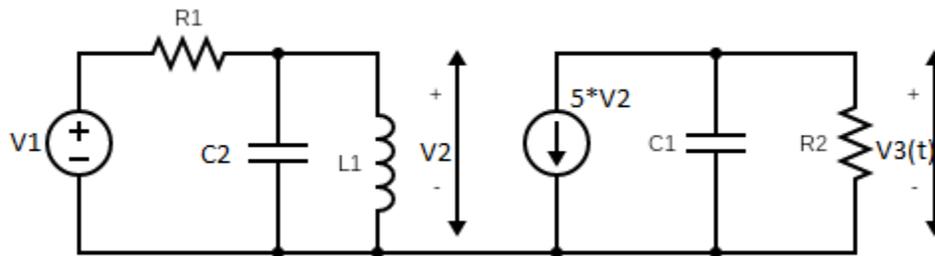
( $V_z = 5.6V$ )



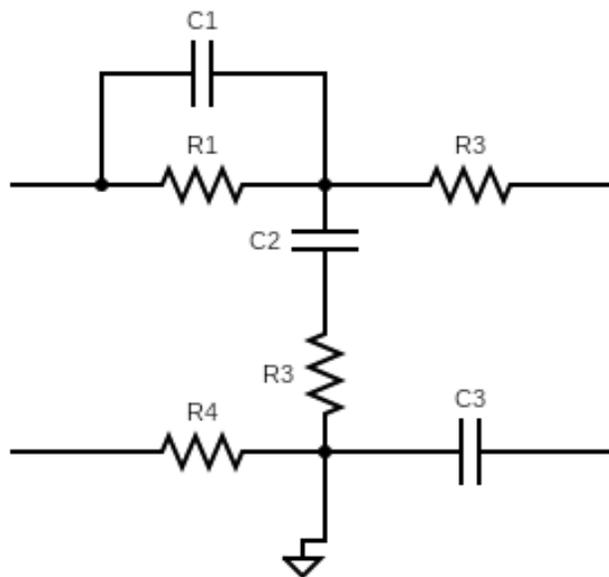
Q9. Himanshu made a 3 terminal N type semiconductor device and called it as black box B. Three terminals are Named as 'A', 'B', 'C'. when B and C terminals are shorted then, the circuit always remains in saturation and behaves with exponential I-V characteristics. And it is observed that the current going from terminal C is 0. Himanshu then gave this circuit to vaibhav to find output voltage of the following circuit. What will be the answer given by Vaibhav if input is 2 volt sine wave with 50 hz frequency? Assume  $V_{cc}$  and GND whenever necessary.



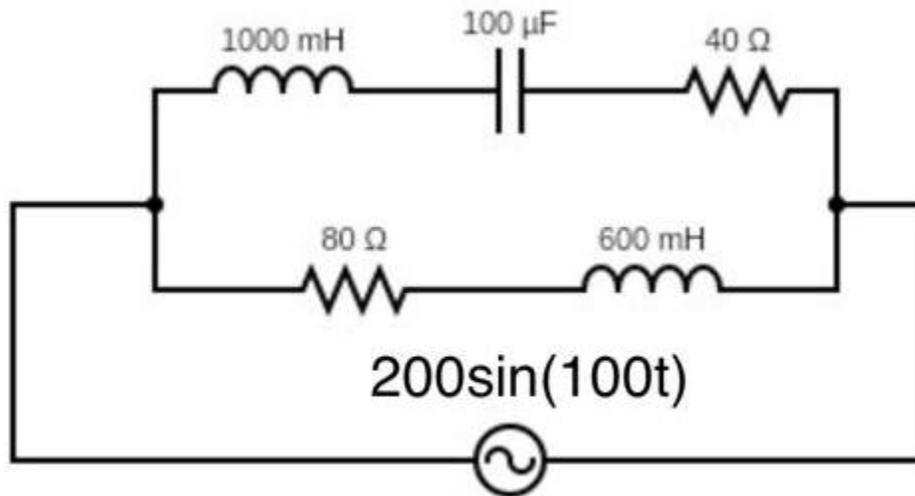
Q10. Signal  $V_1(t)$  is a delta signal with amplitude of 5V, which determines the transfer function in frequency domain  $H(s) = V_3(s)/V_1(s)$ .



Following is a circuit of a two-port network. Visualize and redraw the circuit in such a way that it represents a series combination of two or more two-port networks



Q11.



Find:

- Power in upper branch
- Power factor of upper branch and Phase angle
- Power in lower branch
- Power factor of lower branch and Phase angle