1

1.a In the circuit shown below, determine the current flowing through the 10V voltage source.

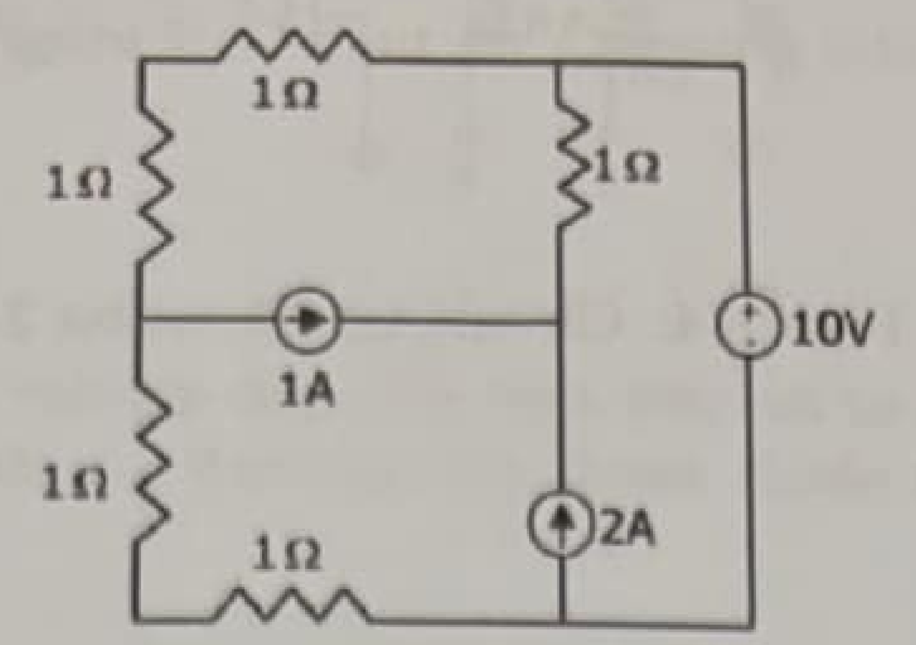

Figure 1: Circuit for Question 1.a.

(1.a: 4pt)

1.b The switch in the following circuit was on position 'a' for a long time, and then moved to position 'b' at time $t = 0$. Determine the current $i(t)$ at $t > 0$.

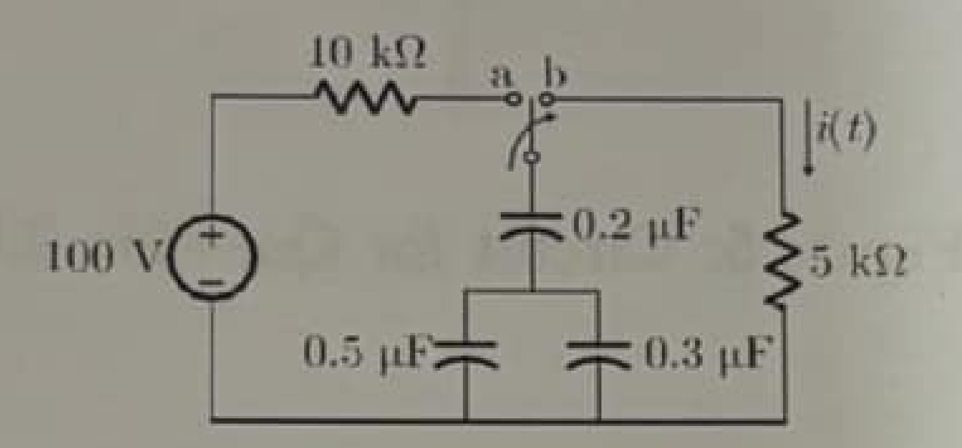

Figure 2: Circuit for Question 1.b.

(1.b: 3 pt)

1.c For the circuit shown below, $R_1 = R_2 = R_4 = 1\Omega$ and $R_3 = 1.1\Omega$. Determine the value of the voltage drop V_{ab}.

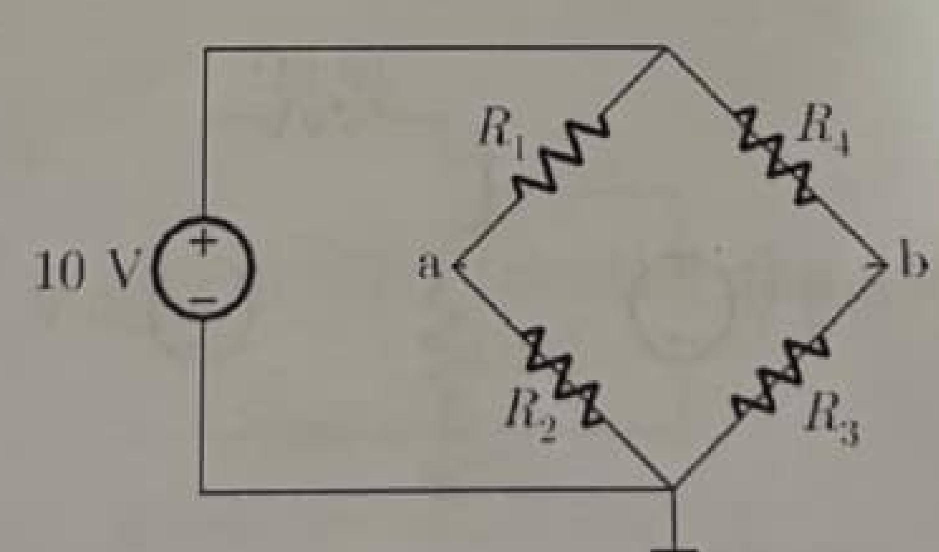

Figure 3: Circuit for Question 1.c.

(1.c: 3 pt)

(Sub-Total Question 1: 10 pt)

2

2.a Determine the value of current I through the resistance r in the following circuit.

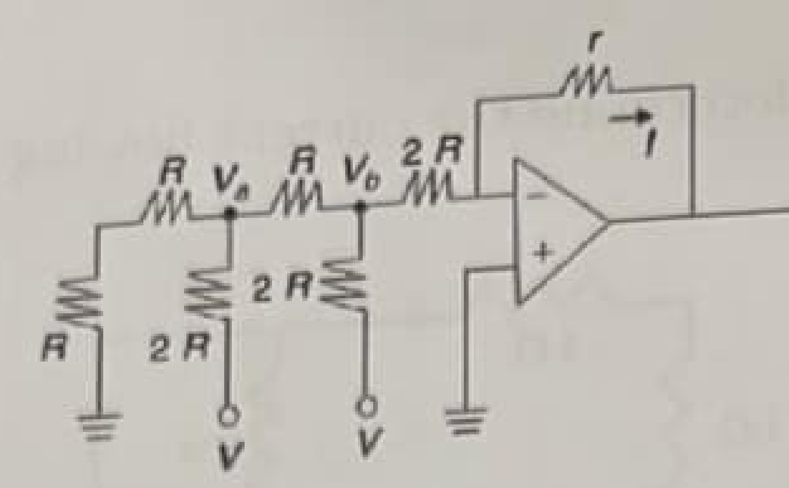

Figure 4: Circuit for Question 2.a.

(2.a: 5 pt)

2.b Determine the value of the output voltage in the following circuit.

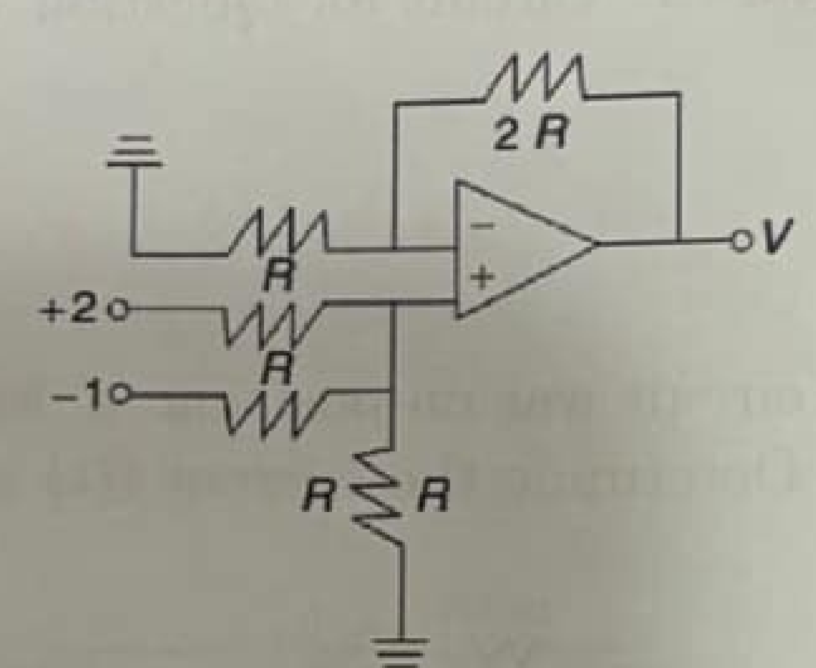

Figure 5: Circuit for Question 2.b.

(2.b: 5 pt)

(Sub-Total Question 2: 10 pt)

3

3.a In the following circuit, assume that β is very large and $V_{BE} = 0.7V$. Determine the mode of operation of the BJT.

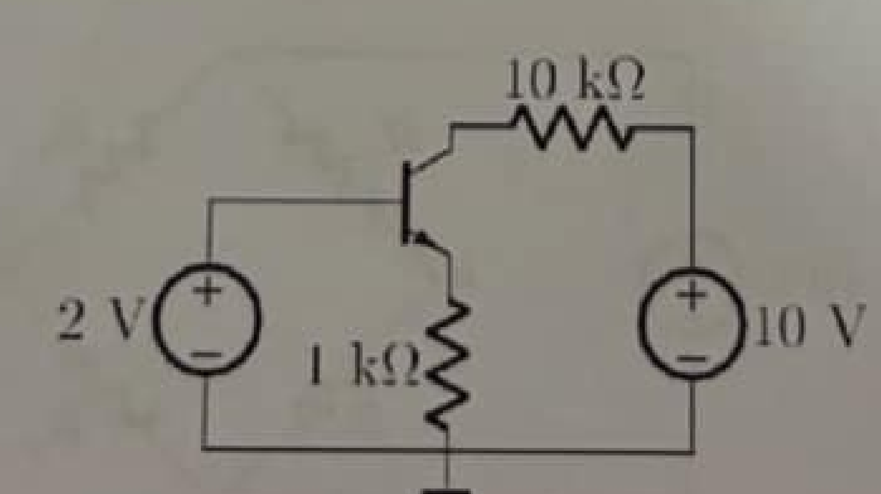

Figure 6: Circuit for Question 3.a.

(3.a: 4 pt)

3.b In the following circuit, determine the current through the ideal diode ($V_{BE} = 0V$).

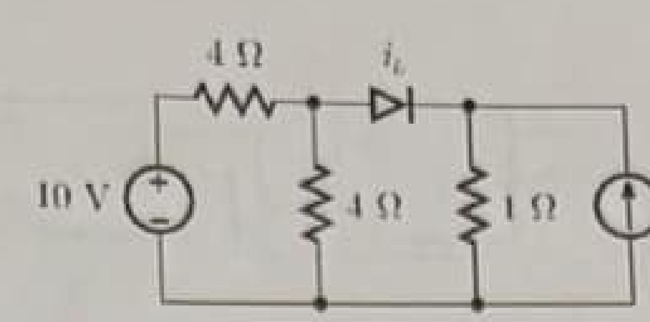

Figure 7: Circuit for Question 3.b.

(3.b: 4 pt)

3.c Draw a hand sketch of the voltage drop V_R with respect to time. Show the voltage values and the required calculations. Assume the Zener diode to be ideal with a breakdown voltage of $6V$.

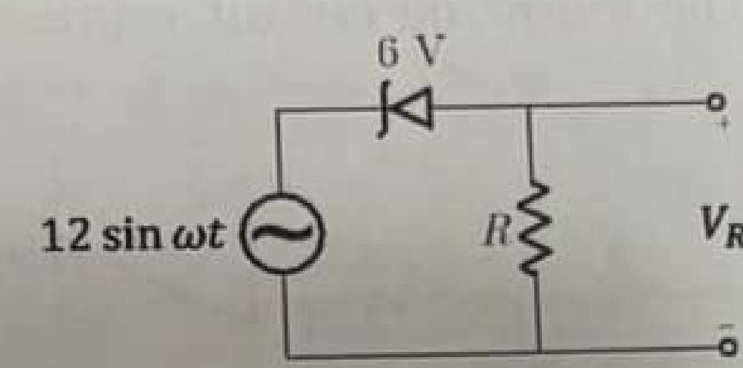

Figure 8: Circuit for Question 3.c.

(3.c: 2 pt)

(Sub-Total Question 3: 10 pt)

4

4.a If $X = 1$ in the following logic equation, determine $Y =?$ and $Z =?$.
$[X + Z\{\bar{Y} + (\bar{Z} + X\bar{Y})\}]\{\bar{X} + \bar{Z}(X + Y)\} = 1.$

(4.a: 2 pt)

4.b Simplify the following Boolean expression using K-map and design the circuit using NAND gates only.
$F(w, x, y, z) = wy + xy + \bar{w}xyz + \bar{w}\bar{x}y + xz + \bar{x}\bar{y}\bar{z}.$

(4.b: 3 pt)

4.c For the following circuit, $Y = AB + \bar{C}\bar{D}$. Identify the gates $G1$ and $G2$.

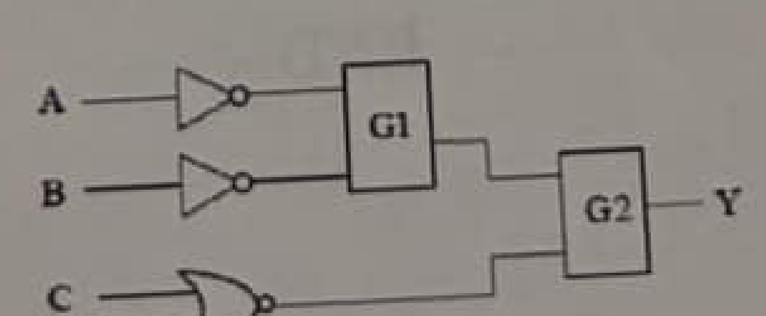

Figure 9: Circuit for Question 4.c.

(4.c: 2 pt)

4.d For following circuit, $t < t_0, Q_1 = Q_2 = 0$. The input X is shown in the figure. Draw a hand sketch of the output Y.

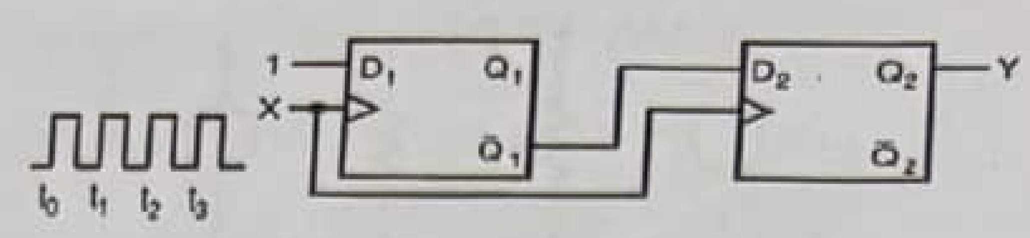

Figure 10: Circuit for Question 4.d.

(4.d: 3 pt)

(Sub-Total Question 4: 10 pt)

5

5.a Determine the type of filter the following circuit represents. Motivate your answer.

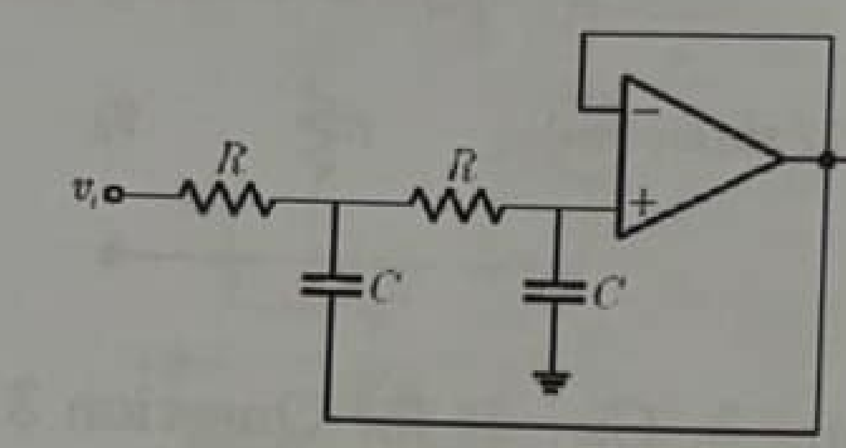

Figure 11: Circuit for Question 5.a.

(5.a: 5 pt)

5.b In the following circuit, input $v_i = V_p cos(t/RC)$. Determine the steady-state output v_o.

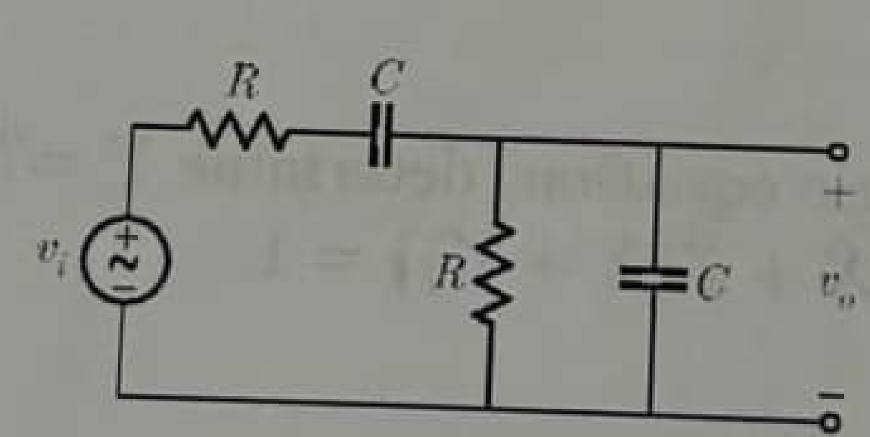

Figure 12: Circuit for Question 5.b.

(5.b: 5 pt)

(Sub-Total Question 5: 10 pt)

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