CSU11031 Electronics Assignment 1

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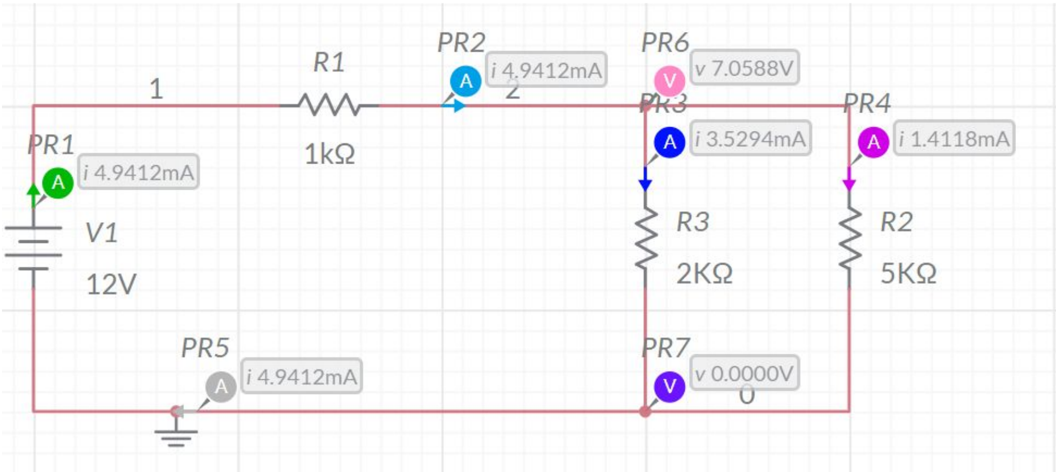
1.



(i) <u>Total Resistance of the circuit</u>

$R_{Total} = R_1 + R_2$

$\frac{1}{R2} = \frac{1}{2} + \frac{1}{5}$

$= \frac{5}{10} + \frac{2}{10}$

$= \frac{7}{10}$

$\frac{1}{R2} = \frac{7}{10}$

$10 = 7R_2$

$\frac{10}{7} = R_2$

$R_{Total} = \frac{10}{7} + 1$

$R_{Total} = \frac{17}{7}$ kΩ

<u>Current</u>

$I = \frac{V}{R}$

$I = \frac{12}{\frac{17}{7}}$

$I = \frac{84}{17}$

I = 4.9412A = PR1 = PR2 = PR5

<u>Voltage at Node 2</u>

PR6 = 7.0885V

$V_2(t) = v(t)(\frac{R2}{R + R2})$

$V_2 = 12(\frac{\frac{10}{7}}{1+\frac{10}{7}})$

$V_2 = 12(\frac{10}{17})$

$V_2 = 7.0588$ V

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Currents in parallel

PR3 = 3.529mA

V = IR

7.0588 = I(2)

$\frac{7.0588}{2}$ = I

3.5294mA = I

PR4 = 1.4118mA

V = IR

7.0588 = I(5)

$\frac{7.0588}{5}$ = I

I = 1.4118mA

Voltage at PR7

V = IR

V = .0035294(2000)

V = 7.0588V - 7.0588V

= 0V

V = IR

V = .0014118(5000)

V = 7.0588 - 7.0588

= 0V

(ii) Current Law

$I_1 + (-I_2) + (-I_3) = 0$

4.9412 - 3.5294 - 1.4118

4.9412 - 4.9412

= 0

(iii) Voltage Law

$$\sum_{loop} V\,branch = 0$$

$E_v - V_1 - V_2 = 0$

V = IR

V = 1(4.912)

= 4.912

V_1 = 4.912

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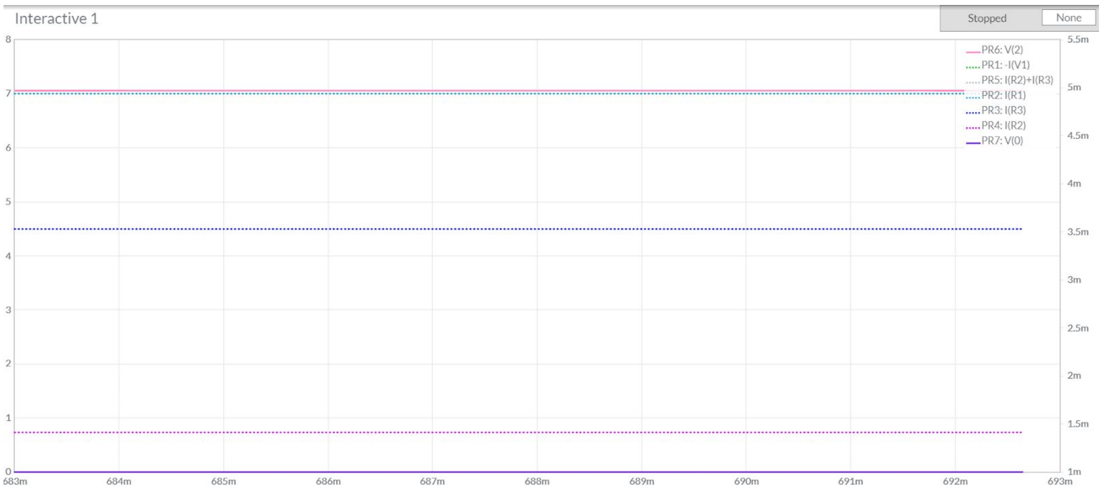
$V_2 = 7.0588$

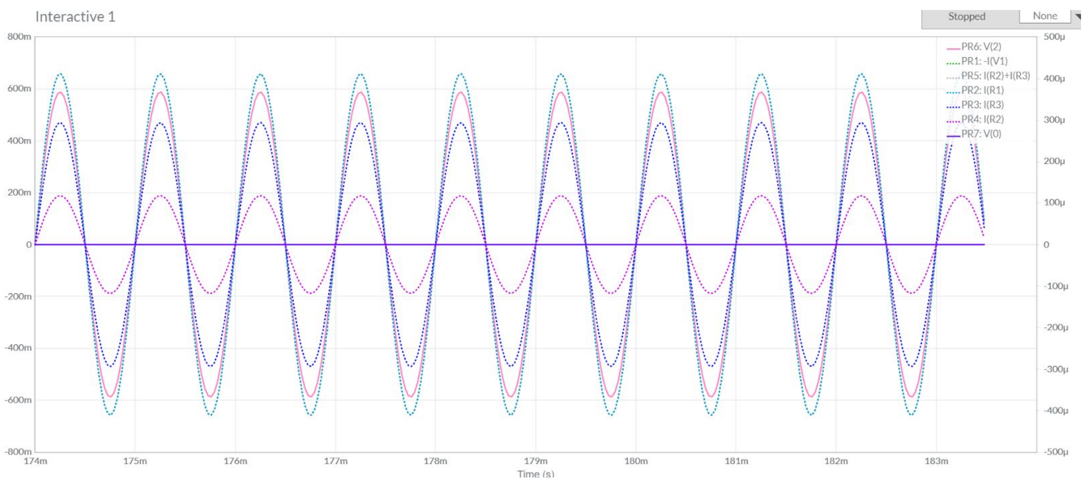
$12 - 4.9412 - 7.0588$

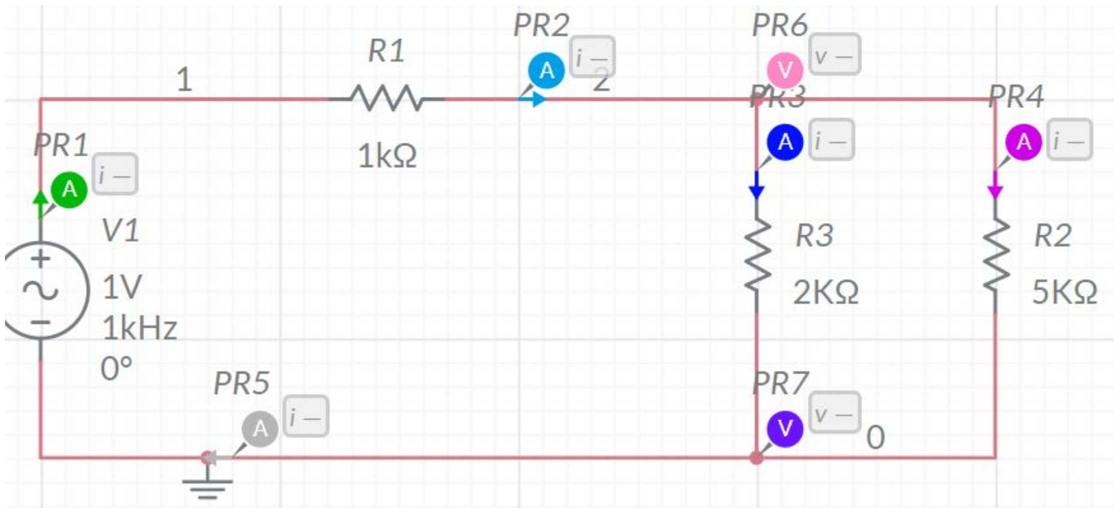
$12 - 12$

$= 0$

(iv)







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The DC source has a steady output that can be observed on the graph. The AC source gives a sinusoidal output pattern due to the current changing direction.

2.

(i)

(i)

The lamp turns on as the simulation starts and shines yellow. The resistance is low so the current flowing through is high and the light is bright.

V1 = 40V

R1 = 80Ω

Lamp = 10Ω

I = $\frac{40}{80+10}$

I = $\frac{40}{90}$

I = 0.4348A

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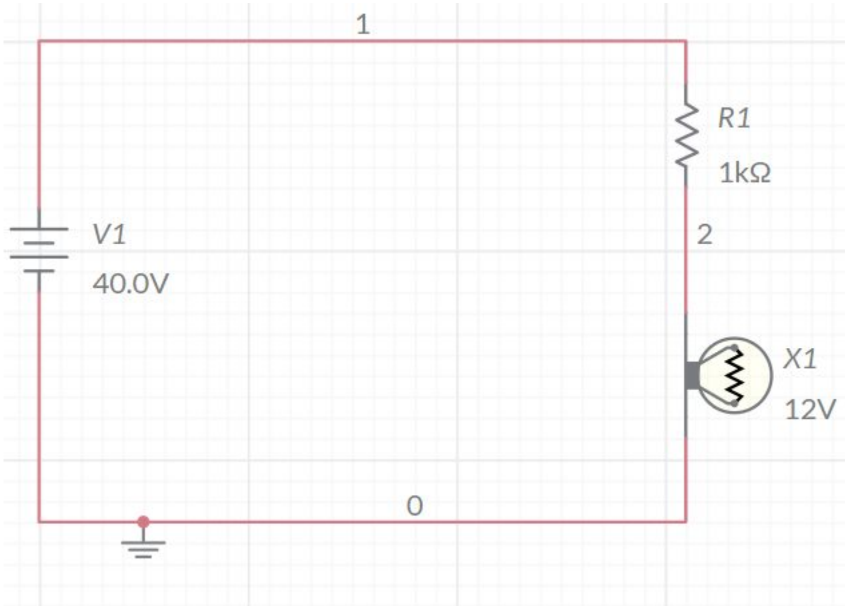
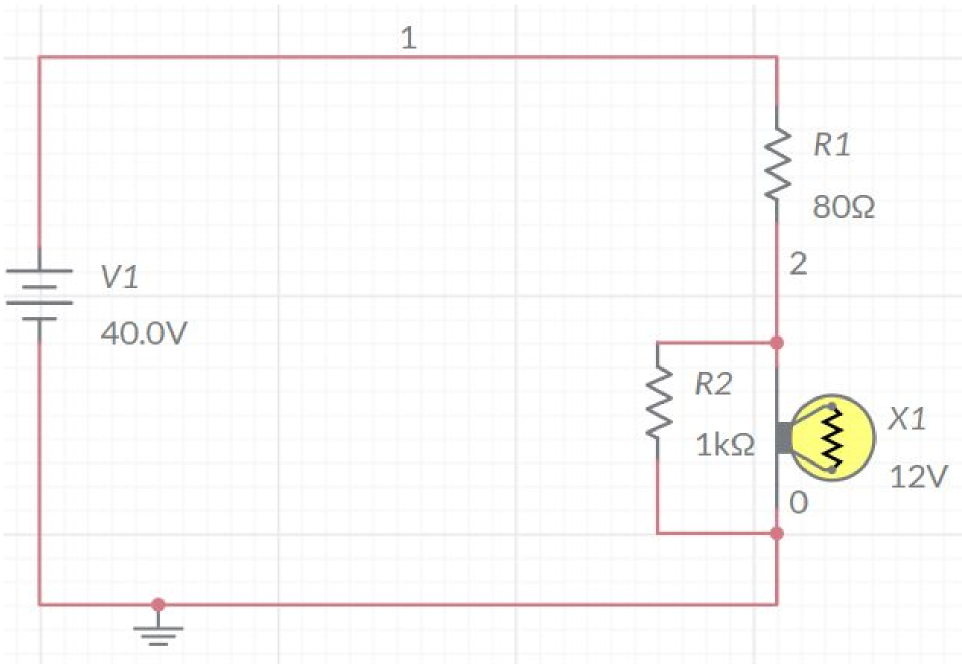


(ii)

The resistance is too high so the light doesn’t shine.



(iii)

This time the lamp turns on.

V = 40V

R1 = 80Ω

$\frac{1}{R2} = \frac{1}{10} + \frac{1}{1000}$

(1000) = 101R2

$\frac{1000}{101}$ = R2

R2 = 9.90099Ω

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$$I = \frac{V}{R1 + R2}$$

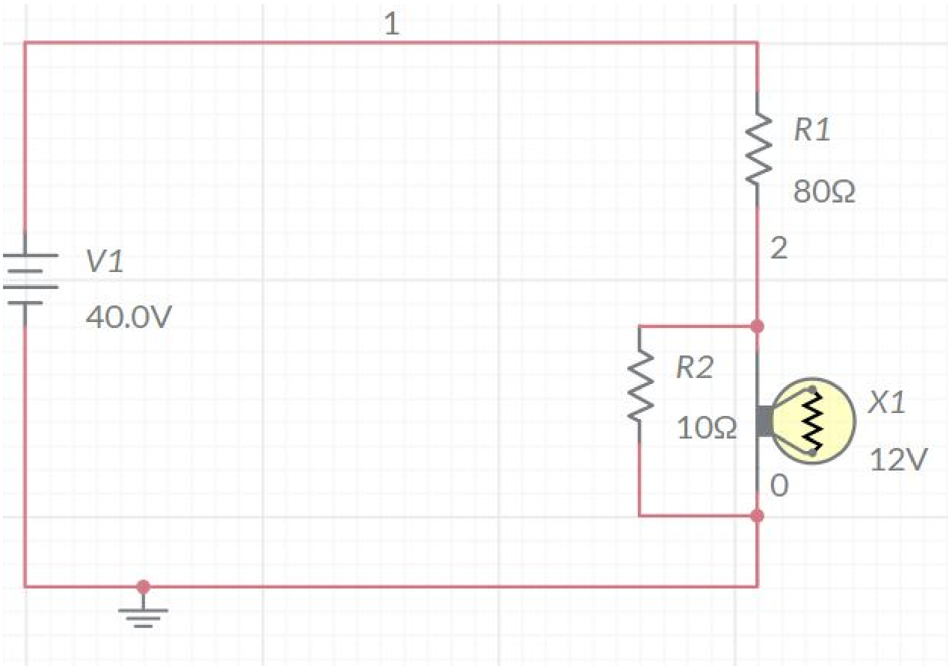
$$I = \frac{40}{80 + 9.90099}$$

$$I = \frac{40}{89.90099}$$

I = 0.44493A

Adding the resistors in parallel means the total resistance will decrease. Ohms law tells us that when the resistance is lower the current is higher.

(iv)



The lamp is on but with a very low light. The resistor and the lamp both have a resistance of 10Ω. Therefore the current is split between them evenly which means the current going through the lamp is halved and the light is slightly dimmer than it was previously.