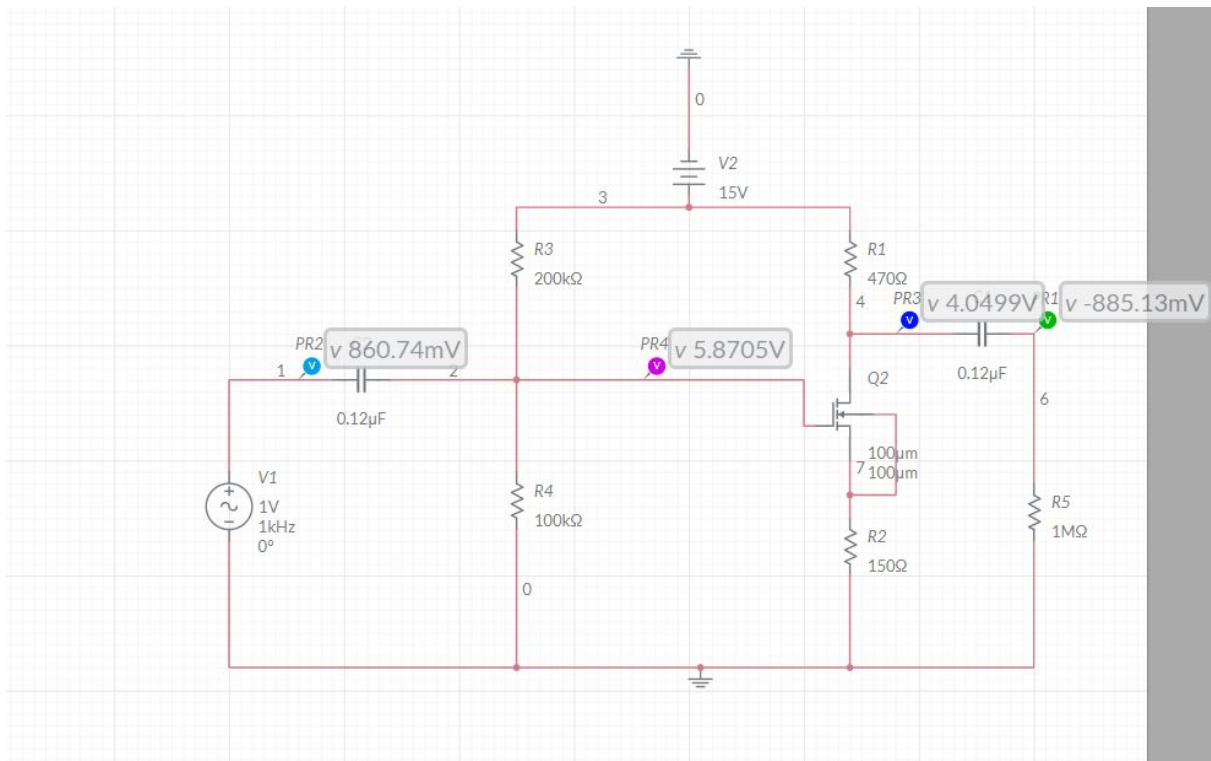
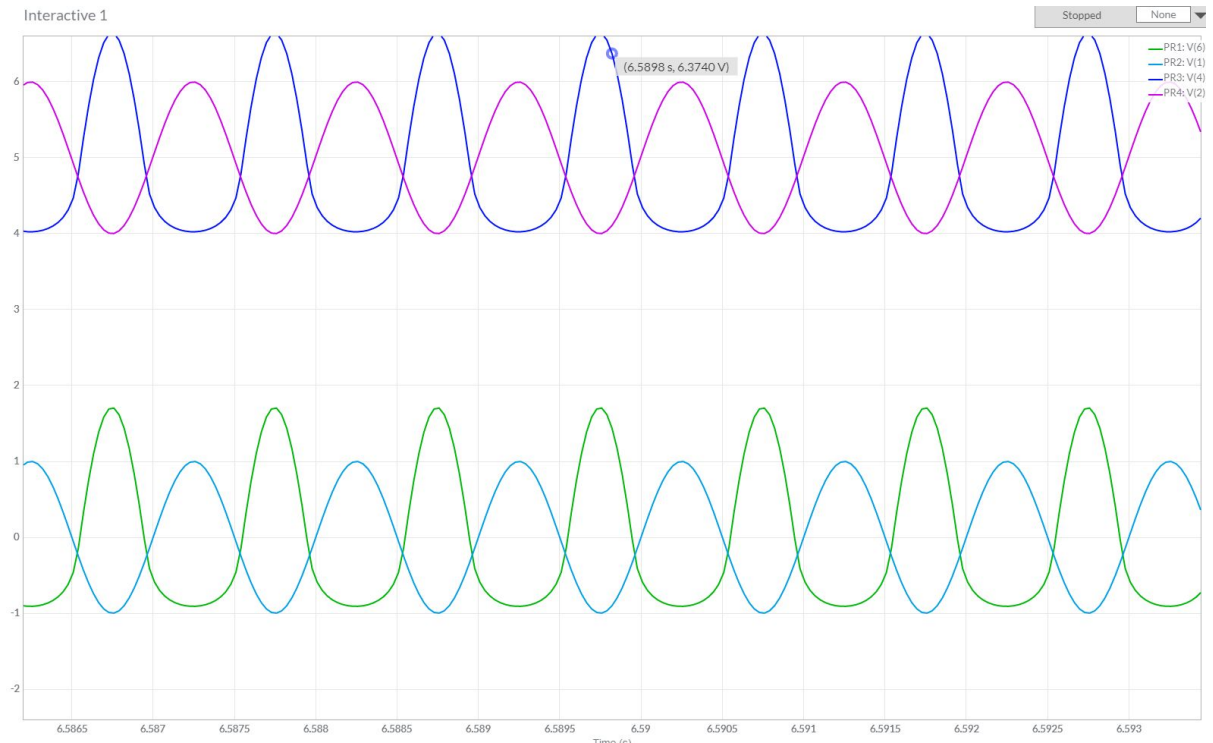


CSU11031 Electronics Assignment 2

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(i)

The voltages are all sinusoidal waves. The voltage at PR4 is much higher than the voltage at PR2 due to the capacitor that is between them. The reason the voltage is cycling like this is that the ac source flowing through the capacitor means the capacitor is constantly working in a loop, changing the voltage in cycles. The voltage at PR3 to PR1 works in much the same way and the capacitor is constantly working

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in a loop and changes the voltage. The transistor aids in the amplification of the voltage at PR3 and PR4.

(ii)

The voltage at the gate of the resistor when the ac source is at zero volts

$$V_{out} = \frac{V_{DD}R_{on}}{R_D + R_{on}}$$

$$R_{on} = 100000$$

$$R_D = 200000$$

$$V_{DD} = 15$$

$$V_{out} = 15 \left(\frac{100000}{200000 + 100000} \right)$$

$$V_{out} = 15 \left(\frac{1}{3} \right)$$

$$V_{out} = 5V$$

(iii)

The source for the entire circuit is the A.C. supply and the D.C. source is used to allow current to flow backwards (losing gate control). The NMOS is expected to block the current drain to the source until the gate is activated. The DC offset is to prevent the polarity switching. When the threshold voltage is reached the channel between the source and the drain is formed. Above the value the drain current increases in proportion to $(V_{GS} - V_{TH})$ which allows it to work as an amplifier.

(iv)

The potential divider provided by the two paths of resistance creates a dc gate voltage. The signal that enters the transistor has a dc component. If the dc component reaches a certain value then the transistor will not switch off even when the ac source gives a negative input. The capacitor at the input allows the ac to pass through but does not allow dc to the source. In other words, the capacitors are there in order to isolate the dc bias of the circuit and they provide negligible reactance at the frequencies of operation.

(v)

The output voltage is inverted, 180° with respect to the input voltage. The reason for this is that as the input voltage increases, the current increases through the base circuit. Essentially, as the base voltage increases the base current increases. If the base current increases then the collector current increases. For a fixed collector resistor, when the collector current increases, the collector voltage decreases.

(vi)

Gain of the Amplifier

$$G = \frac{V_{out}}{V_{in}}$$

$$\text{When } t = 1.4728s$$

$$V_{Out} = 1.7017V$$

$$V_{In} = -998.49mV$$

$$G = \frac{1.7017}{-0.99849}$$

$$G = -1.704273G$$

This is the gain of the amplifier.