1. A periodic waveform is shown in Figure 1.

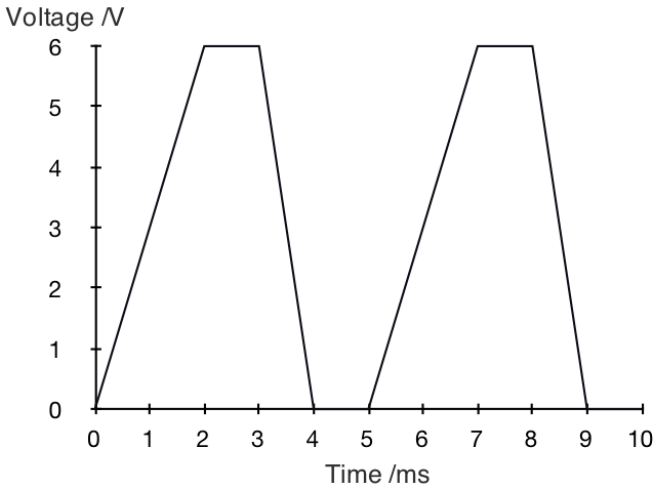


Figure 1: Waveform for question 1

(a) Express the voltage waveform as a set of mathematical equations for one period.

(b) Determine:

i. the instantaneous voltage at 1ms,

ii. the peak voltage, and

iii. the RMS voltage.

(c) If the waveform in Figure 1 is the voltage across a 1μF capacitor, determine and sketch (with labelled axes) the **current** through the capacitor for one period.

(17 marks)

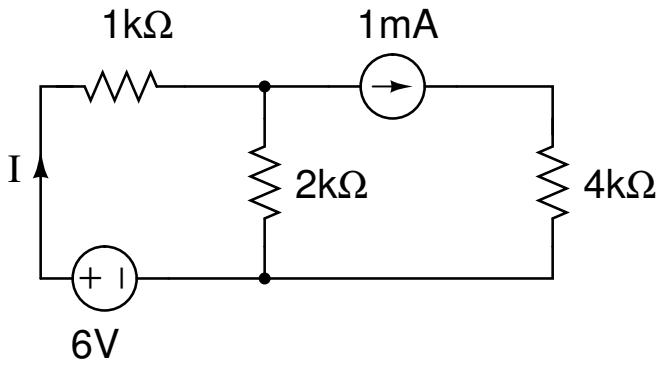


Figure 2: Circuit for question 2.

2. Using *loop analysis* determine the potential difference (or voltage) across the 2kΩ resistor and find the current I in Fig. 2

(8 Marks)

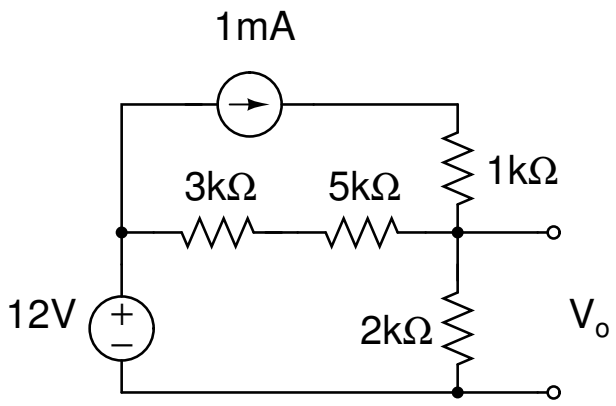


Figure 3: Circuit for question 3

3. Use *superposition* to determine V_0 in the circuit shown in Figure 3. Clearly show the circuits used in your analysis.

(10 Marks)

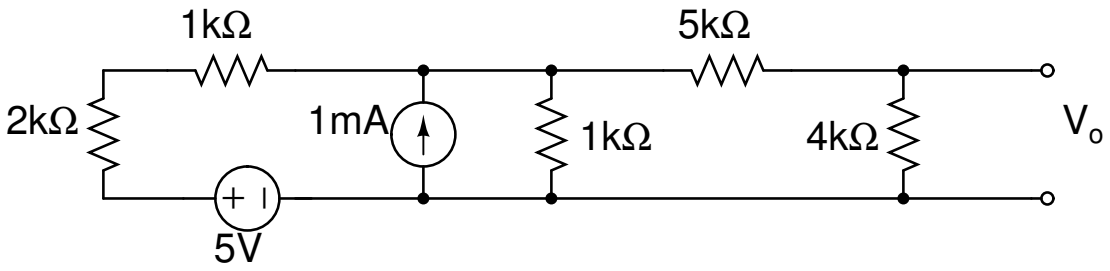


Figure 4: Circuit for question 4

4. Use *source transformation* to determine V_o. Include clear circuit diagrams to illustrate the transformations and solution.

(12 Marks)

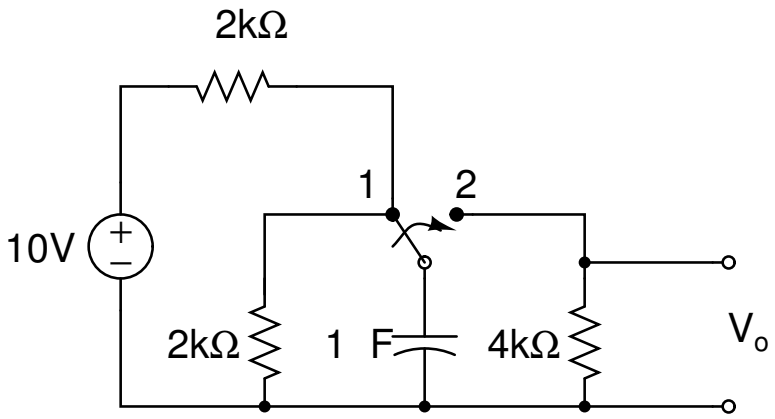


Figure 5: Circuit for question 5

5. At time, t=0, the switch in the circuit shown in Figure 5 is moved from position 1 to position 2. Prior to t=0, the switch had been in position 1 for a long time. Determine an expression for V_0 for time, $t \geq 0$.

(12 Marks)

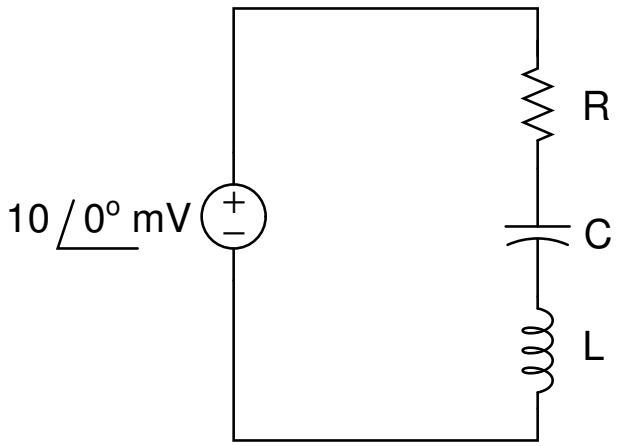


Figure 6: Circuit for question 6

6. The circuit in Figure 6 is required to resonate at a frequency of 3.580MHz. The following values have already been selected R=50Ω and L=1mH.
   (a) Determine the required value of C for attaining resonance.
   (b) What will be the circuit impedance at resonance?
   (c) What will be the voltage across the resistor at resonance?
   (d) What will be the current in the circuit at resonance?
   (e) What will be the circuit's Q?

(10 Marks)

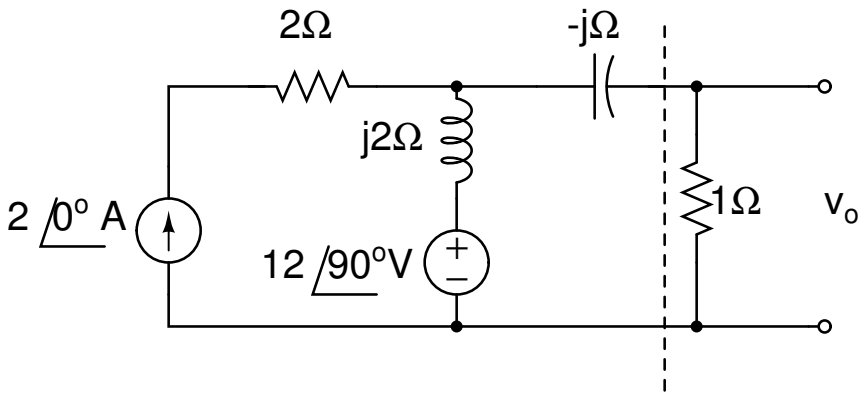


Figure 7: Circuit for question 7

7. Determine and sketch the *Thevenin equivalent circuit* for the circuit to the left of the dashed line in Figure 7. Then find the voltage, v_o, shown in Figure 7. Express the result using phasor notation.

(11 Marks)

8. Given the transfer function

$$G(j\omega) = \frac{j\omega(j\omega+100)}{100\left(\frac{j\omega}{10}+1\right)}$$

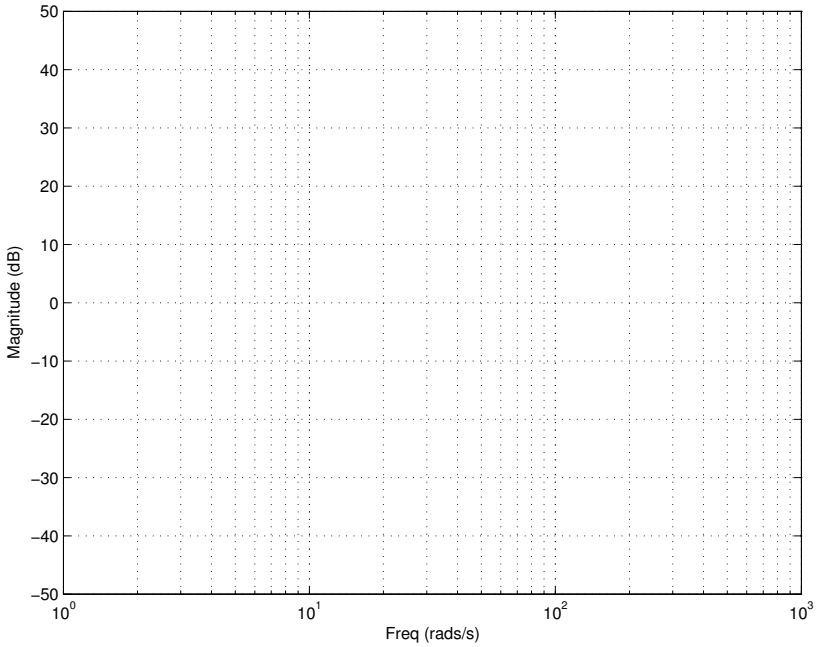
(a) Determine the constant factor and break points, or corner frequencies, of the transfer function.

(b) Draw on the provided graphs (see next page) the Bode magnitude and phase components of each of the individual elements of the transfer function. Clearly label the elements.

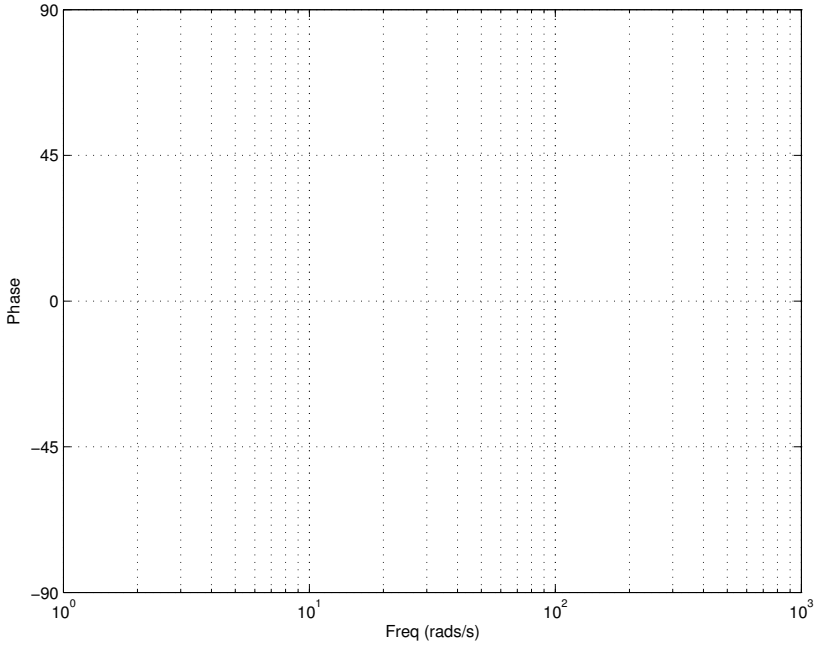
(c) On the same graphs draw the composite magnitude and composite phase Bode plots of the transfer function. Clearly label these composite plots.

(14 Marks)

Graph sheet for drawing individual and composite magnitude Bode plots.



Graph sheet for drawing individual and composite phase Bode plots.



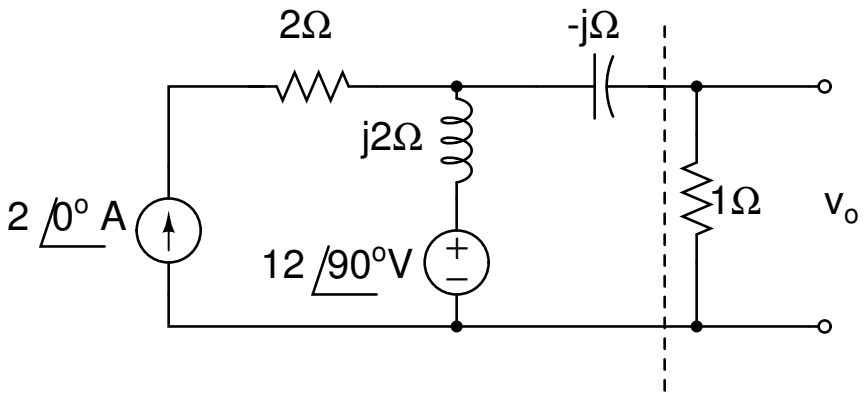


Figure 8: Circuit for question 9 (a repeat of the circuit in question 7)

9. Determine the average power in each of the components, *excluding the sources*, of the circuit in question 7. Note, the circuit is shown again in Figure 8 and any results from question 7 can be used in this question.

(6 Marks)

Additional space for calculations if needed.

Question Number _____

Additional space for calculations if needed.

Question Number _____