GX563

**OLLSCOIL NA hÉIREANN, GAILLIMH**
NATIONAL UNIVERSITY OF IRELAND, GALWAY

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**SUMMER EXAMINATIONS, 2001**

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**FIRST ELECTRONIC ENGINEERING**
**FIRST ELECTRONIC AND COMPUTER ENGINEERING**
**SECOND MECHANICAL ENGINEERING**
**SECOND BIOMEDICAL ENGINEERING**

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ANALOGUE ELECTRONICS

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Duration of examination: *Two* hours

Instructions: Answer *four* questions

**1.** Using Kirchoff's Laws determine the voltage $V_{AB}$ in the circuit of figure 1 below. Specify also, the power dissipated in the resistor labelled R in the circuit.

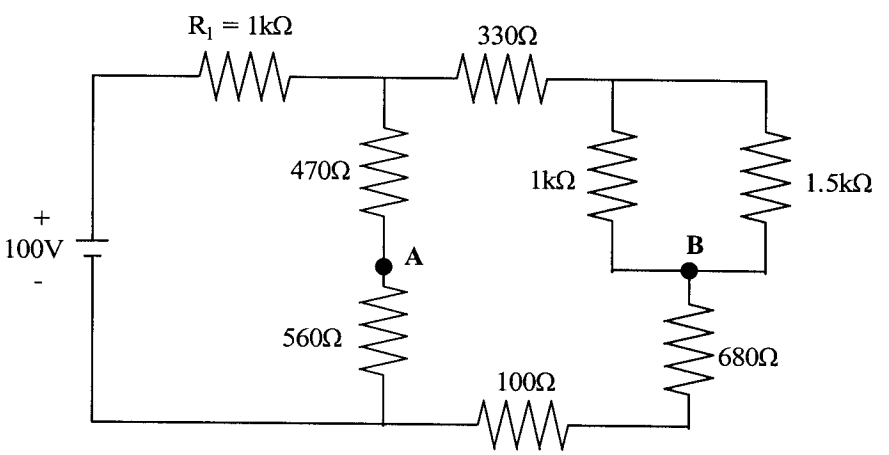


**Figure 1**

[25 marks]

2. Use the principle of superposition to determine the voltage across the 1.5kΩ resistor in the circuit of figure 2.

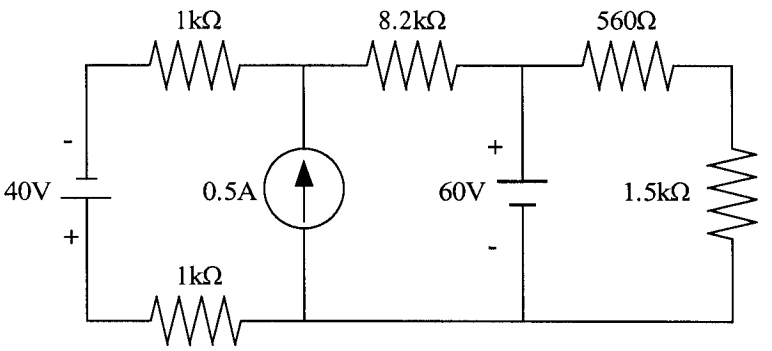


**Figure 2**

[25 marks]

3. **(a)** A voltmeter and an ammeter are two commonly used laboratory instruments. Describe the important electrical qualities each meter most possess for them to be useful as measuring instruments.

[5 marks]

**(b)** **(i)** Determine the Thévenin equivalent of the circuit inside the dotted box of figure 3 (without the load resistor $R_L$ attached).

**(ii)** Proceed to use the Thévenin equivalent to predict the voltage across $R_L$ if it was attached to terminals A and B of the circuit.

**(iii)** What value of load resistor would allow maximum power to be delivered from the circuit.

[20 marks]

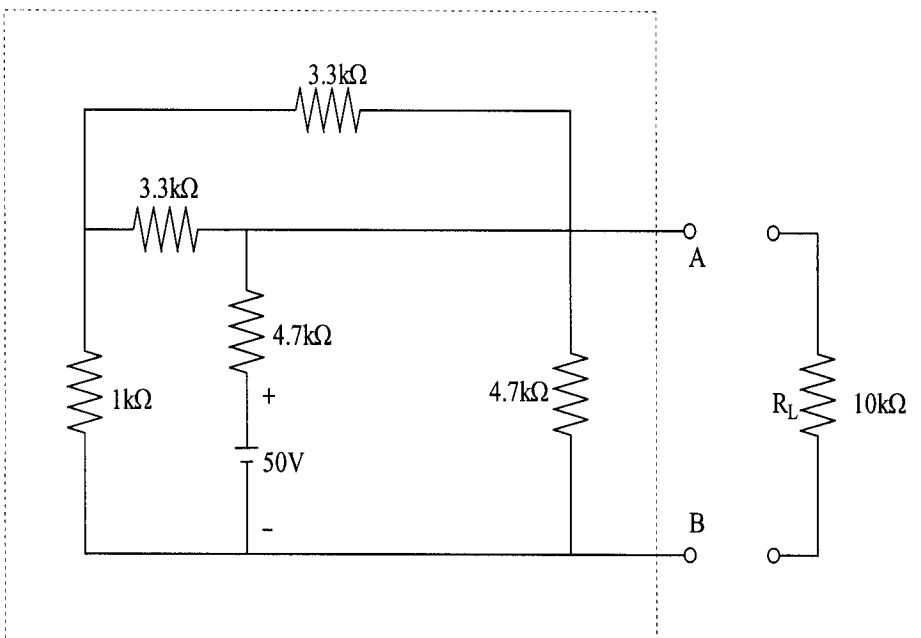


**Figure 3**

4. **(a)** The circuit of figure 4.1 shows a series connected RC circuit. Determine the magnitude and angle of the currents $\mathbf{I_R}$ and $\mathbf{I_C}$ and plot them on a phasor diagram. Calculate the magnitude and phase angle of the supply current $\mathbf{I_s}$, and plot also on the phasor diagram.

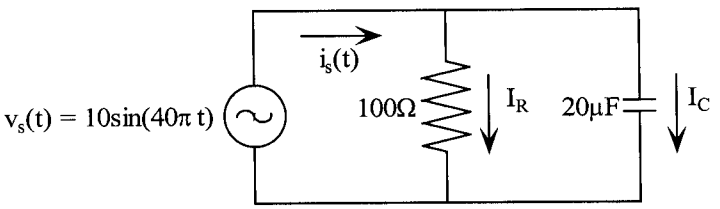


**Figure 4.1**

[12 marks]

**(b)** The magnitude and phase of the current in the circuit of figure 4.2 is to be equivalent to the supply current $\mathbf{I_s}$, of figure 4.1. Calculate the value of R and C of this circuit.

[13 marks]

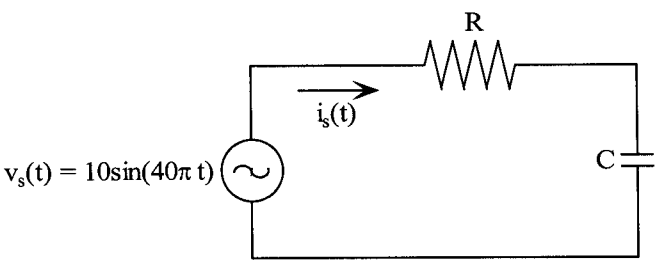


**Figure 4.2**

5. **(a)** Explain what is meant by the term *resonance* when referring to electrical circuits. Describe the conditions that exist when a series RLC circuit is in a state of resonance.

[5 marks]

**(b)** A certain series resonant circuit has a maximum current of 50mA and an inductor voltage $\mathbf{V_L}$=100V. If the supply voltage is 10V, calculate the magnitude of the total impedance **Z** and specify the magnitude values of $\mathbf{X_C}$ and $\mathbf{X_L}$.

[7 marks]

**(c)** Using Phasor analysis determine the magnitude of the supply current $I_S$ of the circuit of figure 5 below. Specify the phase angle between the supply voltage and current.

[8 marks]

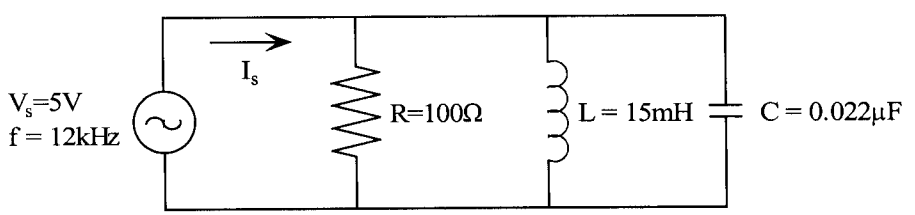


**Figure 5**

6. **(a)** Derive an expression for the rms value of a full-wave rectified sinusoidal signal of period T and peak voltage $V_p$.

[7 marks]

**(b)** The circuit of figure 6 shows a half wave rectifier. Plot two cycles of the output voltage $v_o(t)$ and output current $i_o(t)$. What is the power dissipated in the 1kΩ load resistor.

[6 marks]

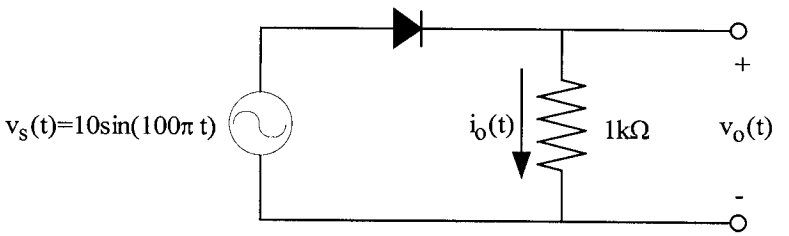


**Figure 6**

**(c)** A smoothing capacitor is to be added to the circuit. Calculate the value of capacitance necessary in order to keep the ripple of the output voltage below 1%.

Plot two cycles of the smoothed output voltage waveform. Specify an approximation to the average output voltage when the smoothing capacitor is attached.

[7 marks]