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Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

Semester II Examinations, 2004/2005

Exam Code(s)	1BN121, 1BP121, 2BI121, 2BI221, 2BJ121
Exam(s)	FIRST ELECTRONIC ENGINEERING FIRST ELECTRONIC AND COMPUTER ENGINEERING SECOND INDUSTRIAL ENGINEERING SECOND MANAGEMENT ENGINEERING SECOND INDUSTRIAL ENGINEERING (Design Stream)
Module Code(s)	EE106
Module(s)	Analogue Electronics
Paper No.	1
Repeat Paper	Special Paper
External Examiner(s)	Professor S. J. McLaughlin
Internal Examiner(s)	Professor D. J. Wilcox Mr. F. O'Malley
Instructions:	Answer 4 questions. All questions will be marked equally.
Duration	2hrs
No. of Answer Books	
Requirements:	
Handout	1
MCQ	
Statistical Tables	
Graph Paper	
Log Graph Paper	
Other Material	
No. of Pages	5
Department(s)	Electronic Engineering

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NATIONAL UNIVERSITY OF IRELAND, GALWAY

SUMMER EXAMINATIONS, 2005

FIRST ELECTRONIC ENGINEERING
FIRST ELECTRONIC AND COMPUTER ENGINEERING
SECOND INDUSTRIAL ENGINEERING
SECOND MANAGEMENT ENGINEERING

ANALOGUE ELECTRONICS

Professor S.J. McLaughlin
Professor D. J. Wilcox
Mr. F. C. O'Malley

Duration of examination: *Two* hours

Instructions: Answer *four* questions

1. *(a)* Find the voltage Vo of the circuit of Figure 1. **[20 marks]**

   (b) Calculate also the power supplied to the circuit by the 24mA source. **[5 marks]**

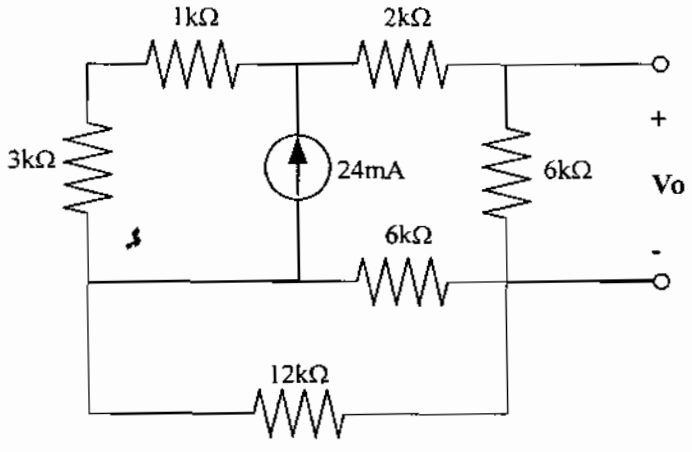


Figure 1

2. Use the principle of superposition to determine the output voltage of the circuit of figure 2.

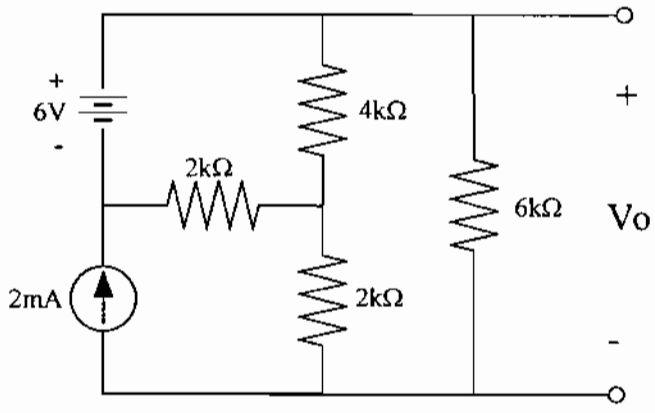


Figure 2

[25 marks]

3. A linear circuit is connected first to an ideal Ammeter and then to an ideal Voltmeter as depicted in figure 3.

The voltage registered on the voltmeter is 10V.
The current registered on the ammeter is 2.5mA.

(a) Determine the Thévenin and Norton Equivalents of the Linear Circuit.

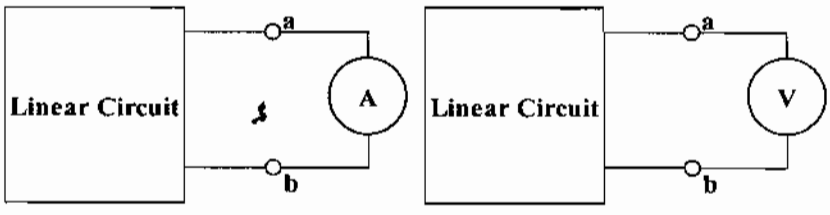
[13 marks]

(b) If a load resistance of R_L = 7.5kΩ is connected across the terminals a and b, determine the load voltage V_L and load current I_L

[6 marks]

(c) Specify the value of R_L which would allow maximum power be delivered from the Linear Circuit and determine this maximum power.

[6 marks]



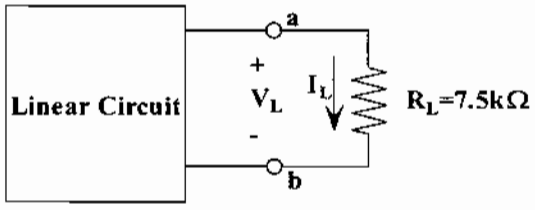


Figure 3

4. *(a)* Draw a sketch showing how the reactance of a capacitor and inductor both vary with frequency.

[5 marks]

(b) A series RLC circuit is shown in figure 4.

(i) Specify the value of C that will place the circuit of figure 4 in resonance at a frequency of ω = 1800rad/sec.

[3 marks]

(ii) Using these values for C and ω, calculate the magnitude of the supply current **I**, and voltages $\mathbf{V_R}$, $\mathbf{V_L}$ and $\mathbf{V_C}$. Specify also the phase angle of each of these voltages.

[7 marks]

(iii) Proceed to plot these quantities on a phasor diagram and specify the phase angle between the supply voltage and supply current. Sketch two cycles of $v_s(t)$ and i(t). Specify the Q factor of this circuit.

[10 marks]

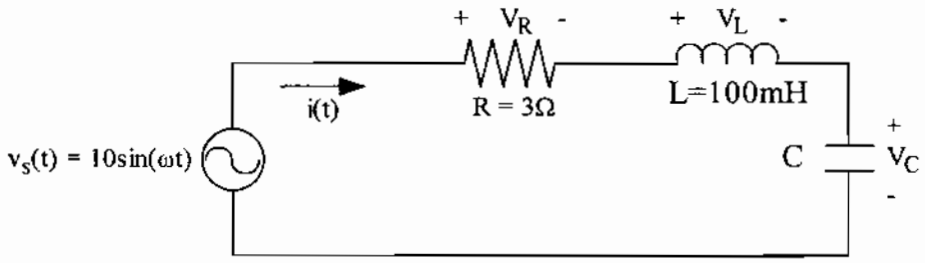


Figure 4

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) The circuit of figure 5 below shows a parallel RLC circuit with a supply voltage of

$$v_s(t) = 120\sqrt{2}\sin(2\pi 60t)$$

(i) Calculate the magnitude of the currents $\mathbf{I_L}$, $\mathbf{I_R}$ and $\mathbf{I_C}$

[5 marks]

(ii) Plot the currents on a phasor diagram and calculate the magnitude of the supply current $\mathbf{I_S}$.

[6 marks]

(iii) Specify the phase angle between the supply voltage and supply current. Indicate if the supply current is lagging or leading.

[5 marks]

(iv) What is the average power delivered to the circuit from the supply.

[4 marks]

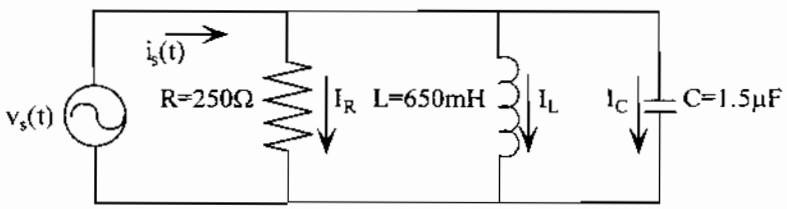


Figure 5

6. *(a)* Derive an expression for the *average value* of the waveform of figure 6.1 below.

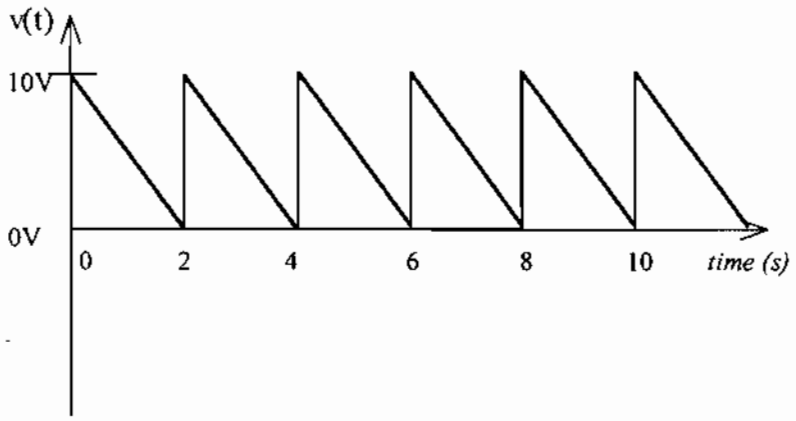


Figure 6.1

[10 marks]

(b) The circuit of figure 6.2 shows a particular application of a diode. Sketch the output voltage, $v_o(t)$, of the circuit and state the overall application of this circuit.

[6 marks]

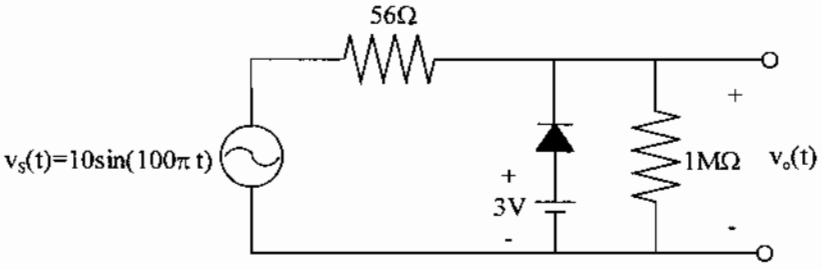


Figure 6.2

(c) A smoothing capacitor is to be added a half wave rectifier circuit with input: $v(t) = 10\sin(200\pi t)$ and load resistance R_L = 1kΩ. Calculate the value of capacitance necessary in order to keep the ripple of the output voltage below 10%.

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

[9 marks]