GX2629

OLLSCOIL NA hÉIREANN, GAILLIMH

NATIONAL UNIVERSITY OF IRELAND, GALWAY

AUTUMN EXAMINATIONS, 1999

FIRST ELECTRONIC ENGINEERING
FIRST ELECTRONIC AND COMPUTER ENGINEERING
FIRST INDUSTRIAL ENGINEERING
FIRST UNDENOMINATED ENGINEERING

ANALOGUE ELECTRONICS

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Duration of examination: *Two* hours

Instructions: Answer *four* questions

1. Using Kirchoff's Laws determine the current flowing in each branch of the circuit of figure 1.1 below. Indicate the voltage that exists across each resistor and specify the total power delivered by the battery to the circuit.

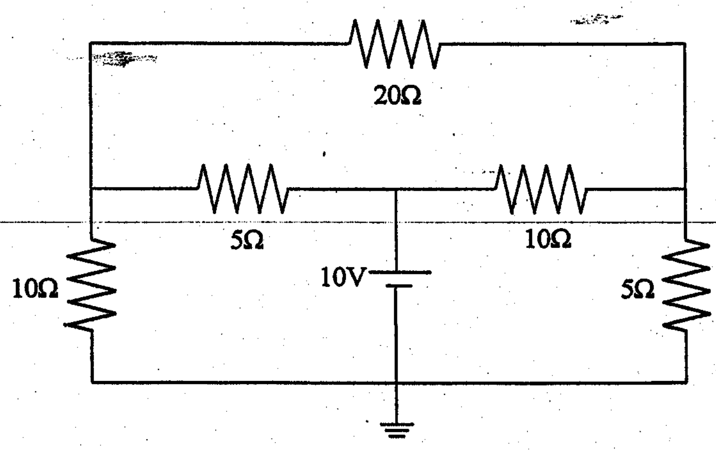

Figure 1.1

2. (a) The load resistor, of the circuit of figure 2.1 is to be attached between terminals A and B as indicated. You are required to calculate the Thévenin equivalent of the circuit without the load connected.

(i) Determine the open circuit voltage V_{AB}.

(ii) Determine the short circuit current I_{AB}.

(iii) Draw the Thévenin equivalent circuit.

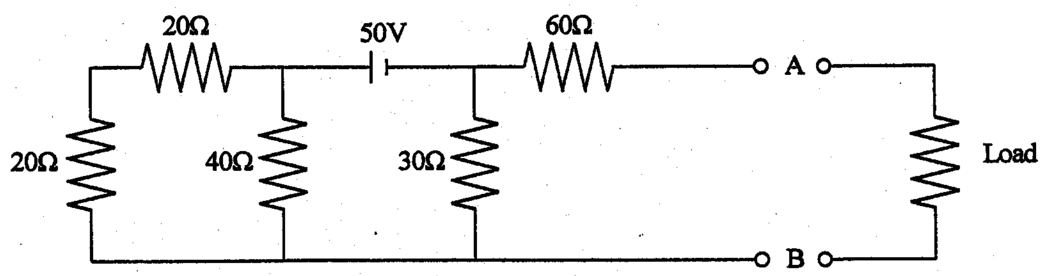

Figure 2.1

(b) By attaching the load resistor, R_L=60Ω, to the equivalent circuit determine the voltage across this load and the current through it. What value of load resistance would draw maximum power from the supply.

3. (a) Explain what is meant by the principle of superposition as applied to electrical circuits.

(b) Using the principle of superposition determine the current I, flowing in the 2kΩ resistor in the circuit of figure 3.1.

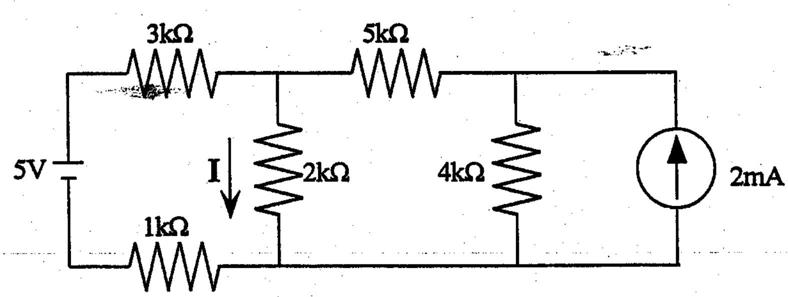

Figure 3.1

4. Determine the magnitude of the currents I_R, I_L and I_C in the circuit as of figure 4.1. Plot each of these on a phasor diagram. Proceed to determine the magnitude of the supply current I_s and plot it also on the phasor diagram. Specify exactly the phase relationship between the supply current and supply voltage. Finally, plot two cycles of both $i_s(t)$ and $v_s(t)$.

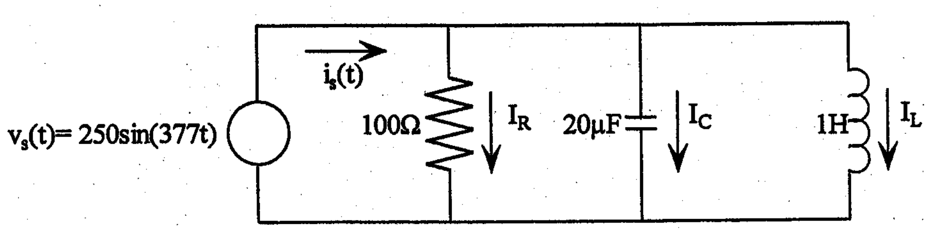

Figure 4.1

5. For the circuit of figure 5.1 use a phasor diagram to determine the magnitude and phase angle of the following variables: V_L, V_R, V_C, I_S and V_s.
Your phasor diagram should include a representation of each of above.
Also, plot one cycle of the supply voltage and current.

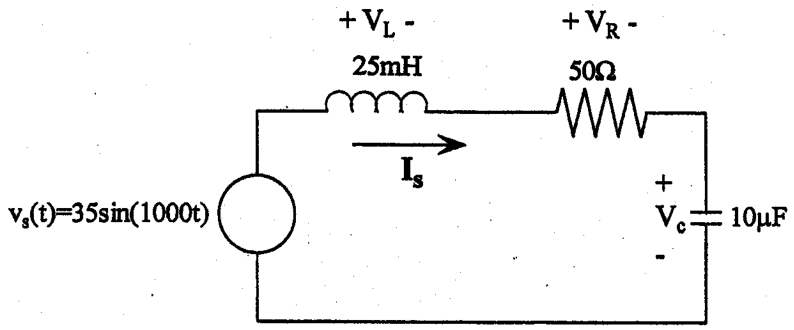

Figure 5.1

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

(b) The circuit of figure 6.1 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.

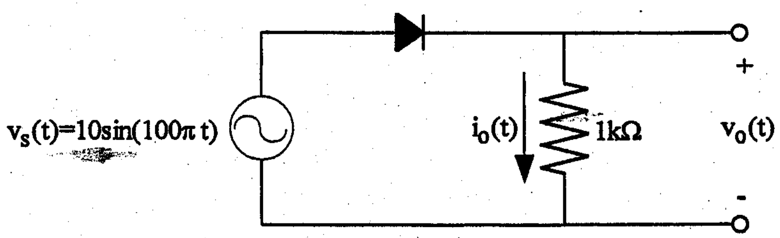

Figure 6.1

(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 10%. Plot two cycles of the smoothed output voltage waveform.