Indian Institute of Technology Patna
Department of Electrical Engineering

EE101 - Electrical Sciences
Autumn - 2014
Mid Sem Exam
17 September 2014

There are 5 problems. They carry equal marks.

$(5 \times 6 = 30)$

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1. Determine the current I in the network shown below.

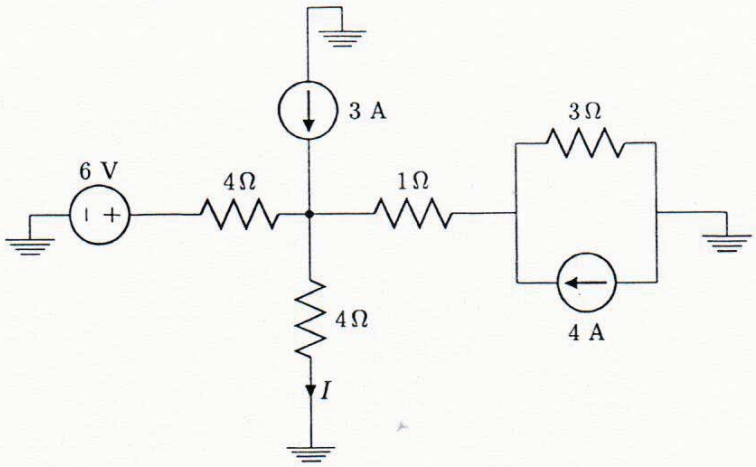
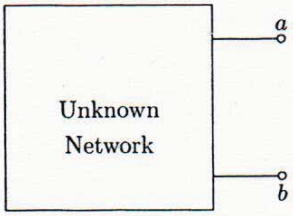


Figure 1

2. Draw the thevenin and norton equivalent circuits of an unknown network containing linear resistors and independent sources.



However, two different experiments were conducted on the network and measurements were made as given in Figure 2.

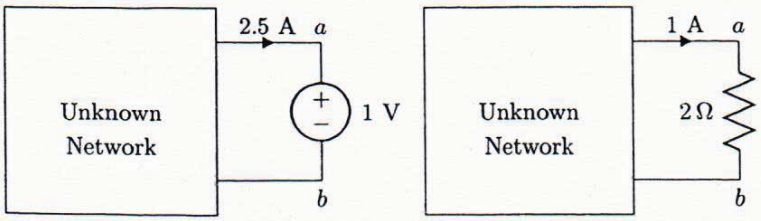


Figure 2

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3. Find $v_c(t)$ and $i_L(t)$ and plot them for $t > 0$. Inductor and capacitor do not have any initial charge.

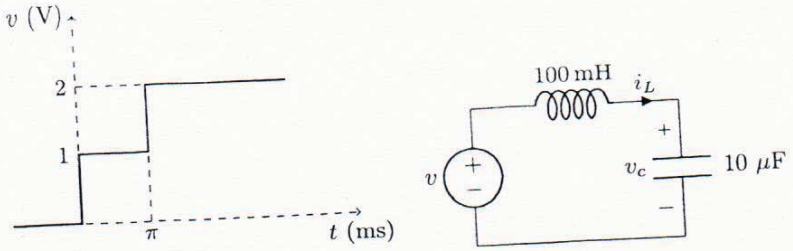

Figure 3

4. Consider the circuit shown in Figure. 4

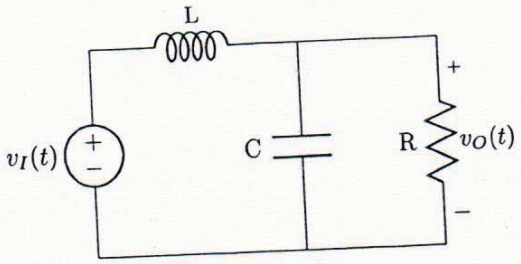

Figure 4

(a) Assume the circuit is in sinusoidal steady state with $v_I(t) = V_I \cos(\omega t)$. Let $v_O(t)$ take the form $v_O(t) = V_O \cos(\omega t + \phi)$. Determine $A = V_O/V_I$ and ϕ.

(b) For a given L and ω, determine the value of C that maximizes A, and for this value of C, determine A.

5. The network shown in Figure 5. (a) consists of one resistor, three voltage sources and two ideal diodes. Its $i - v$ relation is given in Figure 5. (b).

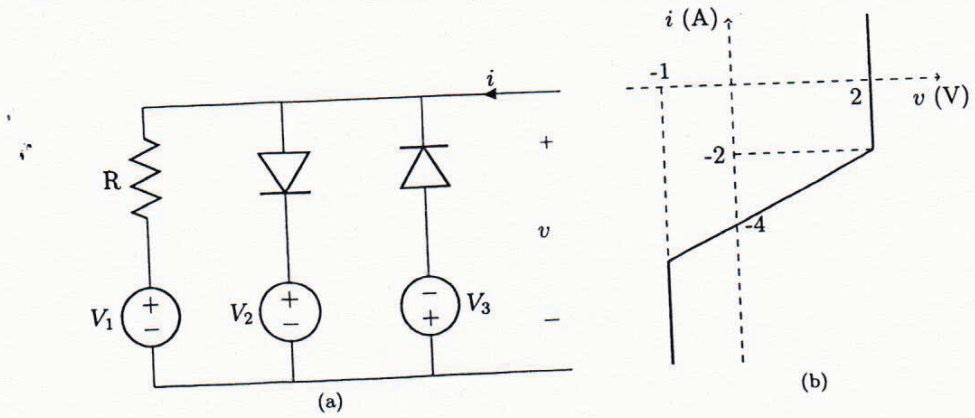

Figure 5

(a) Determine the numerical values of V_1, V_2, V_3 and R.

(b) If a resistor of 1Ω is connected across the network, determine the numerical values of i and v.