2016

M.Sc.

1st Semester Examination

ELECTRONICS

PAPER—ELC-102

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

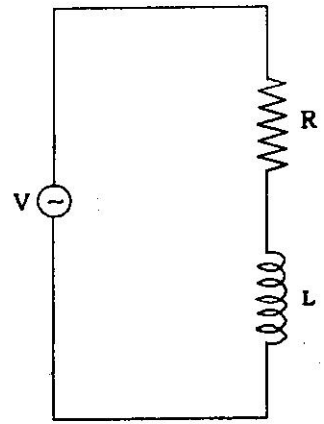
(*Network Analysis and Synthesis*)

Answer *Q. No. 1* and any *three* questions from the rest.

1. (a) State Norton's theorem.

(b) With a neat figure explain a two-port network. Give at least one example of a two-port network.

(c) Draw the phasor diagram of an R.L. circuit as given in the figure :



(d) Design a filter with R and L to reject any noise above 20 Hz. Assume R = 100Ω.

(e) Define Laplace transform explaining the meaning of all symbols.

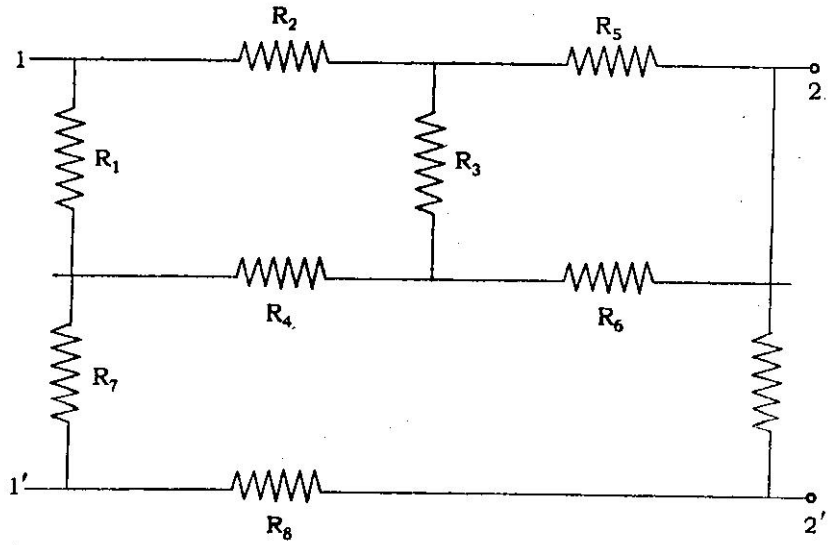
5×2

2. (a) The reduced incidence matrix of an oriented graph is :

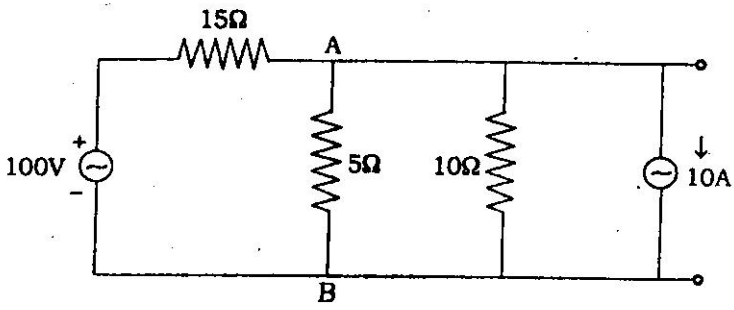
$$[A]=\begin{bmatrix} 0 & -1 & 1 & 1 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Draw the graph.

(b) Reduce the following network to an equivalent T network :

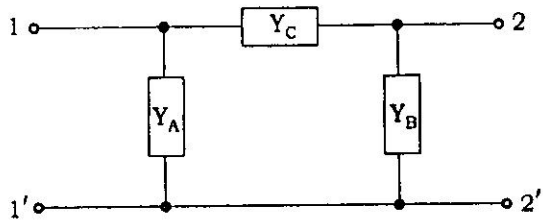


(c) Use Thevenin's theorem to determine the current in the branch AB of the following circuit :



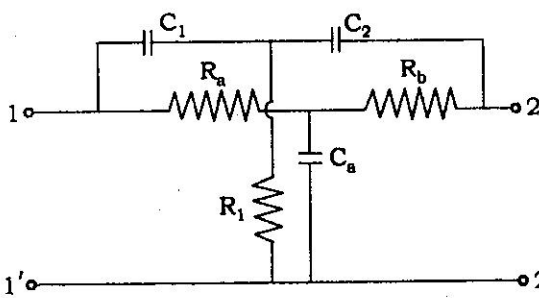
3+3+4

3. (a) Determine the Y matrix of the following network :



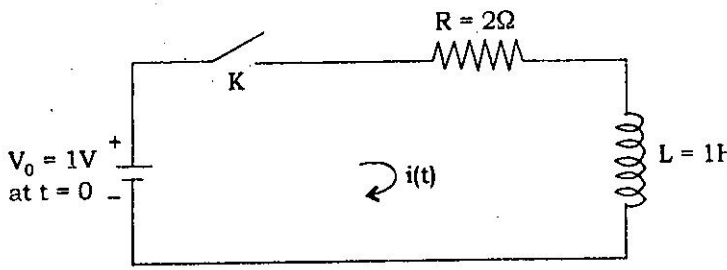
(b) For a reciprocal network prove that AD – BC = 1, where the symbols have their usual meanings.

(c) Determine y_{11} of the following twin-T network :

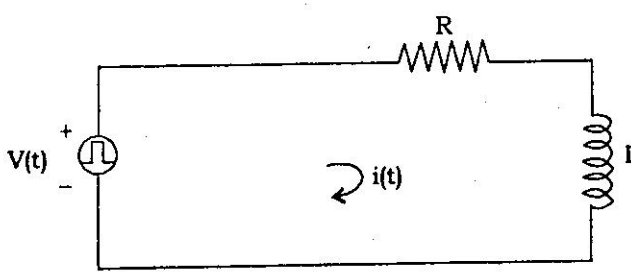


3+4+3

4. (a) Consider the circuit shown below. The K switch is closed initially and it opens at t = 0. Determine current i(t) using Laplace transform :



(b) A pulse of width a is applied to the following RL network at t = 0. Determine the current through the circuit.



(c) Check whether the following function will be treated as a driving point impedance function or not :

$$Z(S) = \frac{4S^4 + S^2 - 3S + 1}{S^3 + 2S^2 + 2S + 40}$$

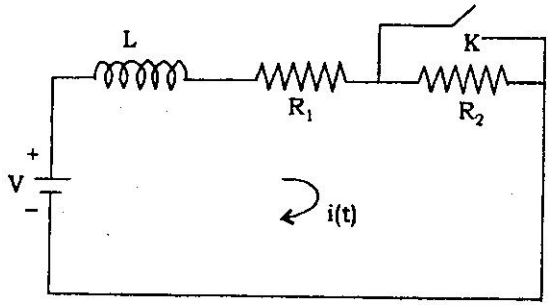
3+4+3

5. (a) Consider the function :

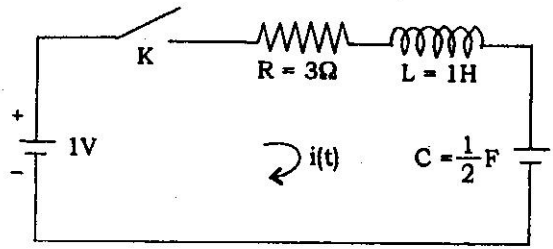
$P(S) = (S + 1)(S + 2)(S + 3)(S + 4)$.

Indicate whether the function is stable using R-H theorem.

(b) For the network circuit shown below, determine i(t) (i) when k is closed at t = 0, (ii) k is opened at t = 0 :



(c) Determine i(t) for the following circuit. K is closed at t = 0 :



2+4+4

6. (a) The driving point impedance function of a Foster form is given by :

$$Z_D = jWH\left[1 + \frac{A_0}{w^2} + \frac{A_2}{w^2 - w_2^2} + \cdots + \frac{A_k}{w^2 - w_k^2} + \cdots\right]$$

Draw its equivalent network.

(b) Determine the expression for the driving point impedance of a reactive network which has poles at w = 0, 4000 rad/sec and infinity. Zeros are to be located at w = 2000 and 6000 rad/sec. The impedance is to be – j 700 ohm at 1000 rad/sec.

(c) Derive the design equations for a low-pass constant-k filter.

3+3+4

[Internal Assessment — 10 Marks]