2018

M.Sc. 1st Seme. 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.

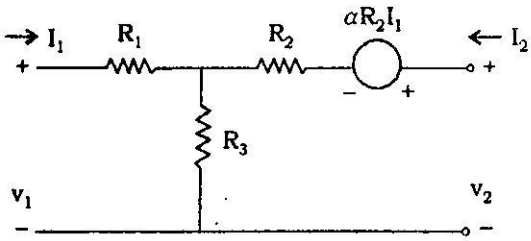
Network Analysis and Synthesis

Group–A

1. Answer any *four* questions : 4×2

(a) State and explain the reciprocity theorem.

(b) Determine Z parameters of the following circuit :



(c) Explain the following terminologies used in network graph :

(i) Branch (ii) Node (iii) Tree (iv) Loop.

(d) Determine i(t) for the following transfer function

$$I(s) = \frac{2s+5}{(s+1)(s+2)}$$ using Lap Lace transform.

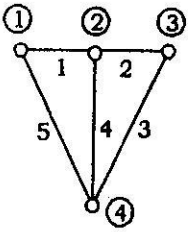
(e) What are the drawbacks of constant K-type filters ?

(f) Determine the stability of the following function :

$F(s) = (s + 1)(s + 2)(s + 3)(s + 4)$.

(g) Explain what do you mean by critical frequencies of a driving point admittance function.

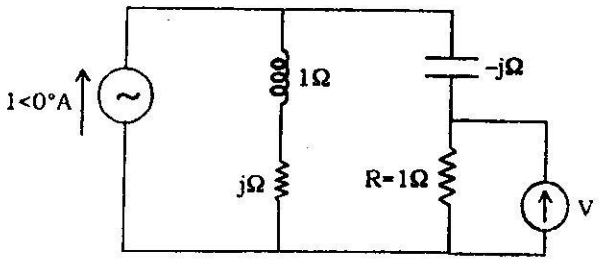
(h) The following figure represents a graph of a network. Find the trees.



Group–B

2. Answer any *four* questions : 4×4

(a) In the following circuit find the reading of the voltmeter V. Interchange the current source and the voltmeter and verify the reciprocity theorem.



(b) 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.

(c) Explain the following types of networks :

(i) Active network,

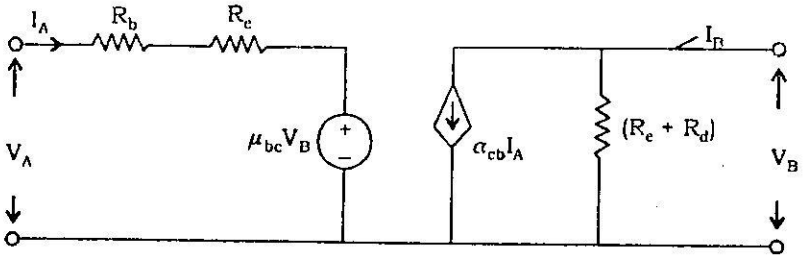
(ii) Passive network,

(iii) Lumped and distributed networks,

(iv) Recurrent and non-recurrent networks. 1×4

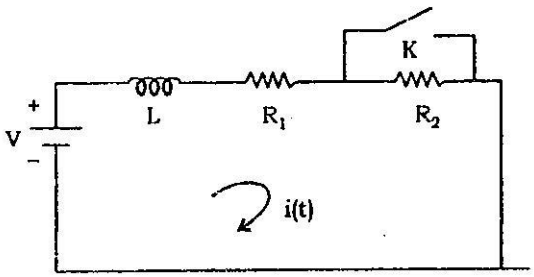
(d) The Z parameters of a two port network are $Z_{11} = 10\Omega$, $Z_{22} = 15\Omega$, $Z_{12} = Z_{21} = 5\Omega$. Find the equivalent T network.

(e) A common emitter transistor equivalent circuit is shown in the following figure. Find the h parameters :

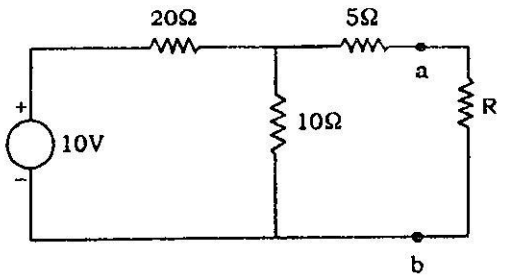


(f) Prove that for a reciprocal network AD – BC = 1 where A, B, C, D are the two port network parameters.

(g) Consider the network shown below. Determine the current if the switch K is closed at t = 0. After the steady state has been reached determine i(t) if K is opened at t = 0.



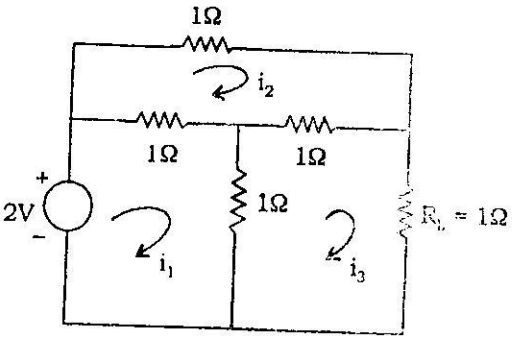
(h) Calculate the resistance R in the following circuit which will allow maximum power dissipation in it. Calculate the maximum power.



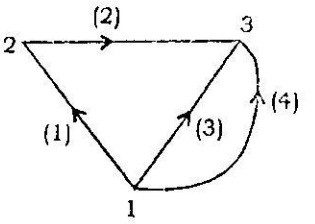
Group–C

3. Answer any *two* questions : 2×8

(a) (i) Apply the mesh method to find the current through the resistance R_L in the following figure :

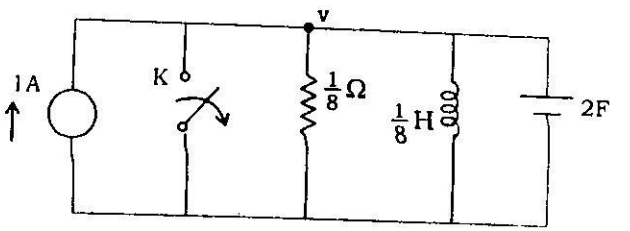


(ii) How many trees are possible for the graph shown below ?



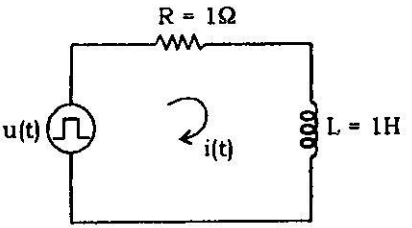
4+4

(b) (i) Determine the voltage V in the following network for $t > 0$, the switch K opens at $t = 0$.



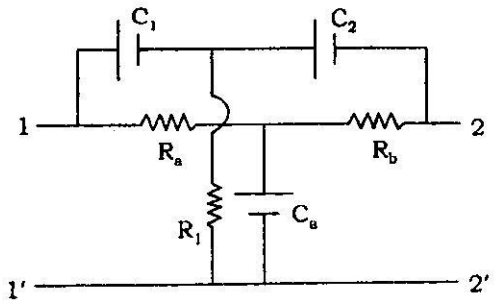
(Continued)

(ii) Determine the current i(t) of the following network using Laplace transform



Where u(t) is a single pulse having width a. 4+4

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



(ii) Consider the following function and comment if such function is suitable for representing impedance function of any port

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

(d) (i) A time domain voltage V(t) is applied to a series combination of RLC network. Find s domain impedance and current. Assume initial condition of the voltage in inductor to be assisting the input current and that in the capacitor opposing the input current. Draw the t-domain and s-domain circuits.

(ii) For the given denominator polynomial of a network function, verify the stability of the network using Ruth criteria

$$Q(s) = s^4 + s^3 + 2s^2 + 2s + 12.$$

(iii) The driving point impedance of an LC network is given by

$$Z(s) = \frac{2s^5 + 12s^3 + 16s}{s^{4+}4s^2 + 3}.$$

Determine the first cauer form of the network.

2+3+3

Internal Assessment — 10

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