PG/IS/ELC-103/13

M.Sc. 1st Semester Examination, 2013

ELECTRONICS

(*Network Analysis and Synthesis*)

[Theory]

PAPER– ELC - 103

Full Marks : 50

Time : 2 hours

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

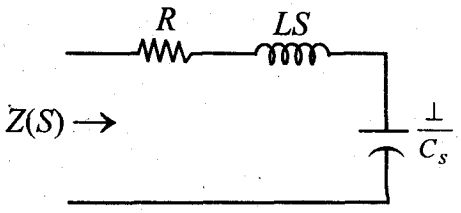
The figures in the right-hand margin indicate marks

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

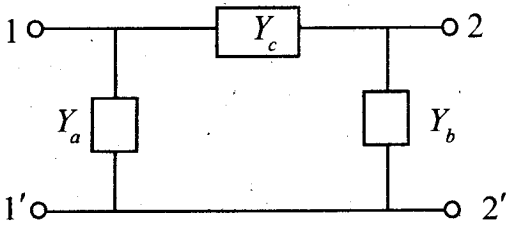
Illustrate the answers wherever necessary

1. Answer *all* questions : 2×5

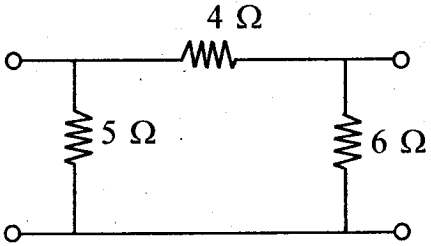
(*a*) Determine the driving-point impedance of the following Network.



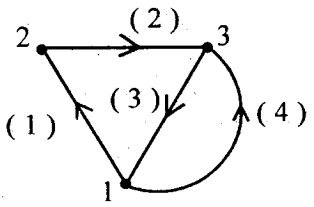
(*b*) Find out the admittance matrix of the following circuit.



(*c*) Convert the following π network to an equivalent *T* network.



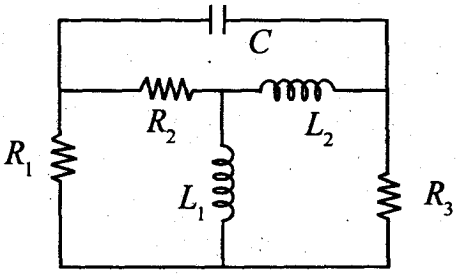
(*d*) Determine the number of trees possible for the following graph.



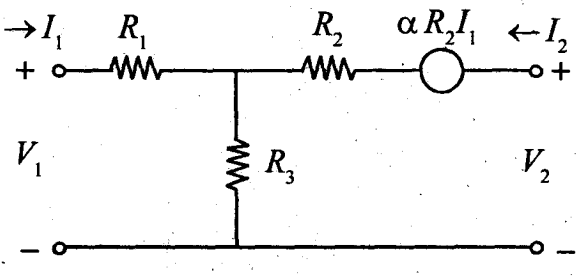
(*Continued*)

(*e*) State and explain the Foster's reactance theorem.

2. (*a*) A network is shown in the following figure. Draw its graph. 2



(*b*) Determine the impedence matrix of the following circuit. 2



(*c*) Incidence matrix of a graph is given below. Draw its directed graph. 4

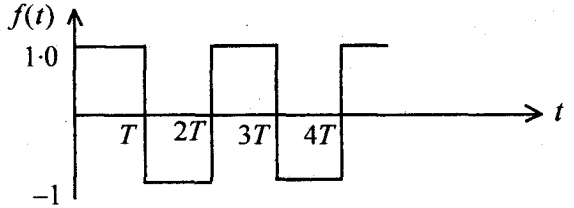
Nodes ↓	Branches → 1	2	3	4	5	6	7
(1)	−1	0	−1	1	0	0	1
(2)	0	−1	0	−1	0	−1	0
(3)	1	1	0	0	−1	1	0
(4)	0	0	1	0	1	0	−1

(*d*) Find the possible number of trees in a graph for $[A]$(the reduced incidence matrix) and $[A^t]$ (the transposed matrix of A). 2

3. (*a*) Define Laplace transformation of a function $f(t)$. 2

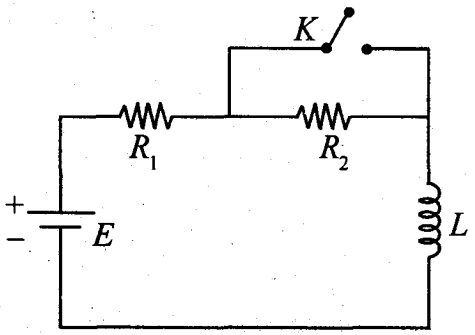
(*b*) For $f(t) = \cos \omega t$, find $F(s)$. 2

(*c*) Obtain the Laplace transform of the square wave train shown in the following figure. 2



(*Continued*)

(*d*) In the given figure, the battery voltage is applied for a steady state period. Obtain the complete expression for the current after closing the switch *K*. Assume $R_1 = 1\Omega$, $R_2 = 2\Omega$, $L = 1\text{H}$ and $E = 10\text{ V}$. 4



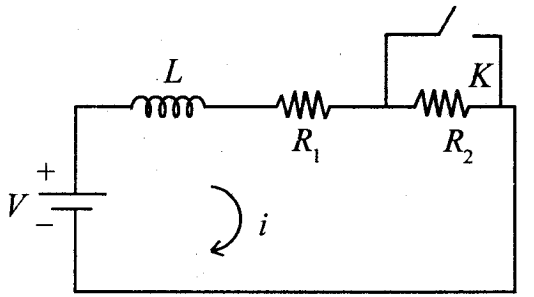
4. (*a*) Prove that for a reciprocal network

$$AD - BC = 1,$$

where A, B, C, D are different network parameters. 5

(*b*) For the network shown below the switch *k*

is closed at $t = 0$, determine the current i in the circuit. 5



5. (*a*) Show that the nominal characteristics impedance of a constant *K* filter is $\sqrt{\frac{1}{c}}$. 5

(*b*) Design a constant-*K* low-pass *T* section filter with a nominal resistance of 50 Ω to produce cut off at a frequency 1·2 kHz. Find out the attenuation at 2kHz frequency. 5

6. (*a*) Determine the expression for the driving point impedance of a reactive network which has poles at $w = 0$, 4,000 rad/s and α, zeros are to be located at $w = 2{,}000$ and 6,000 rad/s. The impedance is to be $-j$ 700 ohm at 1000 rad/s. 4

(*b*) Find the first Foster network of the driving point impedance function derived earlier. 6

[*Internal Assessment* : 10 Marks]