PG/IS/ELC-103/12

M.Sc. 1st Semester Examination, 2012

ELECTRONICS

(*Network Analysis and Synthesis*)

(Theory)

PAPER—ELC-103

Full Marks : 50

Time : 2 hours

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

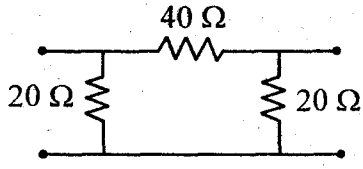
The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary

1. (*a*) Define 'characteristic impedence' of a two port network.

(*b*) Draw the equivalent *T*-section network for the given Π-section network.



(*c*) Draw equivalent *CE*-transistor circuit using '*h*'-parameters.

(*d*) Test whether the following system function is positive real function or not

$$H(s) = \frac{s^2 + 10s + 5}{s + 3}.$$

(*e*) A network is expressed by the following differential equation :

$$5\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 2y = 2\frac{dx}{dt} + x$$

where, '*x*' is the input and '*y*' is the output obtain the transfer function. 2 × 5

2. (*a*) The reduced incidence matrix of a network is given below :

Nodes ↓	Branches → 1	2	3	4	5	6
a	1	0	0	–1	0	0
b	0	1	0	1	–1	0
c	0	0	1	0	1	–1
d						

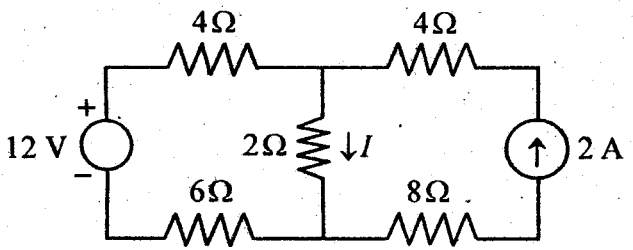
Find :

(*i*) Compete incidence matrix

(*ii*) Without drawing the connected graph, the branches in series and also in parallel

(*iii*) Whether branches (1, 4, 5) form a tree or not.

(*b*) For the network as shown in the figure find the current '*I*' through the 2Ω resistance using Thevenin's theorem



(1 + 1 + 1 + 1) + 6

3. (*a*) Draw the pole-zero diagram of the following system function

$$H(s) = \frac{5s(s^2 + 5s + 6)}{(s+1)(s^2 + 3s + 9)}$$

(*b*) Following test data were obtained for an unknown two-port network experimentally. Obtain the *Y*-parameters.

Status of circuit	V_1	V_2	I_1	I_2
Output shorted	25 V	0	5 mA	0·2 mA
Input shorted	0	30 V	6 mA	3 mA

5 + 5

4. (*a*) A *T* section low pass filter has a series inductance 80 mH and shunt capacitance 0·022 μF. Determine the cut-off frequency and nominal design impedance R_0. Also design an equivalent Π section.

(*b*) Design a high pass active filter of cut-off frequency 1 kHz with a pass-band gain of 2. 5 + 5

5. (*a*) The driving point impedance of an *L-C* network is given by

$$Z(s) = \frac{5(s^2+1)(s^2+9)}{s(s^2+4)}$$

obtain Foster first form of network inserting the values of all the elements.

(*b*) The driving point impedance of a *R-C* network is given as

$$Z(s) = \frac{(s+1)(s+3)}{s(s+2)}$$

obtain Cauer any of the two forms of network and insert the values of the elements. 5 + 5

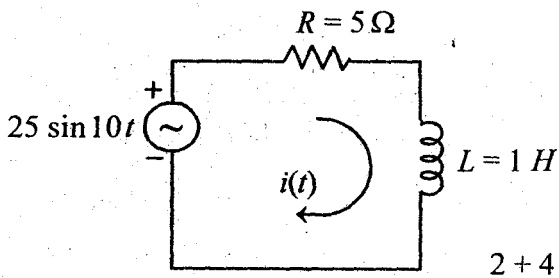
6. (*a*) Find the convolution integral where $f_1(t) = e^{-at}$ and $f_2(t) = t$.

(*b*) Find the final value of the function whose Laplace Transform is,

$$I(s) = \frac{s+6}{s(s+3)}$$

check the result by solving it for $i(t)$.

(*c*) A sinusoidal voltage 25 sin 10t is applied at $t = 0$ to a circuit as shown in the figure. By the method of Laplace transform find the current $i(t)$. Initial conditions are taken to be zero.



2 + 4 + 4

[*Internal Assessment* : 10 Marks]