Roll No. | | | | | | | | | | |

No. of Printed Pages—7 **EE-301**

B.TECH

THIRD SEMESTER EXAMINATION, 2002-2003

NETWORK AND SYSTEMS

Time : 3 Hours *Total Marks : 100*

Note : (1) Answer *ALL* the **FIVE** questions.
(2) Semilog graph paper will be supplied in examination hall.
(3) Do not write roll number and signature on supplied semilog/graph paper.

1. Answer any FOUR of the following :—

(*a*) Define the following terms related to a network graph :— (1×5)

(*i*) Path

(*ii*) Loop

(*iii*) Tree

(*iv*) Co-tree

(*v*) Planar graph

(*b*) A network graph has three basic cut-sets and six basic loops. Draw —

(*i*) the oriented network graph having all the nodes in one line, and (2)

(*ii*) all the six basic loops. (3)

(*c*) Determine currents in all branches of the network shown in Figure 1, using node analysis method. (5)

aktuonline.com

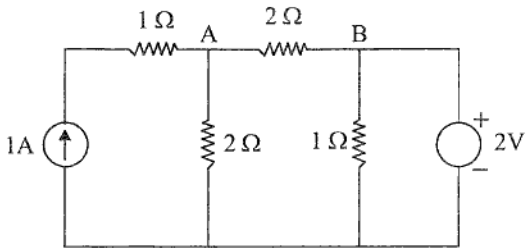


Figure 1

(*d*) Define impulse function and represent in mathematical and graphical forms. Show that it is derivative of unit step function. How is it realized practically ? **(2+2+1)**

(*e*) Consider the network shown in Figure 2. The switch is initially closed for a long time. The switch is opened at $t=0$. Find differential equation relating $i_L(t)$ with $V(t)$ and also evaluate initial conditions. **(4+1)**

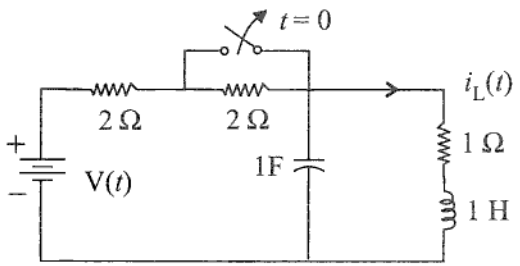


Figure 2

(*f*) For the network shown in the Figure 3, draw network graph. Selecting elements 1, 2 and 3 as the tree elements, obtain basic cut-sets and write basic cut-set matrix. **(3+2)**

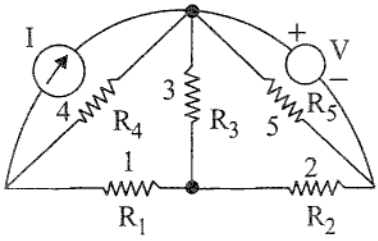


Figure 3

2. Answer any FOUR of the following :—

(*a*) State and prove Maximum Power Transfer theorem for AC circuits. **(1+4)**

(*b*) Replace the network to the left of terminals A–B in Figure 4 by Thevenin's equivalent circuit. Find current and power delivered to the load Z_L, if $Z_L = (4 + j4)$ ohm. **(4+1)**

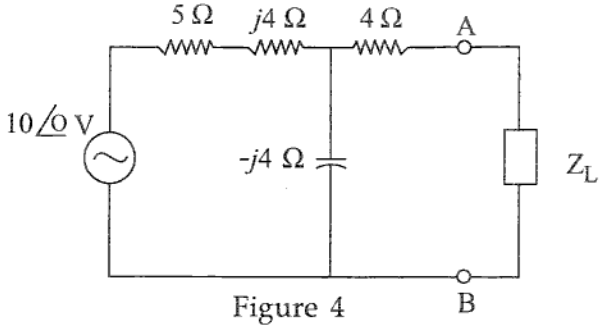


Figure 4

(*c*) Verify Tellegen's Theorem in the network shown in Figure 5. **(5)**

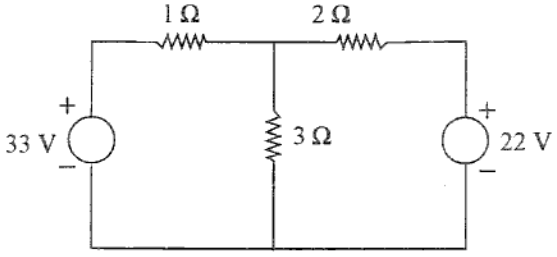


Figure 5

aktuonline.com

(*d*) In the network shown in Figure 6, the switch is in position 1 long enough to establish steady state conditions. At $t = 0$, the switch is moved to position 2. Find the current in the circuit. (5)

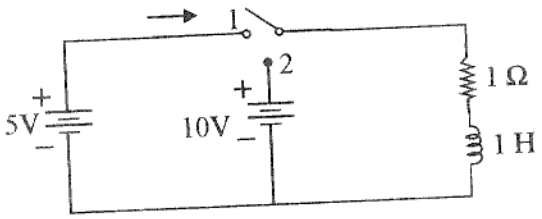


Figure 6

(*e*) Explain, in brief, the block diagram representation of LTI continuous time network. (5)

(*f*) In the network shown in Figure 7, find $v_2(t)$ using Laplace Transform technique. (5)

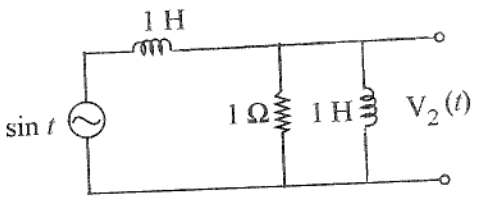


Figure 7

3. Answer any TWO of the following :—

(*a*) A system has the following transfer function :—

$$\frac{C(S)}{R(S)} = \frac{(S+1)(S+3)}{(S+2)(S^2+8S+32)}$$

 aktuonline.com

Determine time response C(t) of the system for a unit step input. **(10)**

(b) Determine frequency response of a general second order system. Obtain correlation of frequency response with transient response of the same system. **(10)**

(c) Explain concept of convolution integral. Determine Inverse Laplace Transform of the following function using Convolution Integral :—

$$F(S) = F_1(S).\, F_2(S) = \frac{1}{S^2(S+2)}$$ **(4+6)**

4. Answer any TWO of the following :—

(a) Determine h-parameters of the network shown in Figure 8. **(10)**

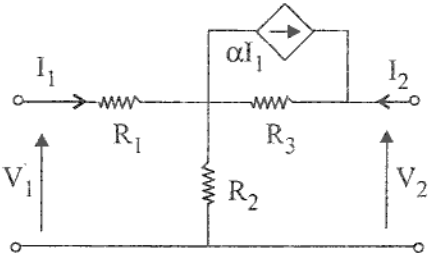


Figure 8

(b) Determine transmission parameters of the network shown in Figure 9 using the concept of interconnection of two two-port networks N_1 and N_2 in cascade :— **(10)**

aktuonline.com

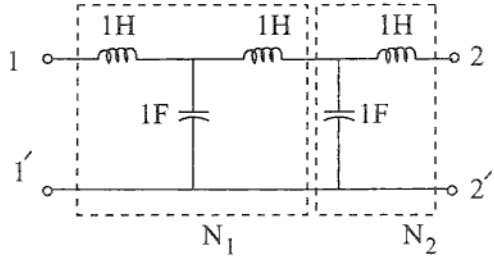


Figure 9

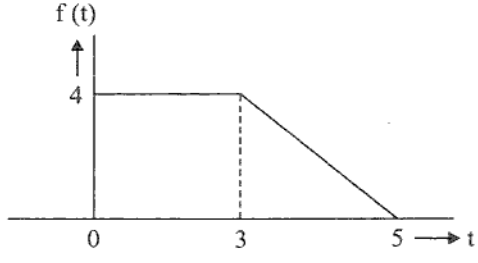
(c) Explain Image Impedances of a two-port network. Obtain Image Impedances in terms of transmission parameters. (4+6)

5. Answer any *TWO* of the following :—

(a) (i) Without finding inverse Laplace Transform of $F(S)$, determine $f(0^+)$ and $f(\infty)$ for the following function :— (4)

$$F(S)=\frac{5S^3-1600}{S\left(S^3+18S^2+90S+800\right)}$$

(ii) Determine Laplace Transform of the following wave shown in Figure 10.



(6)

Figure 10

aktuonline.com

(*b*) (*i*) Define positive real function and mention its properties. (5)

(*ii*) Write general form of RC driving point impedance function and mention its properties. (5)

(*c*) Realize the following LC driving point function in :— (5+5)

(*i*) First Foster form, and

(*ii*) Second Cauer form.

$$F(S)=\frac{S^2+4S+3}{S^2+2S}$$

Turn Over