Code : 104304

B.Tech 3rd Semester Exam., 2019
(New Course)

NETWORK THEORY

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **EIGHT** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer the following questions in brief (any *seven*) : 2×7=14

(a) Define the term complex frequency.

(b) Write Z parameters in terms of *ABCD* parameters.

(c) Define twig and link.

(d) What do you mean by transfer function?

(e) How can you say that a network is stable? Give definition.

(f) Write down all the properties of loop impedance matrix.

(g) Explain the following terms with reference to network topology :

(i) Tree

(ii) Twig and link

(iii) Incidence matrix

(iv) Oriented graph

(h) Write the Laplace transform of—

(i) unit step;

(ii) unit impulse;

(iii) unit ramp.

(i) Explain the following terms with the help of examples :

(i) Causal and Non-causal systems

(ii) Time variant and time invariant systems

(iii) Continuous and discrete-time signals

(iv) Deterministic and probabilistic signals

2. (a) For the given reduced incidence matrix, draw the graph and hence obtain the *f*-cut set matrix : 6

$$\begin{bmatrix} 0 & 0 & 1 & 1 & 1 & 0 & -1 \\ 0 & 1 & 0 & 0 & -1 & 1 & 1 \\ -1 & 0 & 1 & 0 & 0 & -1 & 0 \end{bmatrix}$$

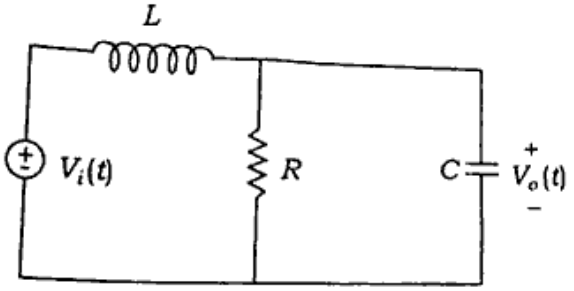
(b) State and prove convolution theorem for Laplace transform. 8

3. (a) In a linear two-port network, $V_1(t)$ and $V_2(t)$ be the input voltage and its response at the output, $V_2(t) = te^{-2t}u(t)$. If the response to an impulse voltage be given by $V(t) = (e^{-t} + e^{-2t})u(t)$. Find the $V_1(t)$ as well as the transfer function of the network. 8

(b) Explain in detail band stop filter, with proof. 8

(Turn Over)

4. (a) Determine what type of filter is shown in figure below. Calculate the corner or cut-off frequency. Take, $R = 2\ k\Omega$, $L = 2\ H$, and $C = 2\ \mu F$: 8



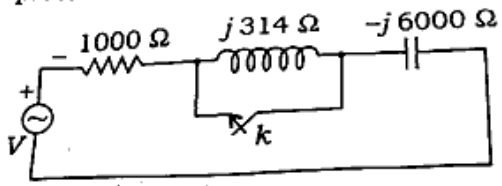
(b) Explain the parallel *R-L-C* resonance. Give essential equations and waveforms. 6

5. (a) Design a constant *k* low-pass filter having cut-off frequency 2·5 kHz and design resistance $R_0 = 700\Omega$. Also, find the frequency at which this filter produces the attenuation of 19·1 dB. Find its characteristic impedances and phase constants at pass band and stop or attenuation band. 8

(Continued)

(b) What do you mean by 'POLES' and 'ZEROS' of a given network transfer function? What are the significances and limitations of network transfer function? Explain the complex frequency in the circuit theory. 6

6. In the following figure with switch open, steady state is reached with $v = 100\sin 314\,t$ volts. The switch is closed at $t = 0$. The circuit is allowed to come to steady state again. Determine the steady-state current and complete solution of transient current : 14



7. A network has two input terminals a, b and output terminals c, d. The input impedance with c-d open circuited is $(250 + j100)\,\Omega$ and with c-d short circuited is $(400 + j3000)\,\Omega$. The impedance across c-d with a-b open circuited is $200\,\Omega$. Determine the equivalent T network parameters. 14

8. (a) What do you mean by 'Positive Real Function'? What are the properties associated with PRF? What are the significances of PRF? 7

(b) What are the properties of Hurwitz polynomial? Test whether the polynomial is Hurwitz or not.

$$F(s) = s^7 + 2s^6 + 2s^5 + s^4 + 4s^3 + 8s^2 + 8s + 4$$ 7

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