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B.Tech 4th Semester Examination

Network Analysis and Synthesis

EC-4004

Time : 3 Hours   **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/ continuation sheet will be issued.

Note :   Attempt other four questions, selecting one from each section A, B, C, D. Section E is compulsory.

SECTION - A

1.   Find the Laplace transform of

(i) $f(t) = ke^{-at}$ (ii) $f(t) = \sin \omega t$

(iii) $f(t) = e^{-at} t\, u(t)$ (iv) $f(t) = \sinh(at)$ **(4×5=20)**

2.   (a)   For the given network function, draw the pole zero diagram and hence obtain the time domain response $I(t)$.

$$I(s) = \frac{s^2 + 4s + 3}{s^2 + 2s}$$

(b)   Determine the number of roots with positive real parts and negative real parts for the following polynomial equation using Routh criteria:
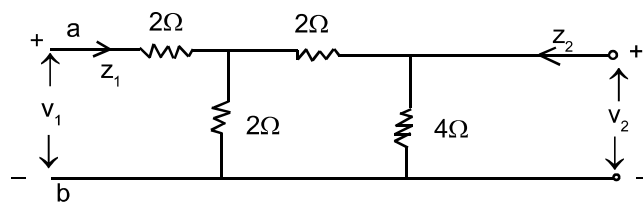
$$Q(s) = s^4 + 2s^3 + 8s^2 + 10s + 15$$ **(20)**

SECTION - B

3. Find out ABCD parameters of the network shown in figure 1. Also find the image parameters for the network.

Fig. 1

(20)

4. A common emitter transistor amplifier can be represented by 4-port network. A signal source of 1my and resistive load of 10 kΩ is applied at the output of the network. Given $h_{ie} = 2k\Omega$ $h_{fe} = 50$ $h_{oe} = 25\times10^{-6}$ mho and $h_{re} = 3\times10^{-4}$

Calculate

(i)   h-parameter equivalent circuit

(ii) Voltage drop across load

(iii) load current   (20)

SECTION - C

5. Define the following with suitable example.

    (a) Twig (b) Link (c) Fundamental loop matrix (d) Fundamental cut-set matrix (e) incidence matrix.   (20)

6. What are important parameters of interest of prototype-k low pass and high pass filter? Explain the impedance of each of these parameters and derive these parameters.   (20)

SECTION - D

7. Realize the function $z(s) = \dfrac{s(s^2+4)}{2(s^2+1)(s^2+9)}$ in both Foster form LC network. **(20)**

8. Test the following polynomial for its Hurwitz character. **(20)**

$$p(s)=s^8+3s^7+10s^6+24s^5+35s^4+57s^3+50s^2+36s+24$$

SECTION - E

9. (a) Find the range of "a" so that $p(s)=s^4+s^3+as^2+2s+3$ is Hurwitz.

(b) Define all the transfer function of two port network.

(c) What is significance of z-parameter in network analysis?

(d) In a tank circuit show that the circulating current at resonance is given by $I=\left(\dfrac{C}{L}\right)^{1/2} \cdot V$ for a supply voltage of V volts (a.c.). Neglect any resistance of the circuit.

(e) Design a high pass filter (both π & T - network) having cut-off frequency of 2kHz with a load resistance of 300Ω.

(f) Find the magnitude of the frequency when the drop across the capacitor in series RLC circuit is maximum.

[P.T.O.]

(g) Z-parameters for a two-port network are given as $Z_{11}=25\Omega$, $Z_{12} = Z_{21} = 20\Omega$, $Z_{22} = 50\Omega$. Find equivalent T network.

(h) List the properties of positive real function.

(i) Give the significance of pole in a network.

(j) Check positive realness of the function.

$$p(s) = \frac{s^2 + 2s + 20}{s + 10}$$ **(2×10=20)**