

(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 131324

Roll No.

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B. TECH.

(SEM. III) THEORY EXAMINATION, 2015-16

**FUNDAMENTALS OF NETWORK ANALYSIS AND
SYNTHESIS**

[Time: 3 hours]

[Total Marks: 100]

Section-A

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short : (2×10=20)
 - (a) Define 'initial value' and 'final value' theorem.
 - (b) Define reciprocal network.
 - (c) List three properties of positive real function.
 - (d) Enlist the two important properties to recognize an R-C impedance in synthesis.
 - (e) Explain an exponential function.

(f) Write the condition of symmetry in terms of Z, Y, h and T parameters.

(g) Differentiate between active and passive filters.

(h) Show that the described by the transfer function

$$H(S) = \frac{1}{(s^2 + 0.76536s + 1)(s^2 + 1.84776s + 1)} \text{ is a}$$

Low Pass Filter.

(i) Determine the range of constant 'K' for the polynomial to be Hurwitz

$$P(s) = s^3 + 3s^2 + 2s + K$$

(j) Write the properties of transfer functions.

Section-B

Note: Attempt any five questions from this section :

(10 x 5 = 50)

2. Explain the concept of reciprocity and symmetry. Derive the above conditions for h and ABCD parameters.

3. Determine the equivalent Norton Network at the terminals a and b of the circuit shown in figure-1.

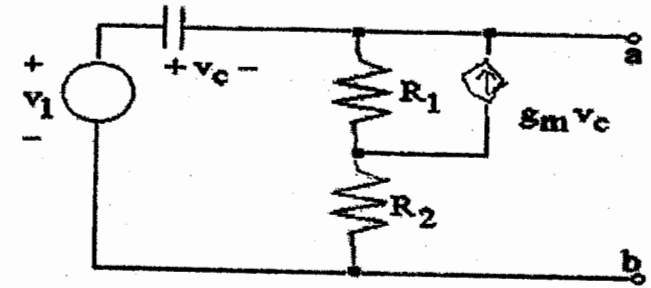


Figure.1

4. The switch K shown in figure-2 is in the steady state in position a for $-\infty < t < 0$. At $t = 0$, it is connected to position b. Find $i_L(t)$, $t \geq 0$

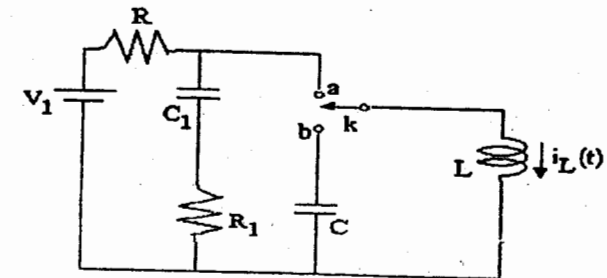


Figure.2

5. Find

- The r.m.s. value of the square-wave shown in figure-3.
- The average power for the circuit having $Z_{in} = 1.05 - 0.67j \Omega$ when the driving-current is $40 - 3jA$.

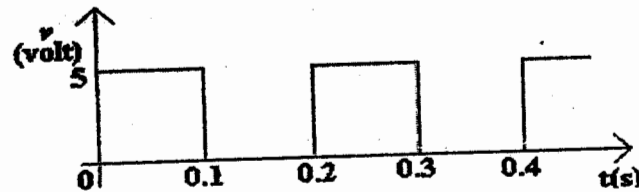


Figure.3

- Determine whether the function $F(S) = \frac{s^3 + 2s^2 + 3s + 1}{s^3 + s^2 + 2s + 1}$ is positive real or not.

- Synthesize a ladder network whose driving point impedance function is given by $Z(S) = \frac{2s^5 + 12s^3 + 16s}{s^4 + 4s^2 + 3}$

- Synthesize an LC network terminated in 1Ω given that

$$Z_{21}(S) = \frac{2}{s^3 + 3s^2 + 4s + 2}$$

- Show that the voltage ratio transfer function of the ladder network shown in figure-4 is given by

$$\frac{V_2(S)}{V_1(S)} = \frac{8s^2}{12s^2 + 12s + 1}$$

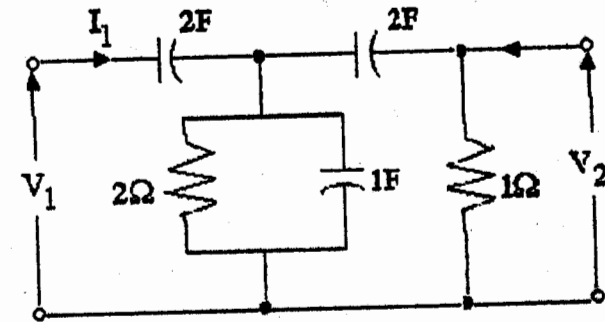


Figure.4

Section-C

Note : Attempt any two questions from this section.
(15x2=30)

10. Express the impedance $Z(s)$ for the network shown in figure-5 in the form :

$$Z(s) = K \frac{N(s)}{D(s)}$$

Plot its poles and zeros. From the pole-zero plot, what can you infer about the stability of the system ?

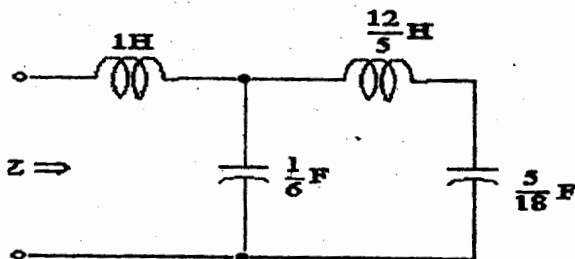


Figure.5

11. Consider the system function $Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+6)}$

Synthesize :

- An R-L network
 - An R-C network
12. Find the poles of system functions for low pass filter with $n=3$ and $n=4$ Butterworth characteristics. (Do not use the tables)

—x—