

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

PAPER ID : 0325

Roll No.

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B.Tech.**(SEM. III) ODD SEMESTER THEORY EXAMINATION 2012-13
FUNDAMENTALS OF NETWORK ANALYSIS AND
SYNTHESIS**

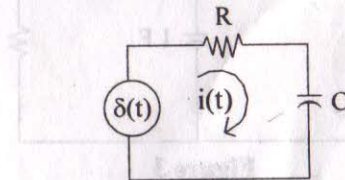
Time : 3 Hours

Total Marks : 100

Note : This paper contains five questions. Attempt all of them.

1. Attempt any four parts : (5×4=20)

- What is complex frequency ? What do its real and imaginary parts describe ? Explain.
- What is the difference between network analysis and network synthesis ? Explain giving an example.
- What is a unit step function ? What is its relationship with a unit impulse function ? Draw the following signals :
 - $u(-t)$
 - $u(1-t)$
 - $-u(t+1)$
- What is the relationship between the transfer function and impulse response ? Elaborate.
- Find the current $i(t)$ and plot it for the Figure 1 shown below for an impulse input.

**Figure 1**

(ii)
$$Z(s) = \frac{(s+2)(s+4)}{(s+1)}$$

(iii)
$$Z(s) = \frac{3(s+2)(s+4)}{s(s+3)} \text{ and}$$

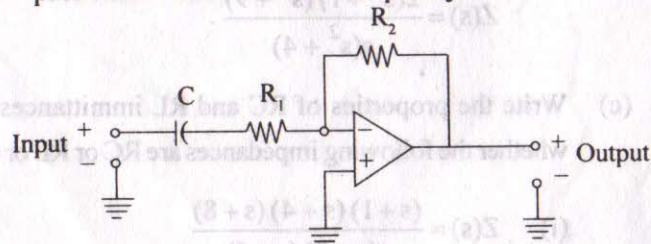
(iv)
$$Y(s) = \frac{2(s+1)(s+3)}{(s+2)(s+6)}$$

4. Attempt any two parts : (10×2=20)

- What is transfer function ? What are its properties ?
- What are minimum phase and non minimum phase functions ? Prove that any transfer function of a passive reciprocal ladder network must be minimum phase.
- Explain the synthesis of an L-C ladder network with a $1-\Omega$ resistive termination to meet a specified transfer impedance Z_{21} or transfer admittance Y_{21} .

5. Attempt any two parts : (10×2=20)

- What is meant by the word 'Active' in network synthesis ? Explain the properties of an ideal Op-Amp.
- Explain and derive the operations of an (i) integrator, (ii) differentiator, (iii) finite gain differential amplifier, (iv) current controlled voltage source.
- Prove that the circuit shown below (Figure 5) is a high pass filter. Find its cut-off frequency.

**Figure 5**

- (f) For the circuit shown in Figure 2, the switch 'S' moves from 'a' to 'b' at $t = 0$. Find and sketch $v_1(t)$ for $0 < t < \infty$. The circuit is in a steady state at $t = 0$.

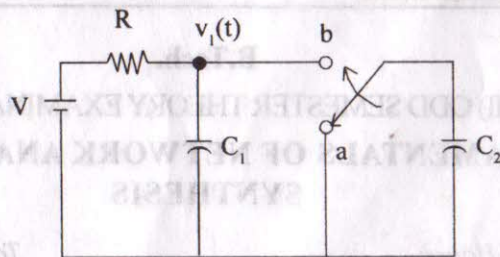


Figure 2

2. Attempt any four parts : (5×4=20)

- (a) State and prove the initial value theorem for a function $f(t)$ having a step discontinuity at $t = 0$.

- (b) Find the initial and final values of the following functions :

(i) $F(s) = \frac{2(s+1)}{s^2 + 2s + 5}$

(ii) $f(t) = 3u(t) + 2e^{-t}$

- (c) State and prove convolution theorem.

- (d) The switch is opened at $t = 0$ in the network shown in Figure 3. Find $v_1(t)$ and $v_2(t)$.

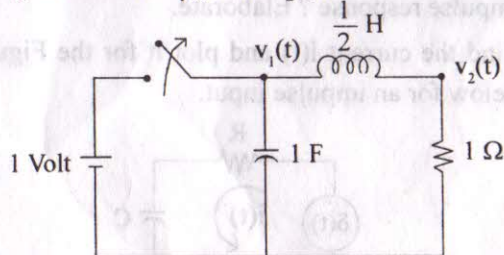


Figure 3

Use Laplace transform method.

(e)

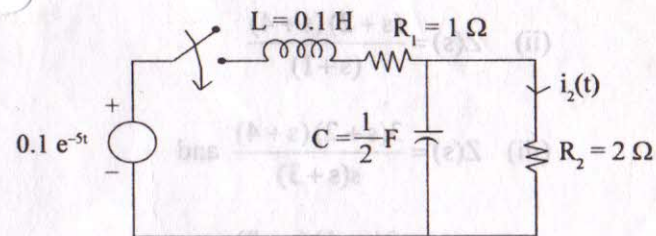


Figure 4

The switch is closed at $t = 0$ in the initially relaxed circuit of Figure 4. Find $i_2(t)$ using Norton's theorem.

- (f) Comment on the relationship between the h parameters of two 2-port networks on being connected in a specific manner.

3. Attempt any two parts : (10×2=20)

- (a) What are Hurwitz polynomials ? Write their properties. What are positive real functions ? Derive the necessary conditions for a function to be positive real. Test whether the following polynomial is Hurwitz :

$$G(s) = s^3 + 2s^2 + 3s + 6.$$

- (b) What are LC driving point immittances ? Write their properties. Synthesize the Foster I and Foster II forms of the following impedance function :

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

- (c) Write the properties of RC and RL immittances. Check whether the following impedances are RC or RL or neither :

(i) $Z(s) = \frac{(s+1)(s+4)(s+8)}{s(s+2)(s+6)}$