

- (c) For the circuit shown in Fig. 15, derive an expression for V_{01} and V_{02} , assuming ideal op-amp.

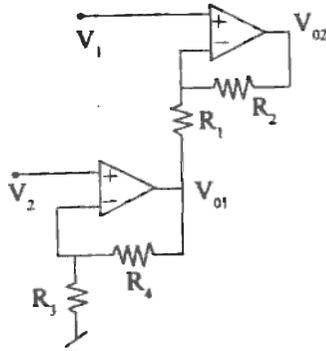


Fig. 15



(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
2010-11

FUNDAMENTALS OF NETWORK ANALYSIS AND
SYNTHESIS

Time : 3 Hours

Total Marks : 100

Note : Attempt all questions. All questions carry equal marks.

Missing Data if any may be suitably assumed.

1. Attempt any four parts of the following : (5×4=20)

- (a) The waveform $f(t)$ in the Fig. 1 is defined as :

$$f(t) = \frac{3}{\epsilon^2} (t - \epsilon)^2, 0 \leq t \leq \epsilon$$

$$= 0, \text{ elsewhere.}$$

Show that as $\epsilon \rightarrow 0$, $f(t)$ becomes a unit impulse function.

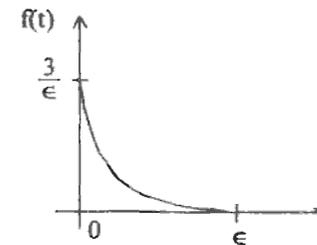


Fig. 1

- (b) Find the response to the excitation shown in Fig. 2 when the network is (i) an ideal differentiator, (ii) an ideal integrator.

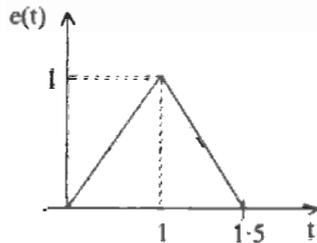


Fig. 2

- (c) Using Shifting property of the step function, obtain an equation of the waveform shown in Fig. 3.

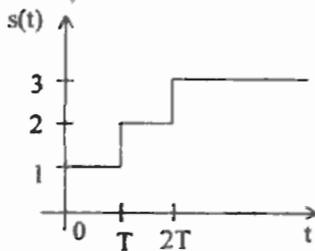


Fig. 3

- (d) For the circuit shown in Fig. 4, at $t = 0$, the switch goes from position 1 to 2, find $i(t)$, given that $e(t) = e^{-t} \sin 2t$. Assume that the circuit had been steady state for $t > 0$.

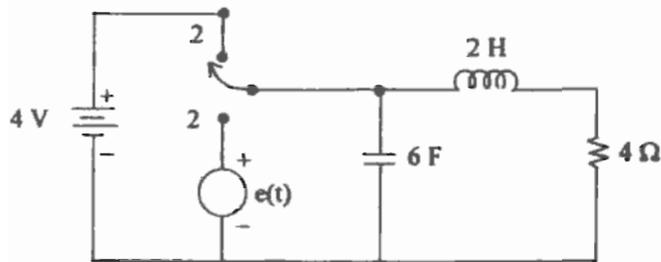


Fig. 4

- (e) For the circuit shown in Fig. 5, $i(t) = 4e^{-2t} u(t)$, find $v(t)$; $0^- < t < \infty$.

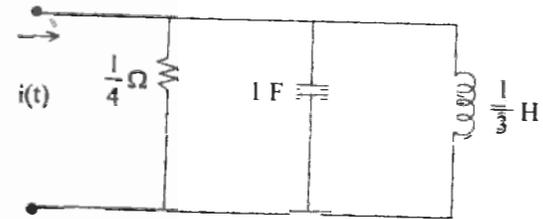


Fig. 5

- (f) Find the requirement for the RC time constant in the RC differentiator circuit, such that output voltage is approximately the derivative of input voltage.

2. Attempt any four parts of the following : (5×4=20)

- (a) Use the convolution integral, find the inverse transform of the following :

(i) $F(s) = \frac{K}{(s+a)(s+b)}$

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

- (b) Find $i_2(t)$ for the circuit shown in Fig. 6 using Thevenin's theorem. The excitation is $e(t) = 100 \cos 200t$.

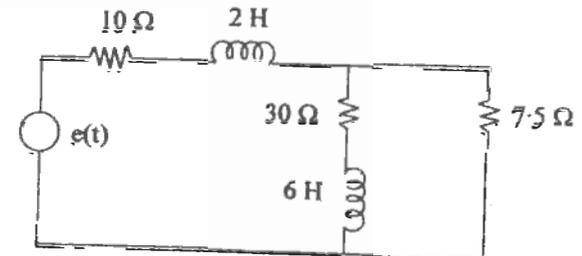


Fig. 6

- (c) Determine the transfer function $H(s) = \frac{V_3(s)}{V_1(s)}$ when $v_1(t) = u(t)$, find $v_3(t)$ for the circuit shown in Fig. 7. Assume zero initial conditions.

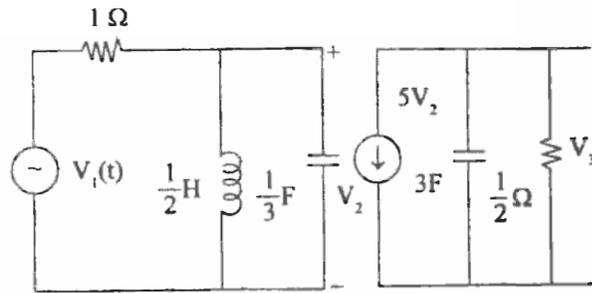


Fig. 7

- (d) Prove that for a passive reciprocal network $AD - BC = 1$, where A, B, C and D are the transmission parameters.
- (e) For the cascade connection of two ports network shown in Fig. 8, shown that the transfer impedance Z_{12} of the overall circuit is given in terms of the Z-parameters of the individual two ports by the equation

$$Z_{12} = \frac{Z_{12a}Z_{12b}}{Z_{11b} + Z_{22a}}$$

In addition, show that the short-circuit admittance Y_{12} is

$$Y_{12} = -\frac{Y_{12a}Y_{12b}}{Y_{11b} + Y_{22a}}$$

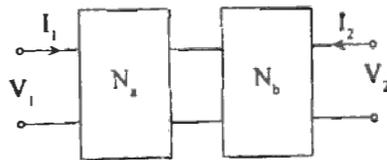


Fig. 8

- (f) For the network shown in Fig. 9, determine the Y and Z parameter.

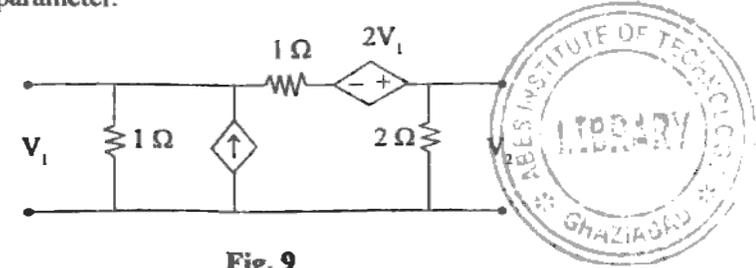


Fig. 9

3. Attempt any two parts of the following: (10×2=20)
- (a) Find the network for the following function in Foster-I and Cauer-I form

$$Y(s) = \frac{(s+1)(s+3)}{(s+2)(s+4)}$$

- (b) For the pole-zero diagram shown in Fig. 10, pick the diagram an R-L impedance function and synthesize in the series Foster form.

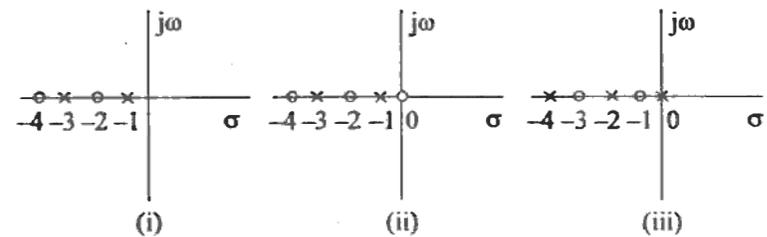


Fig. 10

- (c) Given $Z(s) = \frac{s^2 + Xs}{s^2 + 5s + 4}$
- (i) What are restrictions on X for Z(s) to be positive real function?

- (ii) Find X for $\text{Re}[z(j\omega)]$ to have a second order at $\omega = 0$.
- (iii) Choose a numerical value for X and synthesize $Z(s)$.

4. Attempt any **two** parts of the following : (10×2=20)

- (a) For the networks shown in Fig. 11, show that the driving point impedance Z_{in} are equal to R , when $Z_a Z_b = R^2$.

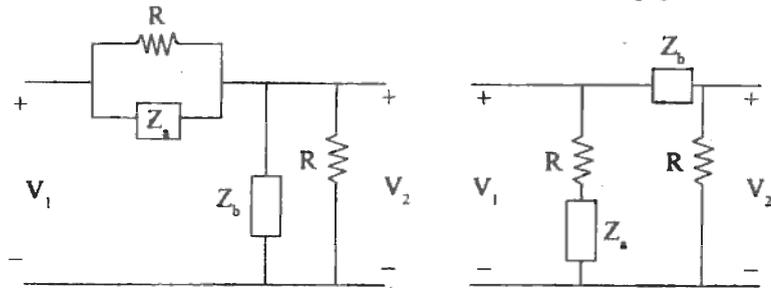


Fig. 11

- (b) Synthesize N_s with termination resistor $R_2 = 4\Omega$ and $R_1 = 1\Omega$ for the network shown in Fig. 12 to give

$$\frac{V_2}{V_g} = \frac{12s^2}{15s^2 + 7s + 2}$$

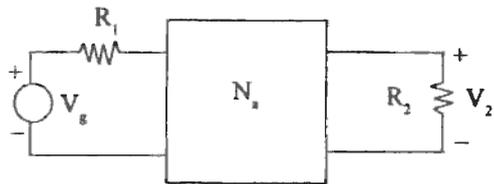


Fig. 12

- (c) For the network shown in Fig. 13, show that—

$$\frac{V_2}{V_o} = \frac{1}{2 + Y} \text{ and synthesize } Y \text{ when } \frac{V_2}{V_o} = \frac{0.5(s^2 + 2)}{s^2 + 2s + 2}$$

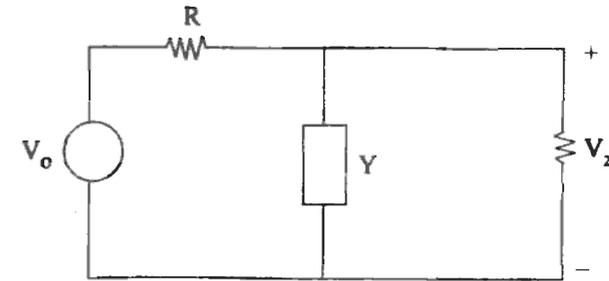


Fig. 13

5. Attempt any **two** parts of the following : (10×2=20)

- (a) Draw the circuit of non-inverting differentiator using one ideal op-amp and determine its transfer function.
- (b) For the circuit shown in Fig. 14, Find I_o . Assuming ideal op-amp.

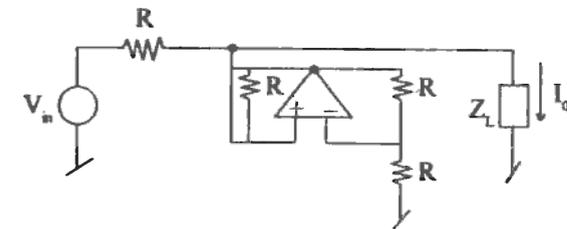


Fig. 14