Roll No. 2300101705 5

Total Pages : 07

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December 2024

B.Tech. (EE/ENC) (Third Semester)

Circuit Analysis and Synthesis (ECP305)

Time : 3 Hours] [*Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) Determine h-parameters if the Y-parameters are : $Y_{11} = 0.1$ mho; $Y_{21} = 0.4$ mho; $Y_{12} = 0.1$ mho; $Y_{22} = 0.5$ mho. **1.5**

(b) Define transfer function of a circuit. **1.5**

(c) Why should low pass filters have inductance in series arm and capacitance in shunt arm ? **1.5**

(d) Find initial value and final value for the function $F(s) = \dfrac{10(s+2)}{(s+1)(s+3)}$ **1.5**

(e) Derive the condition for reciprocity for Y- parameter. **1.5**

(f) Define all the characteristics of filter networks. **1.5**

(g) What is the significance of poles and zeros of network functions ? **1.5**

(h) Find the Laplace transform of $f(t) = \cos \omega t$. **1.5**

(i) Why are Z - parameters called open circuit impedance parameters ? **1.5**

(j) What is the value of load impedance if internal impedance is $5\text{-}j5\Omega$ for maximum power transfer in A.C circuit ? **1.5**

Part B

2. (a) Show that when two 2 -port networks N_1 and N_2 are connected in parallel, the equivalent Y- parameters of the combined network is the sum of Y -parameters of each individual 2 -port network. **7.5**

(b) Determine the Z-parameters and ABCD parameters of the circuit shown in Fig.1. **7.5**

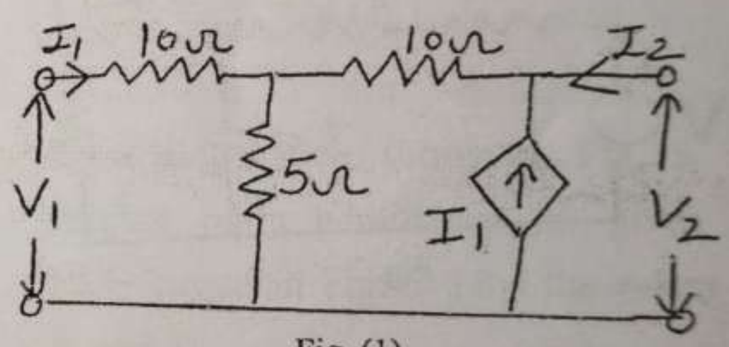

Fig. (1)

3. (a) In what respect high pass filter is different than low pass filter. Derive expressions to determine cut off frequency, inductance and capacitance of high pass filter. **7.5**

(b) Design a band pass filter having a pass band from 500Hz to 5000Hz and a characteristic resistance of 100 ohms. **7.5**

4. Draw the dual of a given network in Fig.2. In the network shown in Fig. 3, find Vo using nodal method. Use matrix approach for analysis. **15**

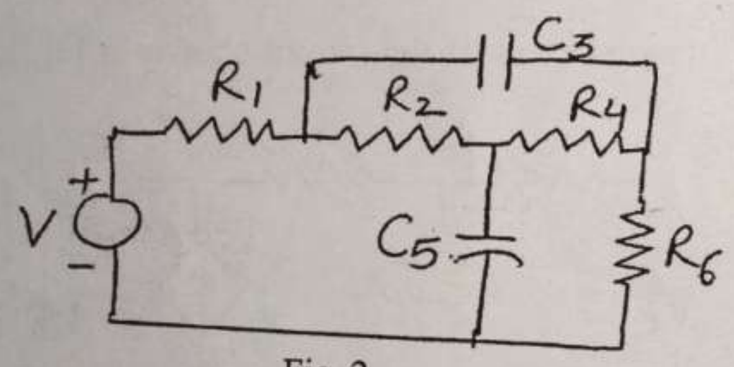

Fig. 2

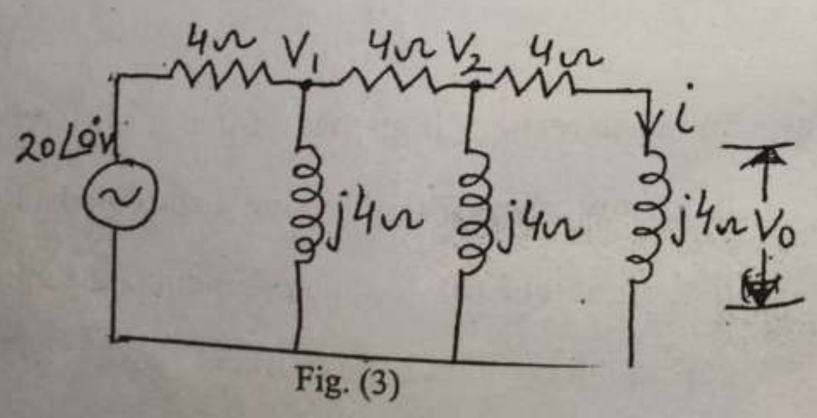

Fig. (3)

5. (a) Write the necessary conditions for driving point functions. Find the following network functions :

$$\frac{V_2(s)}{V_1(s)}, \frac{V_2(s)}{I_1(s)} \text{ and } \frac{V_1(s)}{I_1(s)}$$

for the circuit shown in Fig.4. **10**

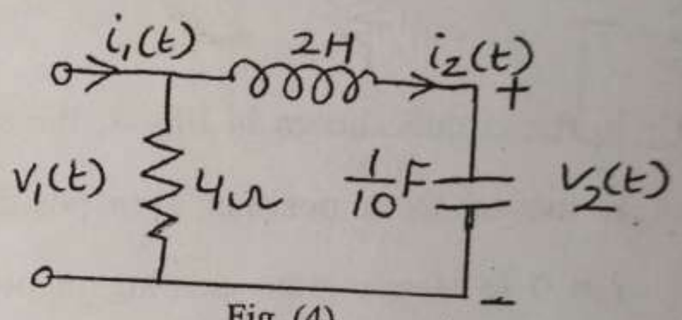

Fig. (4)

(b) A network function obtained using a pole 'zero diagram as shown in Fig. 5, is the driving point admittance for given series RLC circuit in Fig. 6. Find the values of R, L and C. **5**

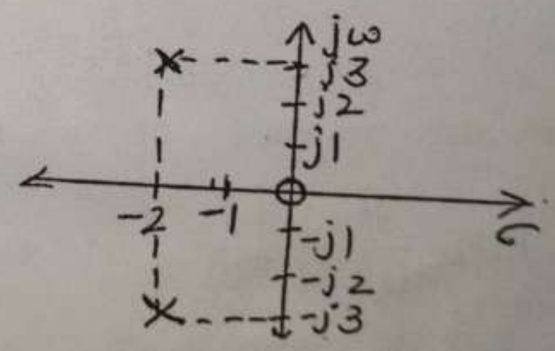

Fig. (5)

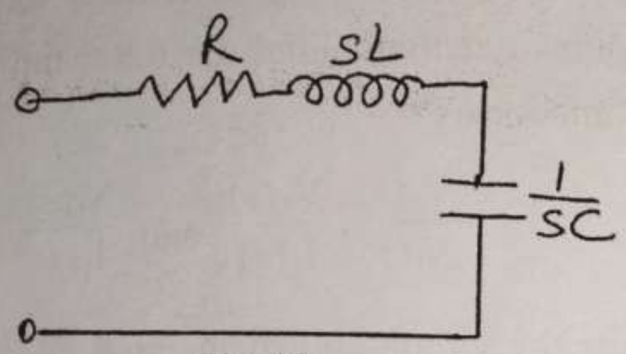

Fig. (6)

6. (a) In the circuit shown in Fig. 7, the switch S is moved from position 1 to position 2 at $t = 0$ (a steady state existing in position 1 before $t = 0$). Solve for the current $i_L(t)$. **7.5**

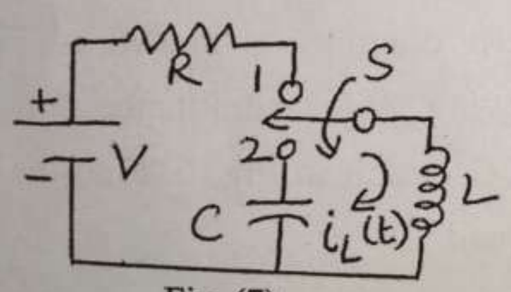

Fig. (7)

(b) Find the response of a network if $H(s) = \dfrac{s^2 + 3s + 5}{(s+1)(s+2)}$ and excitation $x(t) = e^{-3t}u(t)$. **14**

7. Discuss Tellegen's and Reciprocity theorem. Find current I through 2 Ω resistance using Thevenin's theorem for the given circuit in Fig.8. **15**

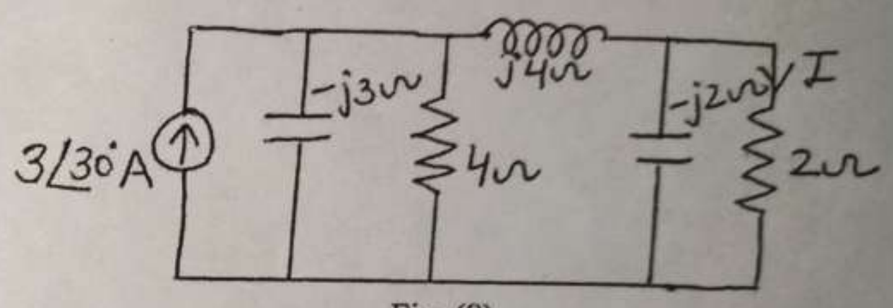

Fig. (8)