EX/ET/PC/B/T/212/2025

BACHELOR OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING EXAMINATION, 2025

(2nd Year, 1st Semester)

CIRCUIT ANALYSIS AND SYNTHESIS

Time: Three Hours **Full Marks: 100**

Answer all

1. For the gyrator-RL network shown in Fig.1, write the differential equation relating v_1 to i_1 and find a two-element equivalent network in which neither of the elements is a gyrator. (CO1) (8)

(OR). In the network shown in Fig.2, all sources are time-invariant. Determine the branch current in the 2 Ω resistor. (CO1) (8)

2. The network shown in Fig.3 is in a steady state with the switch K open. At t = 0, the switch is closed. Find the current in the capacitor for t>0, sketch this waveform and determine the time constant. (CO2) (12)

3. For the network shown in Fig.4, determine the current transfer ratio $\alpha = I_2/I_1$. (CO4) (8)

4. The network shown in Fig.5(a) has the impedance Z(s). If the poles and zeros of Z(s) have the locations shown in Fig.5(b) with Z(j0) = 1, find the values for R, L, and C. (CO4) (12)

5. For what values of k will the network shown in Fig.6 be stable? (CO4) (10)

(OR). The network shown in Fig.7 is in a steady state at $t = 0^-$ with $v_s = 0$. Find $v_c(t)$ for t>0. (CO4) (10)

6. Find the lattice equivalent of the network shown in Fig.8 using Bartlett's bisection method and obtain the z-parameters for the lattice. (CO5) (12)

(OR). Determine the ABCD parameters for the network shown in Fig.9 . Comment on the symmetrical and reciprocal properties of the network. (CO5) (12)

7. The system function of a network is given below. (CO4) (8)
(a) Find the forced response due to the input $\mathbf{e^{-4t}}$ u(t).
(b) Find the steady state response due to the input **cos2t** u(t).

$$\mathbf{H(s)} = \frac{s(s+5)}{(s+1)(s+2)}$$

8. The frequency response of a filter is given below. Compute its cutoff frequency. Sketch the magnitude Bode plot and hence, determine the type of the filter.
(CO5) (10)

$$\mathbf{H(jw)} = \frac{4}{(2+jw10)}$$

(OR). The frequency response test data of a network plotted on Bode diagram and asymptotically approximated is shown in Fig.10. Find the transfer function of the network. (CO5) (10)

9. For the network shown in Fig.11, obtain the resonant frequency, the impedance Z at resonance and the Q - factor at resonance. (CO5) (10)

10. Find the two forms of the continued fraction networks, Cauer's form I and II, for the following driving point impedance function. (CO5) (10)

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

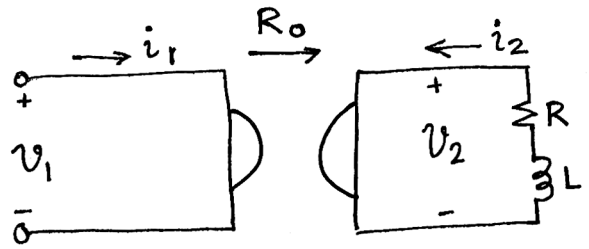


Fig. 1

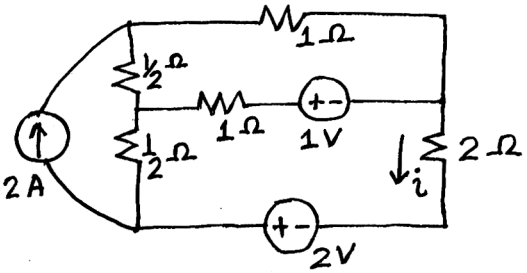


Fig. 2

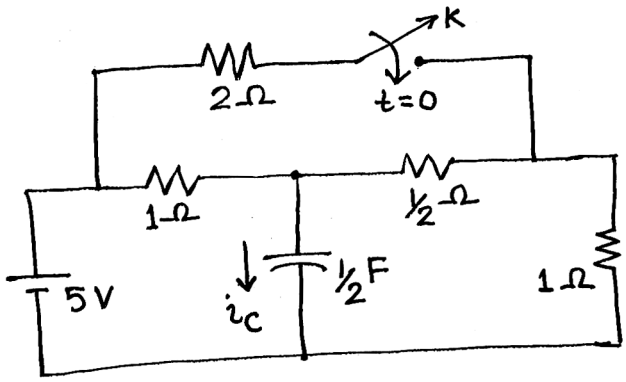


Fig. 3

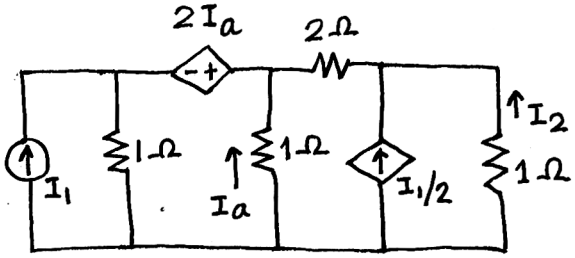


Fig. 4

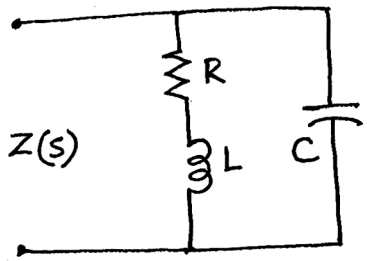


Fig. 5(a)

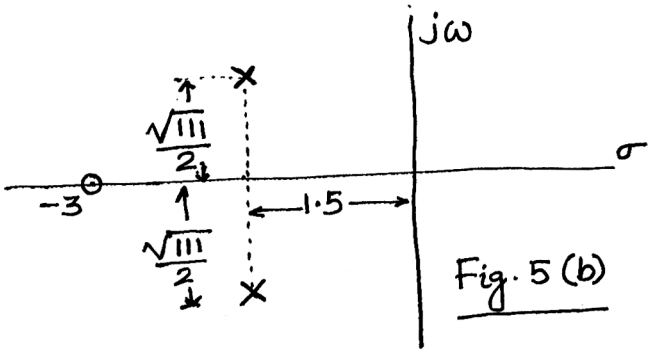


Fig. 5(b)

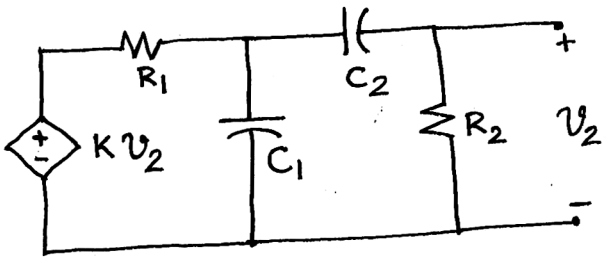


Fig. 6

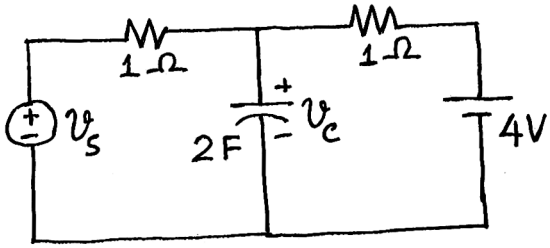
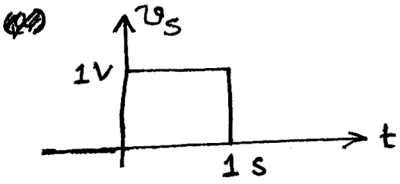


Fig. 7



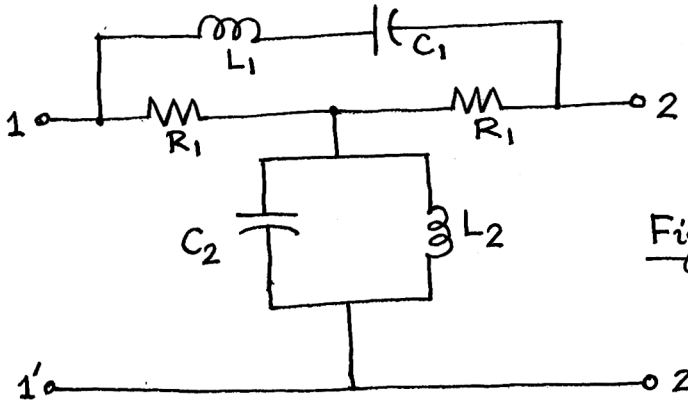


Fig. 8

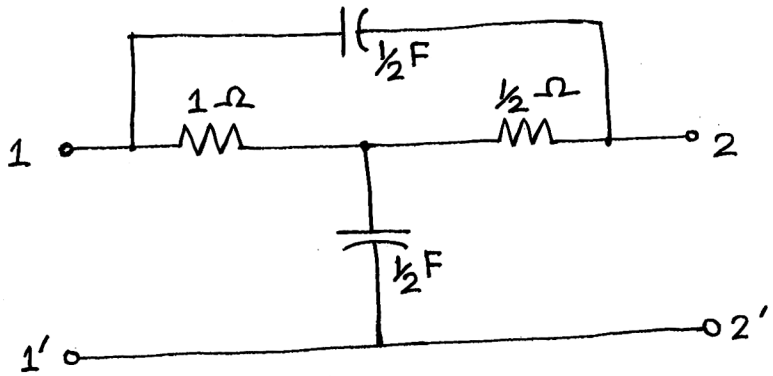


Fig. 9

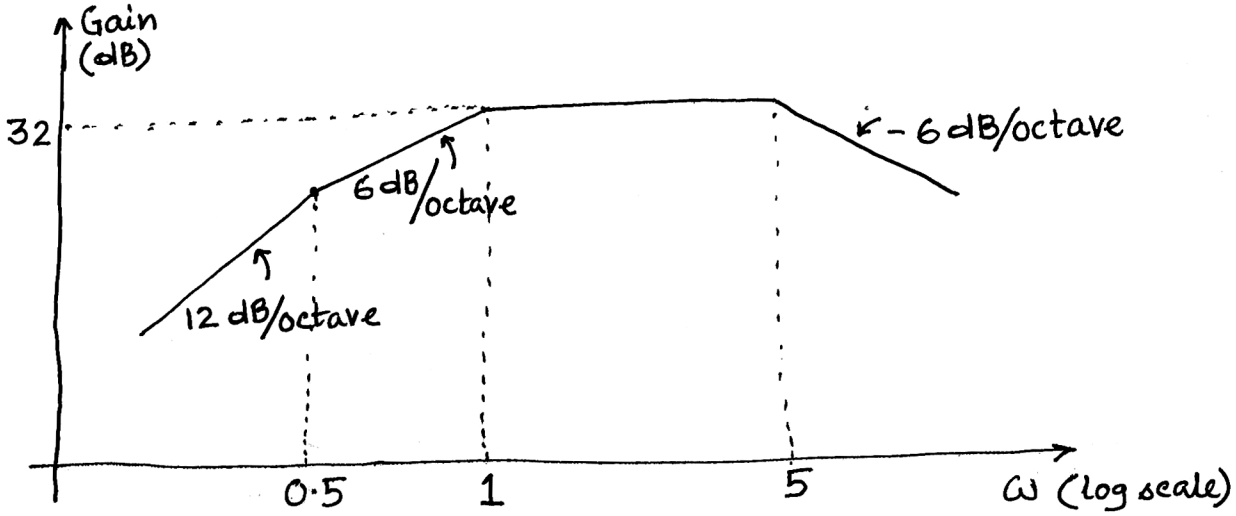


Fig. 10

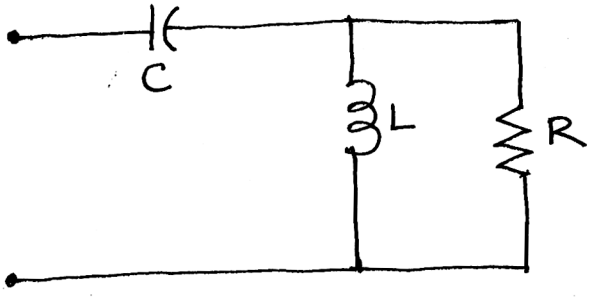


Fig. 11