

Con. 3245-10.

AN-2545

(3 Hours)

[Total Marks : 100

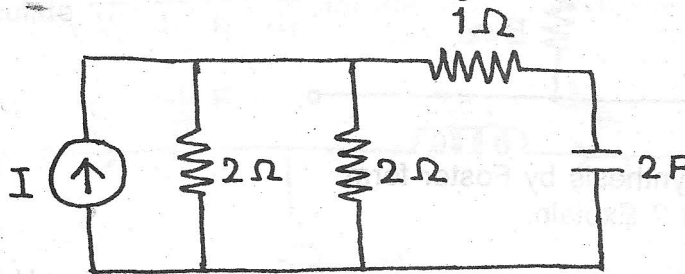
- N.B.** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from remaining **six** questions.
 (3) Assume any **suitable** data if **necessary** and state it **clearly**.
 (4) **All** questions carry **equal** marks (20 each).

1. (a) The Z parameters of a two-port network are 20
 $Z_{11} = 20 \Omega$, $Z_{22} = 30 \Omega$, $Z_{12} = Z_{21} = 10 \Omega$. Find ABCD parameters.
 (b) Reduced incidence matrix is given below :

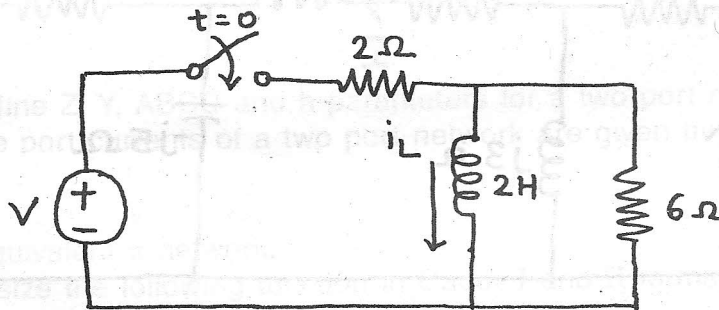
$$A = \begin{bmatrix} -1 & -1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & -1 & 1 & 0 \\ 0 & 0 & -1 & 0 & -1 & -1 \end{bmatrix}$$

Draw the oriented graph.

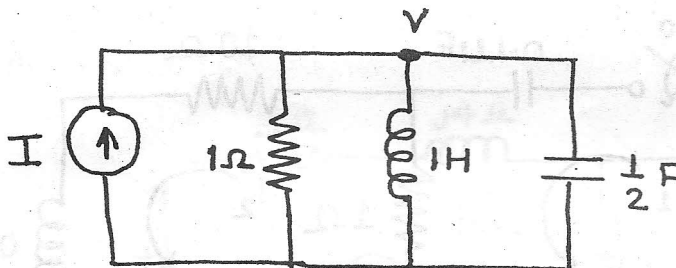
- (c) Find the time constant of the following circuit.



- (d) Write a differential equation valid for $t > 0$ for the circuit shown in figure.



- (e) Find the second order differential equation for the circuit shown in figure.

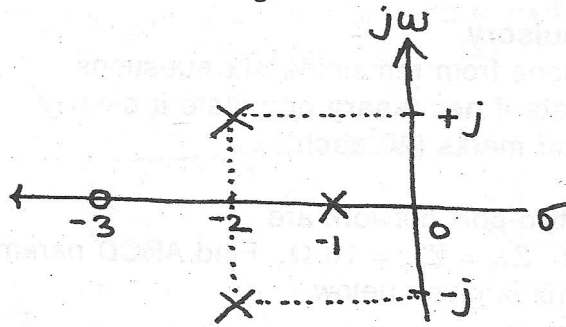


- (f) Write the V-I relationships and their S-domain equivalents for Resistor, Inductor and Capacitor.

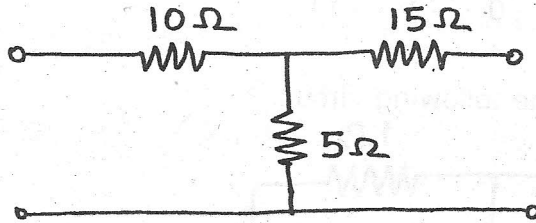
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- (g) Determine the system function if the d.c. gain of the system is 10 and Pole zero plot is as shown in figure.

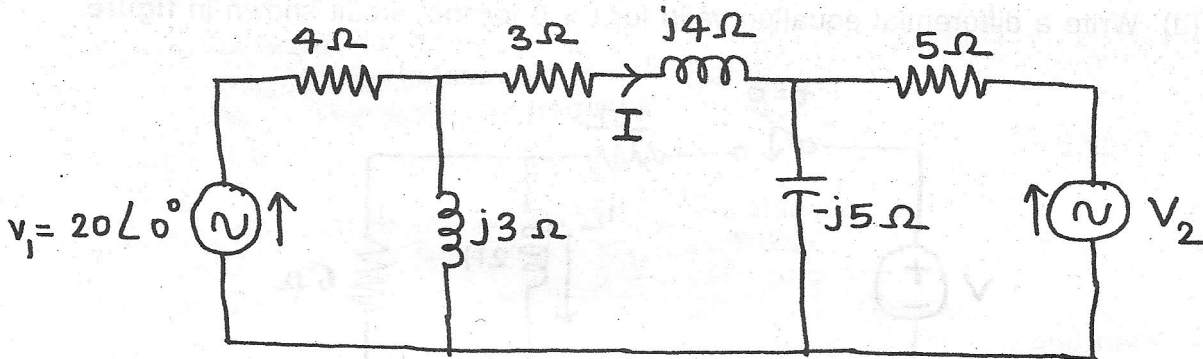


- (h) Find the Z-parameters of the network shown in figure.



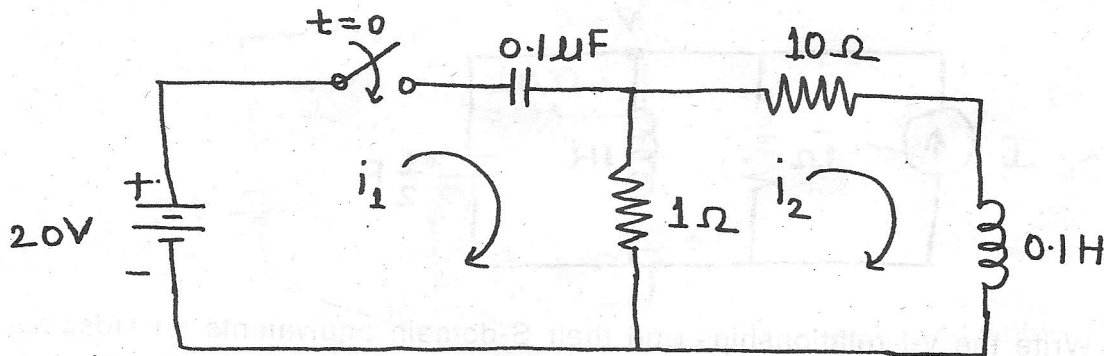
- (i) Explain network synthesis by Foster form.
 (j) What is Bode Plot ? Explain.

2. (a) For the circuit shown in figure. Determine the value of voltage V_2 such that 10 the current I is zero.

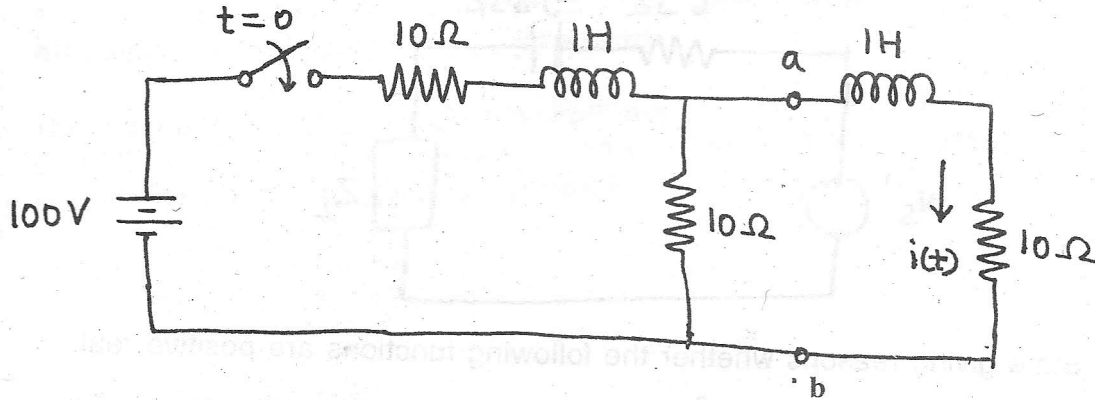


- (b) For the circuit shown in figure find i_1 , i_2 , $\frac{di_1}{dt}$ and $\frac{di_2}{dt}$ at $t = 0+$

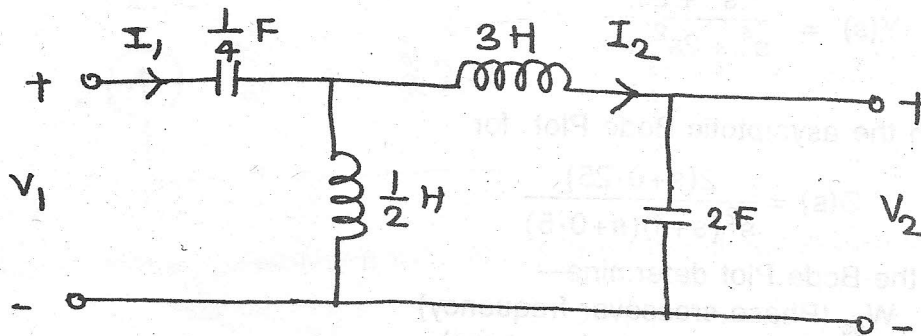
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3. (a) Find $i(t)$ using Thevenin's theorem in 'S' domain. Find initial value and final 10 value of $i(t)$ using Laplace transform theorem.



- (b) Calculate $\frac{V_2}{V_1}, \frac{I_2}{I_1}, \frac{V_1}{I_1}, \frac{V_2}{I_1}$ for the ladder network shown in figure. 10



4. (a) (i) Define Z, Y, ABCD and h parameters for a two port network. 5
 (ii) The port currents of a two port network are given by 5

$$I_1 = 2.5 V_1 - V_2$$

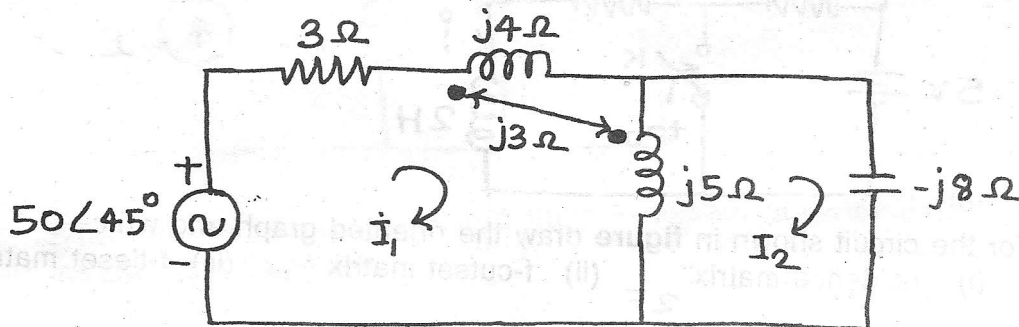
$$I_2 = -V_1 + 5V_2$$

Find equivalent π network.

- (b) Synthesize the following function in Cauer I and II forms 10

$$Z(s) = \frac{s^5 + 7s^3 + 10s}{s^4 + 4s^2 + 3}$$

5. (a) (i) Find the current I_1 using mesh analysis. 5

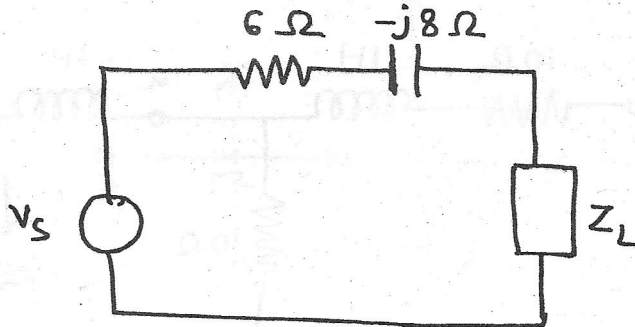


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- (ii) For the maximum power transfer find the value of Z_L if
 (1) Z_L is impedance (2) Z_L is pure resistance.

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- (b) State giving reasons whether the following functions are positive real. 10

(i) $Y(s) = 5 \cdot \frac{s^2 + 2s + 1}{s^3 + 2s^2 + 2s + 40}$

(ii) $Y(s) = \frac{s^3 + 5s}{s^4 + 2s^2 + 1}$

6. (a) Sketch the asymptotic Bode Plot for 12

$$G(s) = \frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$$

From the Bode Plot determine—

- (i) ω_{pc} (Phase crossover frequency)
 - (ii) ω_{gc} (Gain crossover frequency)
 - (iii) GM
 - (iv) PM
- (b) Test whether the following polynomials are Hurwitz 8
- (i) $s^5 + 8s^4 + 24s^3 + 28s^2 + 23s^1 + 6$
 - (ii) $2s^6 + s^5 + 13s^4 + 6s^3 + 56s^2 + 25s^1 + 25$.

7. (a) In the network shown in figure switch 'K' is initially kept open and network reaches steady state. At $t = 0$, switch 'K' is closed. Find an expression for the current through the inductor for $t > 0$. Also sketch the waveform. 10

