S.E / ELTC / Telecommunication

Sem III

Con. 3245-10. Electrical Networks **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**).

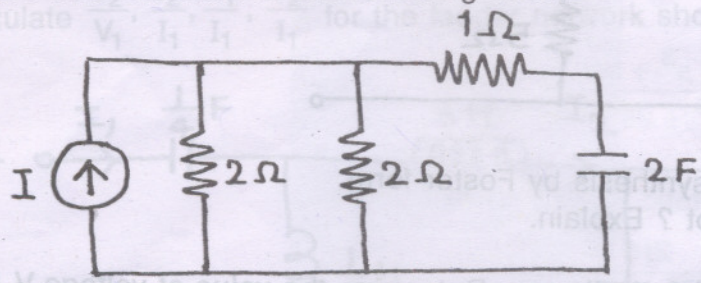
1. (a) The Z parameters of a two-port network are **20**
$Z_{11} = 20\ \Omega$, $Z_{22} = 30\ \Omega$, $Z_{12} = Z_{21} = 10\ \Omega$. Find ABCD parameters.

(b) Reduced incidence matrix is given below :

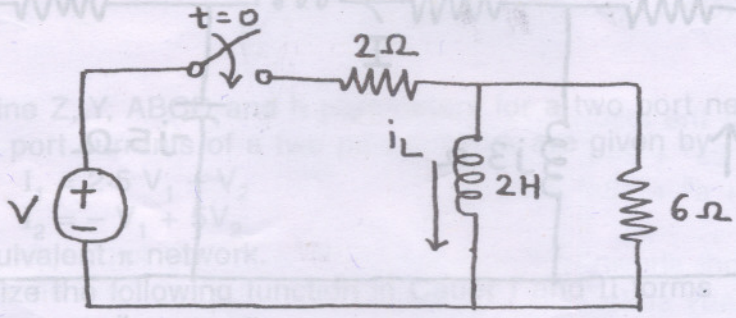
$$A = \begin{bmatrix} -1 & -1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & -1 & 1 & 0 \\ 0 & 0 & -1 & 0 & -1 & -1 \end{bmatrix}$$

Draw the oriented graph.

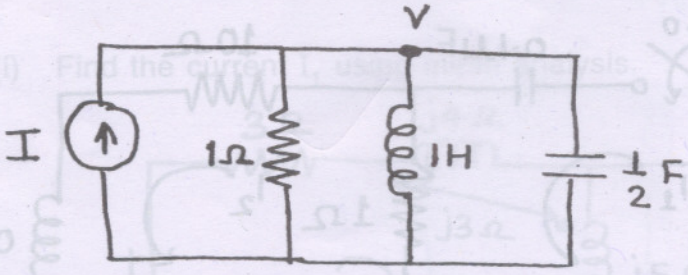
(c) Find the time constant of the following circuit.



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

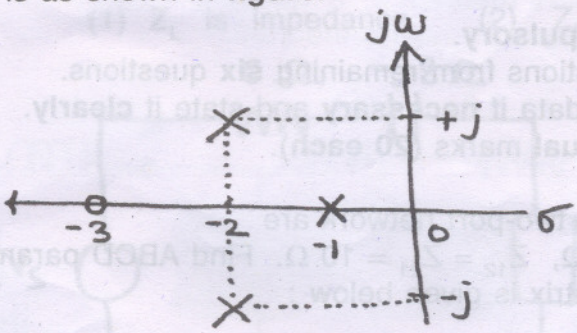


(e) Find the second order differential equation for the circuit shown in **figure**.

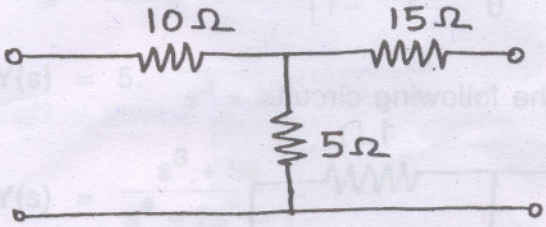


(f) Write the V-I relationships and their S-domain equivalents for Resistor, Inductor and Capacitor.

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



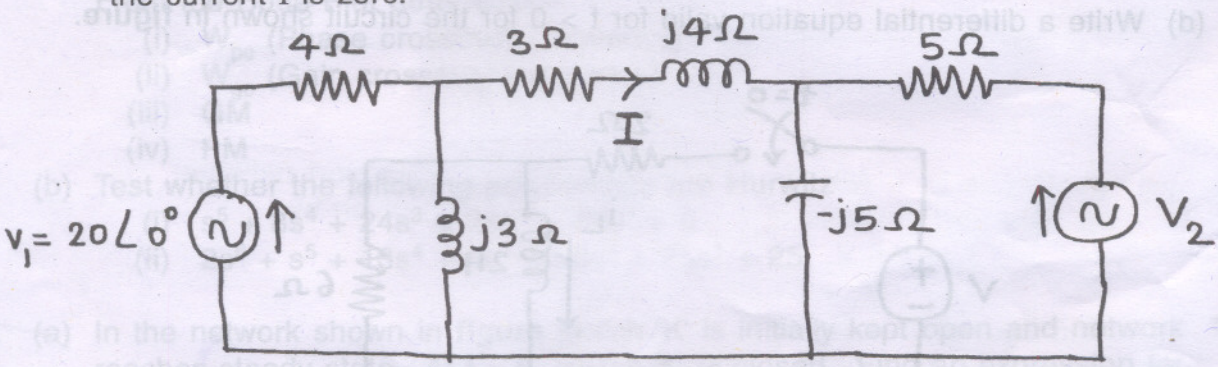
(h) Find the Z-parameters of the network shown in **figure**.



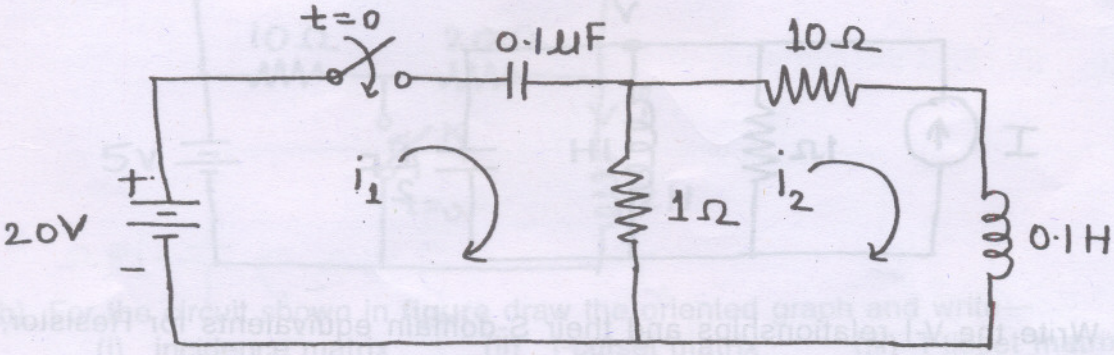
(i) Explain network synthesis by Foster form.

(j) What is Bode Plot ? Explain.

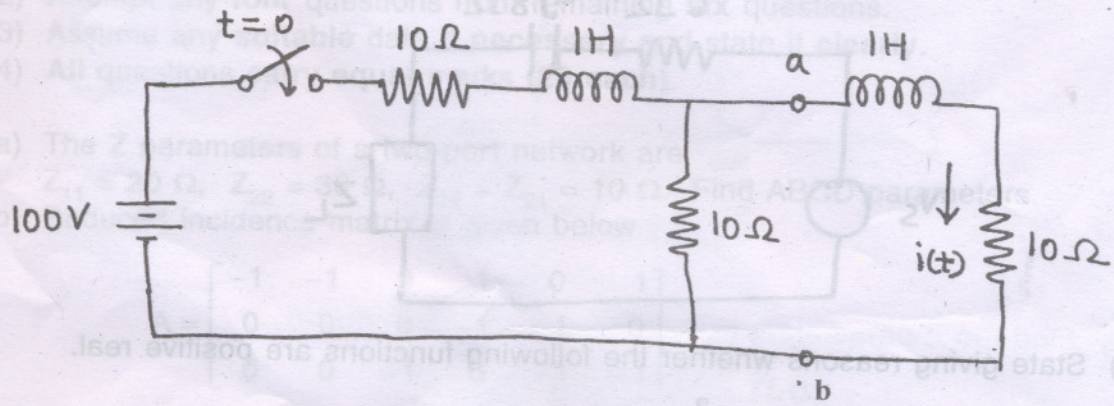
2. (a) For the circuit shown in **figure**. Determine the value of voltage V_2 such that the current I is zero. **10**



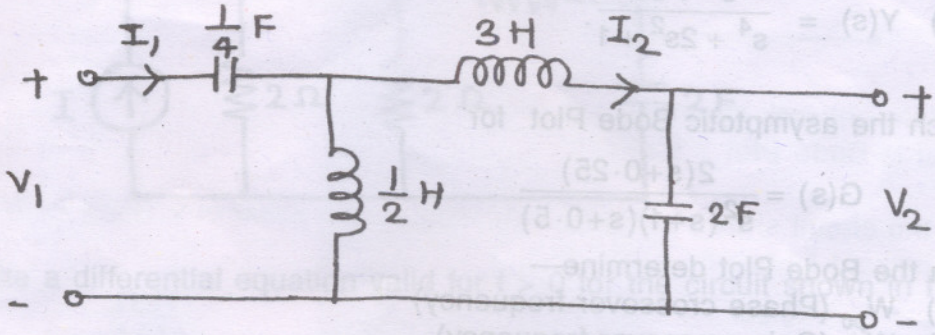
(b) For the circuit shown in **figure** find i_1, i_2, $\frac{di_1}{dt}$ and $\frac{di_2}{dt}$ at t = 0+ **10**



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



(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

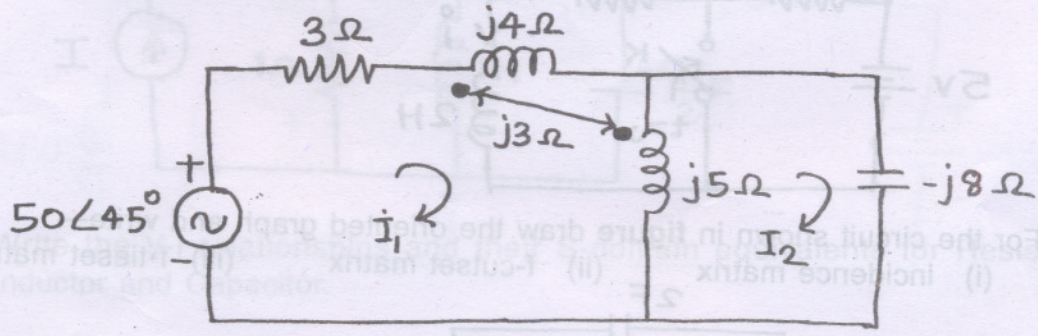
$$I_1 = 2.5\,V_1 - V_2$$
$$I_2 = -V_1 + 5V_2$$

Find equivalent π network.

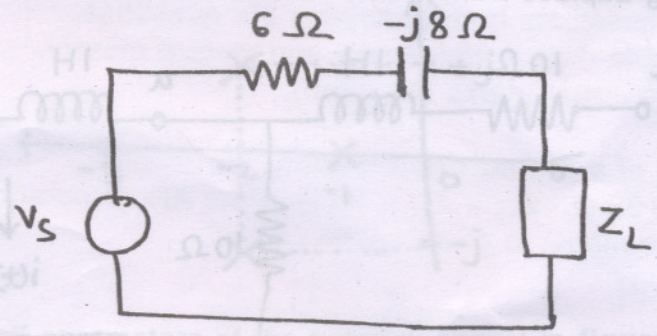
(b) Synthesize the following function in Cauer I and II forms 10

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

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



(ii) For the maximum power transfer find the value of Z_L if 5
(1) Z_L is impedance (2) Z_L is pure resistance.



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

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

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

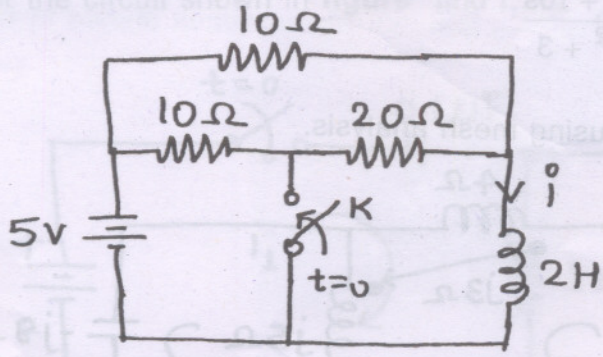
6. (a) Sketch the asymptotic Bode Plot for 12

$$G(s) = \frac{2(s+0\cdot25)}{s^2(s+1)(s+0\cdot5)}$$

From the Bode Plot determine—
(i) W_{pc} (Phase crossover frequency)
(ii) W_{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



(b) For the circuit shown in **figure** draw the oriented graph and write— 10
(i) incidence matrix (ii) f-cutset matrix (iii) f-tieset matrix