3 Sem III / Reo / EITL / Electrical Networks / Dec-eg

Con. 6015–09. (REVISED COURSE) SP–7409

(3 Hours) [Total Marks : 100

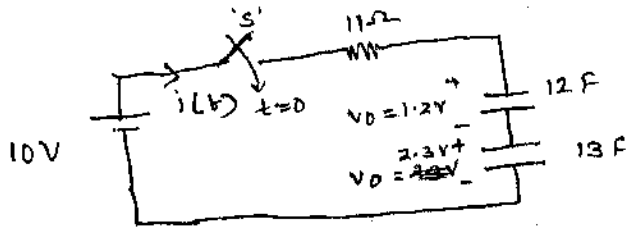
N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.
(3) Assume any **suitable** data if **necessary** and state it **clearly**.

1. (a) Explain with suitable example how to write incidence matrix. **20**
(b) Complete incidence matrix is as per given below. If node 2 is reference node, then determine number of possible trees.

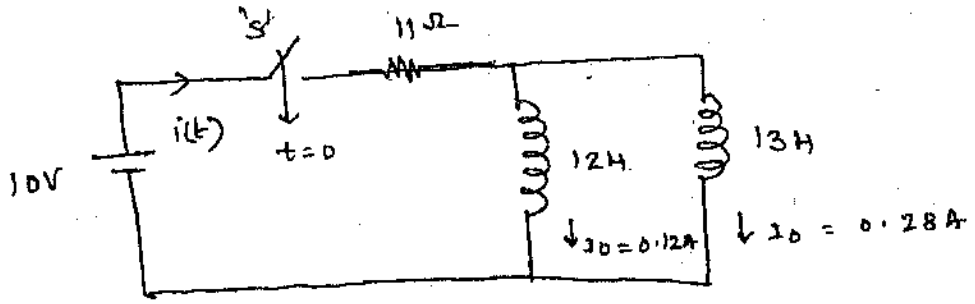
node → branches

↓	1	2	3	4	5
1	1	0	0	−1	−1
2	−1	1	0	0	0
3	0	−1	1	0	1
4	0	0	−1	1	0

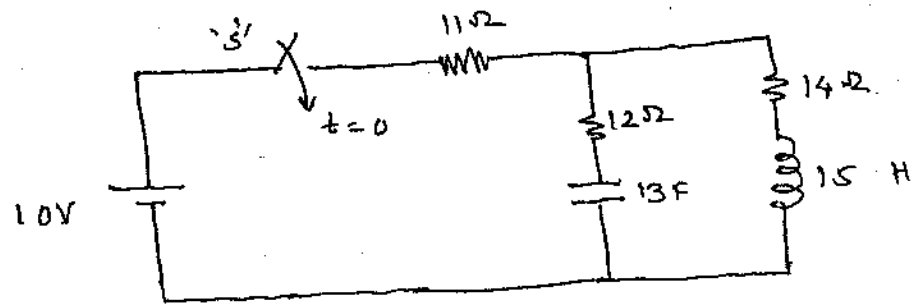
(c) Determine i(t) for t > 0 if switch 's' is closed at t = 0 with initial conditions as shown.



(d) For the circuit shown determine i(t) for t > 0 if switch 's' is closed with initial condition given below.



(e) For the circuit shown switch 's' is closed at t = 0 with zero initial conditions. Draw equivalent circuit at t = 0+ and t = ∞.



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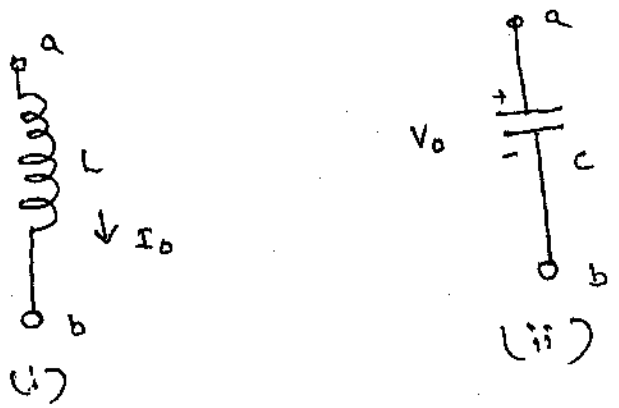
(f) Draw S–domain (Laplace) equivalent circuit for the following.



(g) If $\bar{I}(s) = \dfrac{s}{(s+2)(s+1)^2} = \dfrac{k_1}{(s+2)} + \dfrac{k_2}{(s+1)^2} + \dfrac{k_3}{(s+1)}$ then determine k_1, k_2 and k_3 graphically.

(h) With reference to two port network, define :
- (i) driving point function
- (ii) transfer function.

(i) Explain significance of following C amplifier prarameters with reference to two port network :
- (i) voltage gain
- (ii) current gain
- (iii) input impedance
- (iv) output impedance.

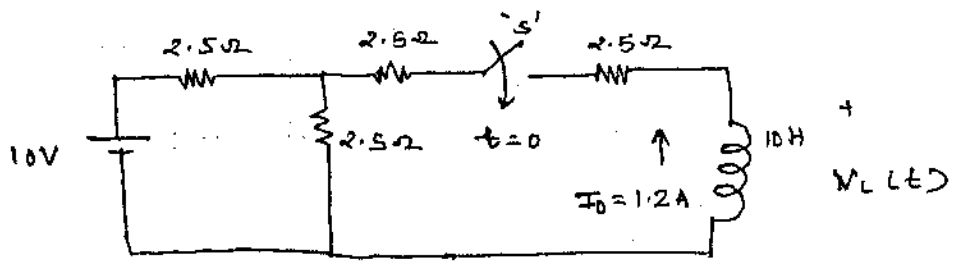
(j) Explain in brief synthesis of LC network function.

2. (a) Define Hurwitz polynomial and explain its properties (at least six). **5**

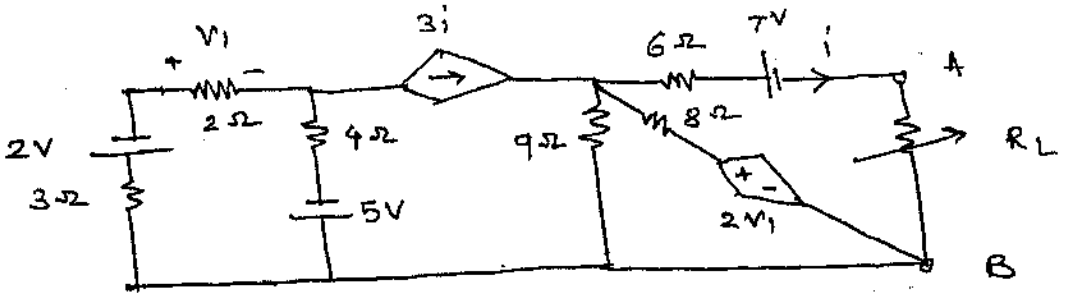
(b) Realise the driving point impedance given below in Foster I form. **5**

$$Z(s) = \frac{3(s^2+1)(s^2+49)}{s(s^2+9)}$$

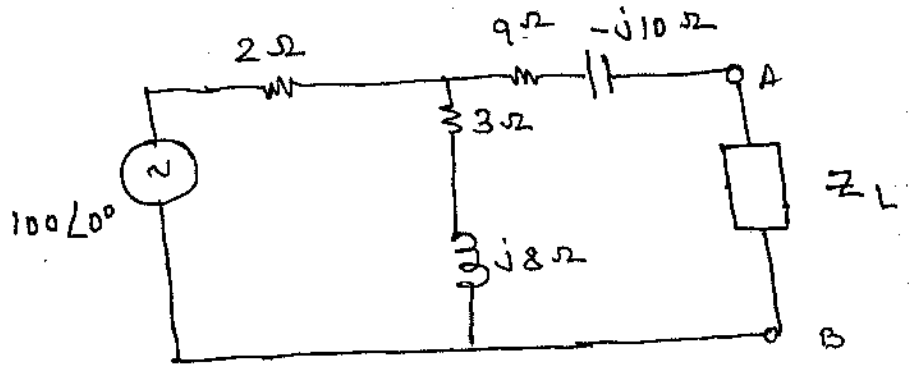
(c) For the network shown below determine $V_L(t)$. The switch 's' is closed at t = 0 with initial conditions shown. (You can use equations for solution of typical R–L–C series circuits) (do not derive) **10**



3. (a) For the network shown below determine maximum power transferred to the load connected between terminals A and B. 10



(i) circuit - I



(ii) circuit - II

(b) Test whether following polynomials are Hurwitz : 10

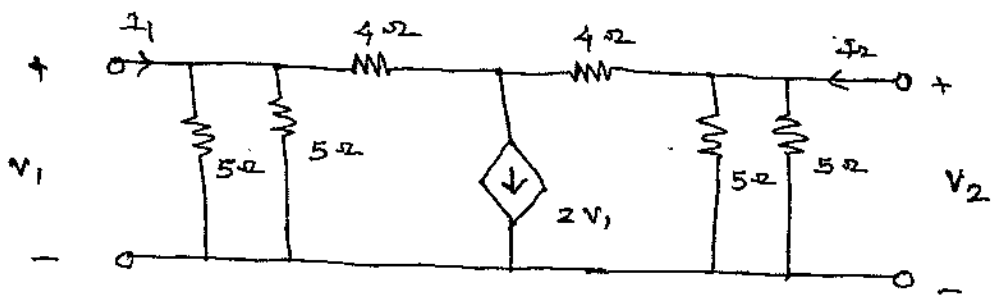
(i) $P(s) = s^3 + 2s^2 + 4s + 2$

(ii) $P(s) = s^4 + 3s^3 + 4s^2 + 2s + 3$

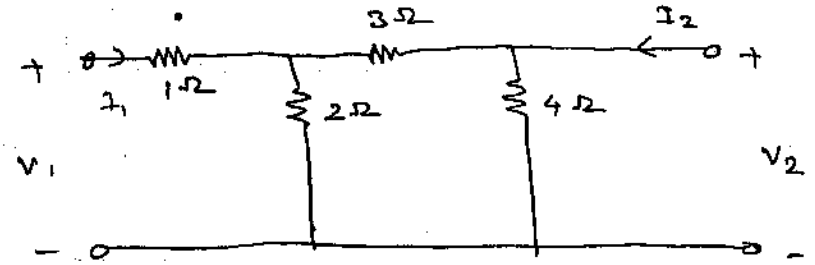
(iii) $P(s) = s^5 + 2s^3 + s$

(iv) $P(s) = s^7 + 3s^6 + 8s^5 + 12s^4 + 17s^3 + 12s^2 + 4s.$

4. (a) (i) For the network shown below determine short circuit admittance parameters. 10



(ii) Two identical sections of the network shown below are connected in parallel. Obtain short circuit admittance parameters of the connection.

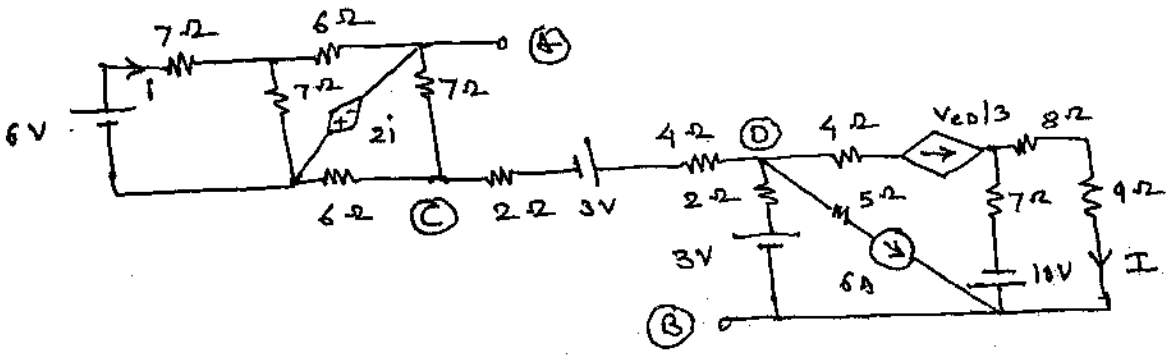


(b) (i) Determine amplitude and phase of a network function given below at (j4) **10**

$$F(s) = \frac{s^3 + 4s^2 + 3s}{\left(s^2 + 6s + 8\right)\left(s^2 + 10s + 29\right)}$$

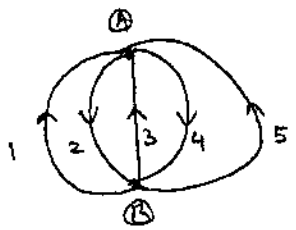
(ii) Write a short note on frequency response of perfect capacitor and pure inductor.

5. (a) For the network shown below determine 'I' flowing through 9Ω resistance. **10**

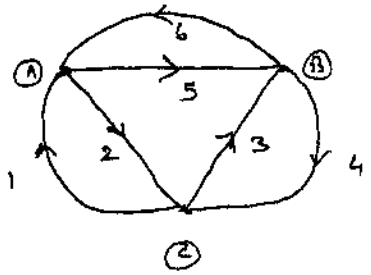


(b) $G(s)H(s) = \dfrac{10(1+s)}{s(1+0{\cdot}02\,s)(1+0{\cdot}2\,s)}$. Sketch the Bode plot for the transfer function given above. **10**

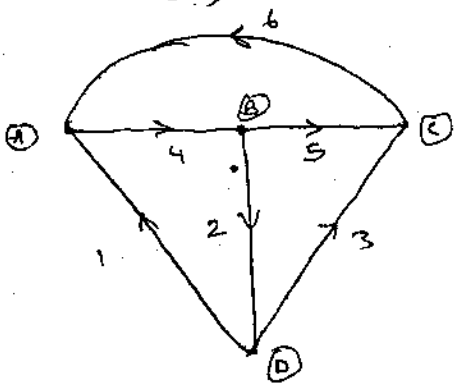
6. (a) With reference to graph theory write cutset matrix (Q) for the following network graphs. **10**



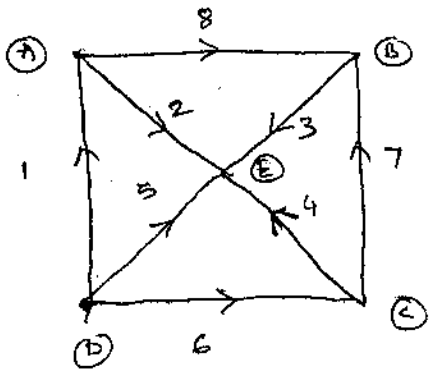
(i)



(ii)

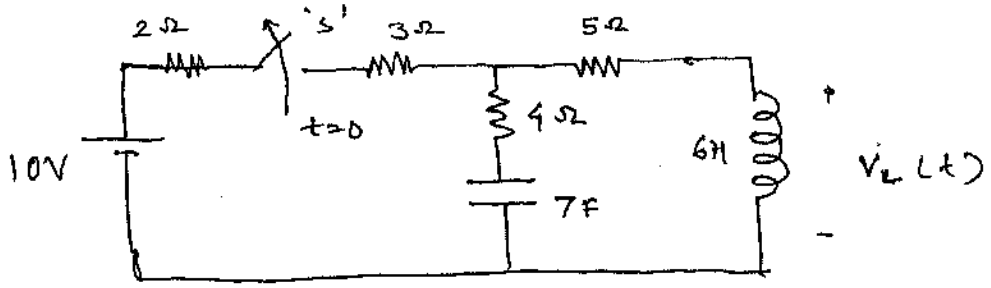


(iii)



(iv)

(b) For the circuit shown switch 's' is opened at t = 0. Switch 's' was ON for long time. Determine $V_L(0^+)$, $\frac{dV_L}{dt}(0^+)$, $\frac{d^2V_L}{dt^2}(0^+)$ **10**



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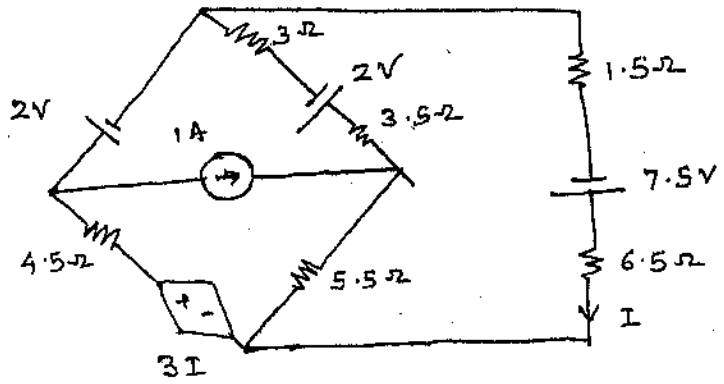
7. Solve any **four** :– **20**

(a) For the circuit shown determine I using Nodal analysis.



(b) With reference to two port network, explain and derive condition for reciprocity and symmetry.

(c) Define positive real function and explain their properties (at least six).

(d) Realise the driving point impedance function in Cauer I and Cauer II form

$$Z(s) = \frac{3\left(s^2+1\right)}{s\left(s^2+9\right)}.$$

(e) Explain in brief time domain and frequency domain response.