(REVISED COURSE)

(3 Hours) **[Total Marks : 100**

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

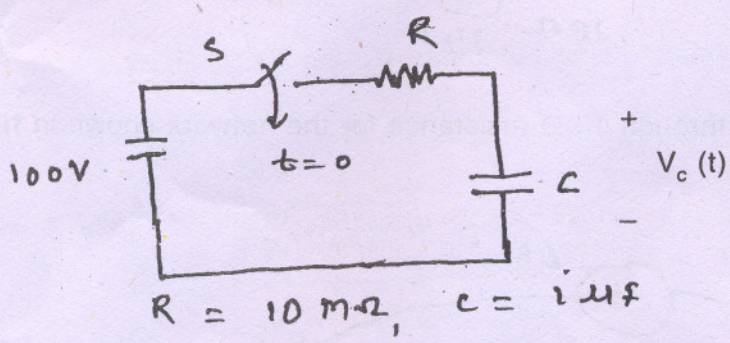
1. (a) State the properties and conditions of positive real function. **20**

(b) Test whether F(s) is positive real function or not.

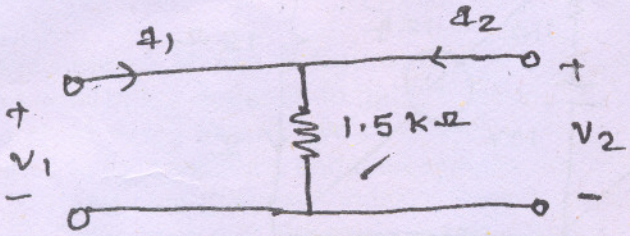
(i) $F(s) = 8s$

(ii) $F(s) = \dfrac{2s^3 + 2s^2 + 3s + 2}{s^2 + 1}$

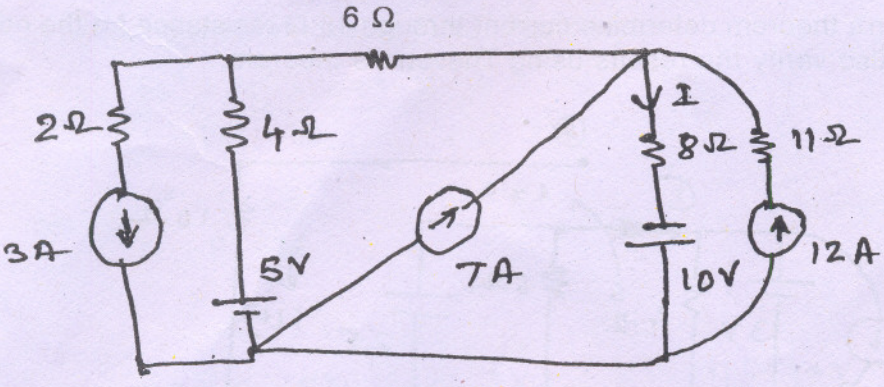
(c) For the circuit shown in **figure**, find and plot $V_c(t)$. The switch 's' is closed at t = 0 with zero initial condition. Also indicate $V_C(t)$ for t = RC



(d) Find z_{12} and z_{22} for the network shown in **figure.**

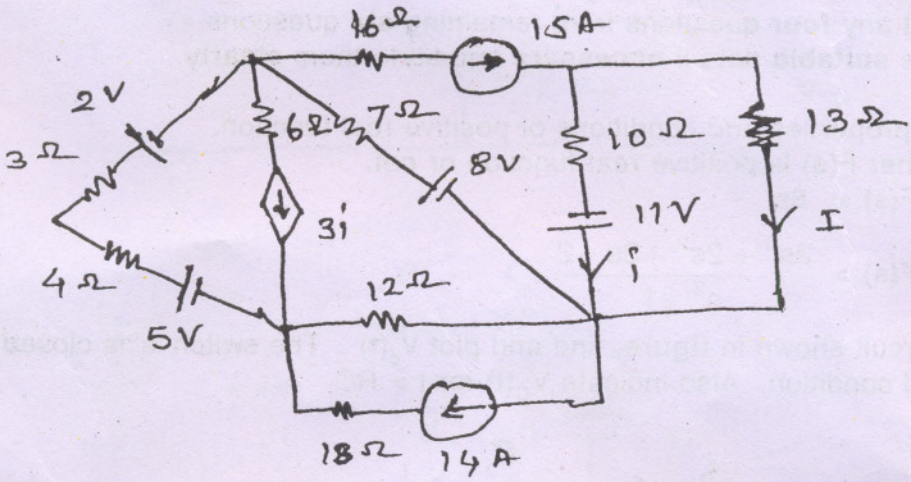


(e)



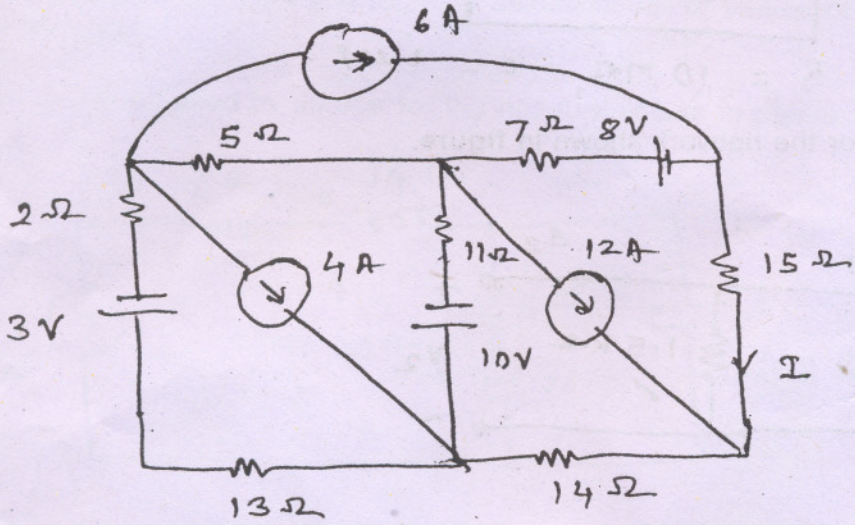
For the network shown in **figure,** determine 'I' , current flowing through 8 Ω resistance.

2. (a) **10**



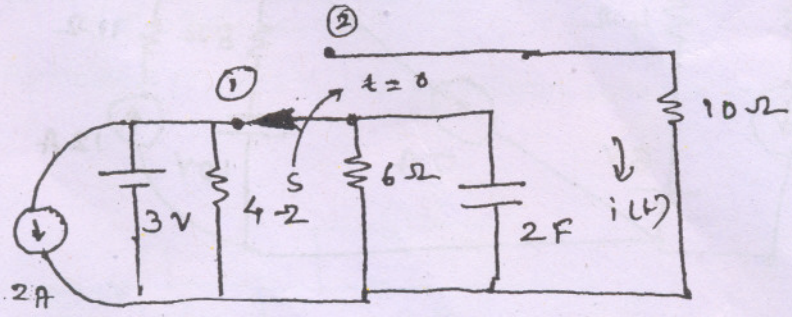
Find current 'I' flowing through 13 Ω resistance for the network shown in **figure**.

(b) **10**



Using Norton's theorem determine current through 15 Ω resistance for the network shown in **figure**. Also verify the results using Thevenin's theorem.

3. (a) **10**



For the network shown in **figure**, switch 's' was in position (1) for long time and steady state is reached. At t = 0, switch 's' is changed from position (1) to position (2), find i(t) [illegible] of problem by using both differential equation and Lplace transform.

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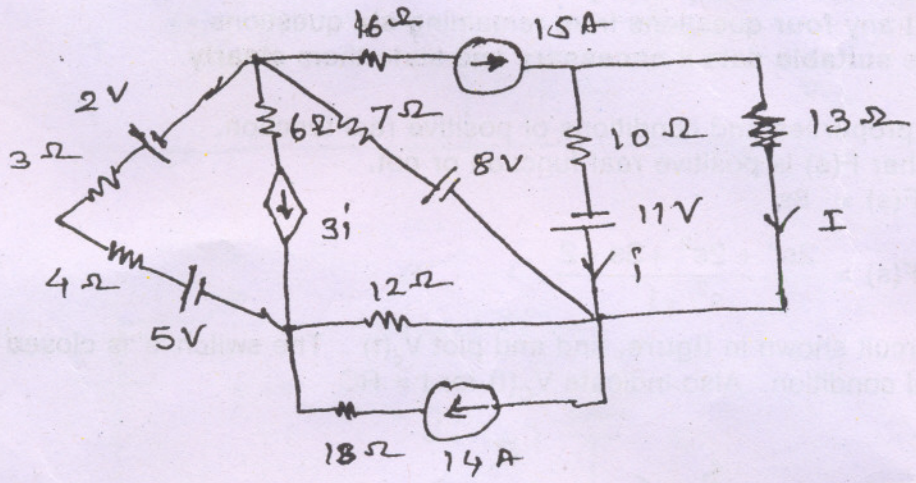
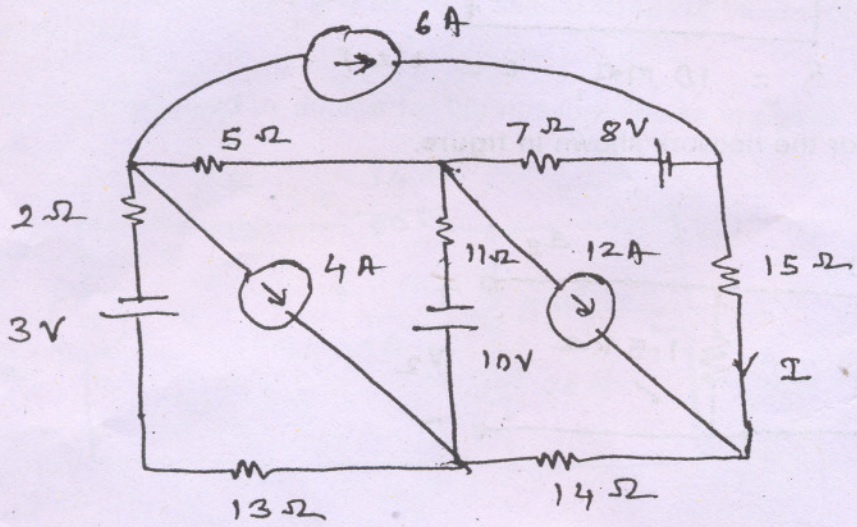


Find current 'I' flowing through 13 Ω resistance for the network shown in **figure**.

(b) 10



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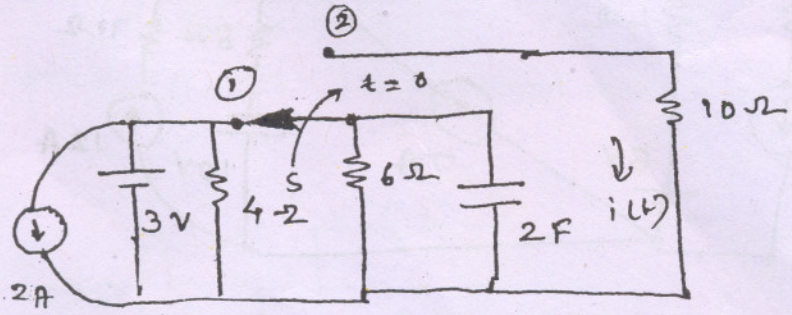
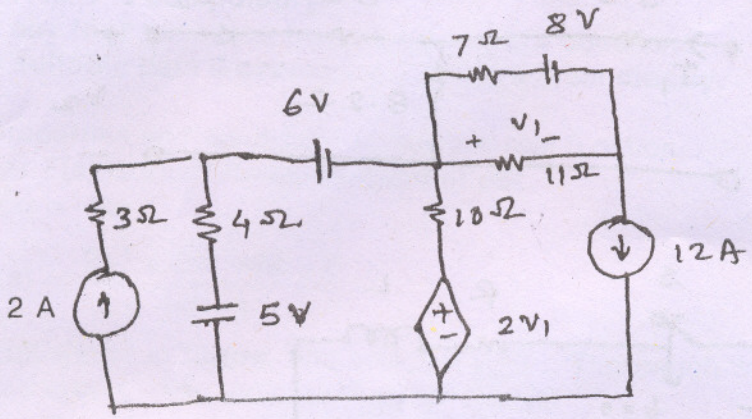


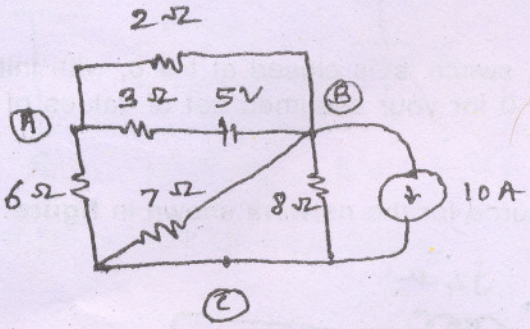
For the network shown in **figure**, switch 's' was in position (1) for long time and steady state is reached. At t = 0, switch 's' is changed from position (1) to position (2), find i(t) for t ≥ 0. Obtain solution of problem by using both differential equation and Lplace transform.

(b) 10



For the network shown in **figure** determine 'V_1' using Nodal analysis.

4. (a) 10



For the network shown in **figure,** determine V_{AB} using network graph theory. Use KCL based equilibrium equation to get the solution.

(b) Write short notes on any **two** of following :— 10

(i) Initial conditions and their significance while getting solution of transient condition and steady state condition for the given R-L-C network.

(ii) Pole-zero plot and their use to get time domain response.

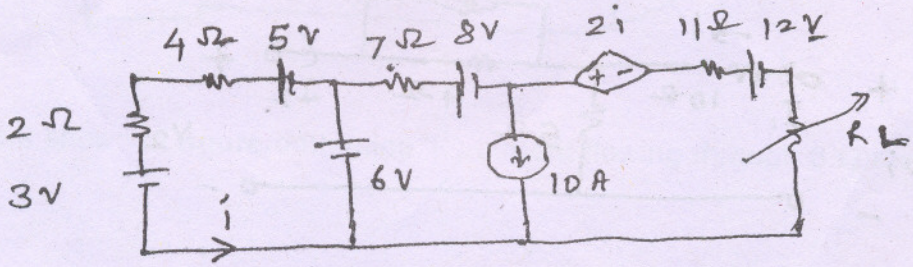
(iii) State and prove maximum power transfer theorem for a R-L-C network excited by AC source.

5. (a) Synthesize following network driving point impedances. 10

(i) $z(s) = \dfrac{6s^3 + 3s^2 + 3s + 1}{6s^3 + 3s}$

(ii) $z(s) = \dfrac{s^2 + 6s + 5}{s^2 + 9s + 14}$

(b) 10

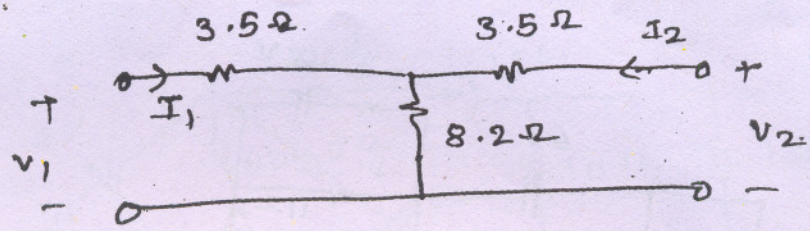


For the network shown in **figure**, find R_L for maximum power transfer and maximum power transferred.

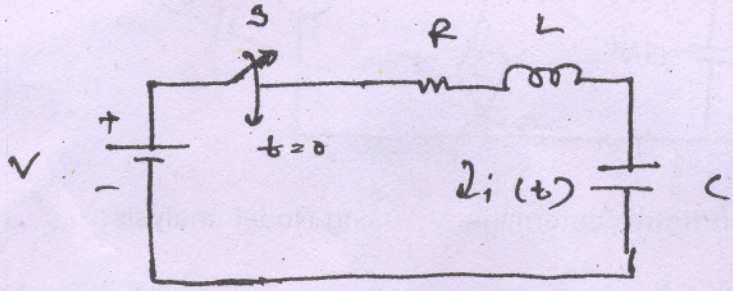
6. (a) (i) Find the range of values of 'a' so that F(s) will be Hurwitz **10**

$$F(s) = s^4 + s^3 + as^2 + 2s + 3$$

(ii) Find ABC D parameters for the network shown in **figure**.

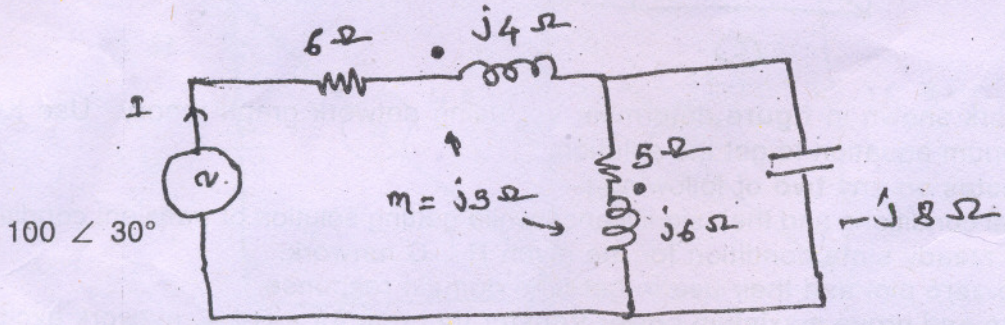


(b) **10**



In the circuit shown in **figure**, switch 's' is closed at t = 0, with initial conditions zero. Derive equation for i(t) for $t \geq 0$ for your assumed set of values of R-L-C and V. Use Laplace transform.

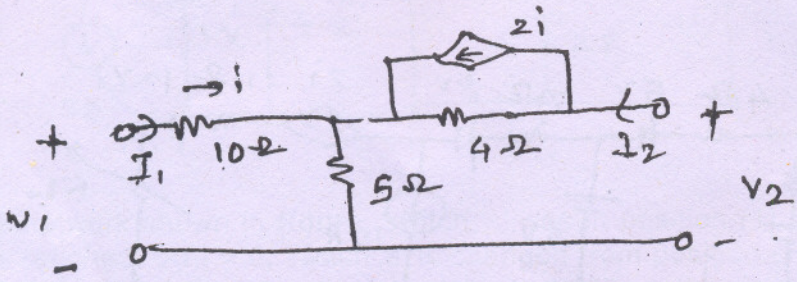
7. (a) Find current (I) supplied by source for the network shown in **figure**. **20**



(b) Test F(s) for positive real function

$$F(s) = \frac{s^2 + 4}{\left(s^3 + 3s^2 + 3s + 1\right)}$$

(c) Determine Y-Parameters (Y_{11} and Y_{12}) for the network shown in **figure**.



(d) Prove the condition for symmetry for the two port network.