

B. TECH
(SEM IV) THEORY EXAMINATION 2022-23
NETWORKS ANALYSIS & SYNTHESIS

Time: 3 Hours

Total Marks: 100

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

2 x 10 = 20

- (a) Define
- (i) Tree
 - (ii) Co- Tree
 - (iii) Twigs
 - (iv) Links .
- (b) The incidence matrix of the network graph is shown. Draw the oriented graph of the network.

$$\begin{array}{c}
 \uparrow \\
 \downarrow \\
 \downarrow \\
 \downarrow \\
 \downarrow \\
 \downarrow
 \end{array}
 \begin{array}{ccccccc}
 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
 1 & 0 & 0 & -1 & 1 & 0 & 0 \\
 0 & 1 & 0 & 0 & -1 & 1 & -1 \\
 0 & 0 & 1 & 0 & 0 & -1 & 0
 \end{array}
 \begin{array}{c}
 \square \\
 \square \\
 \square \\
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 \square \\
 \square
 \end{array}$$

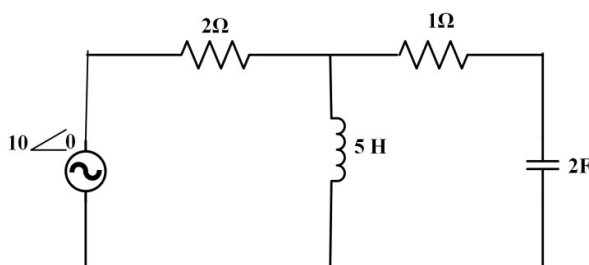
- (c) Derive the expression of maximum power transferred for ac circuits.
- (d) State Reciprocity theorem.
- (e) Differentiate between natural response and forced response in circuit analysis.
- (f) In a series RLC circuit, discuss (i) underdamped (ii) overdamped conditions.
- (g) Define 'Z' and 'Y' parameters of a typical four-terminal network.
- (h) State the conditions for the network to be (i) Reciprocal (ii) Symmetrical
- (i) Name two methods of synthesis for a given positive real function
- (j) Discuss any two properties of LC driving point function.

SECTION B

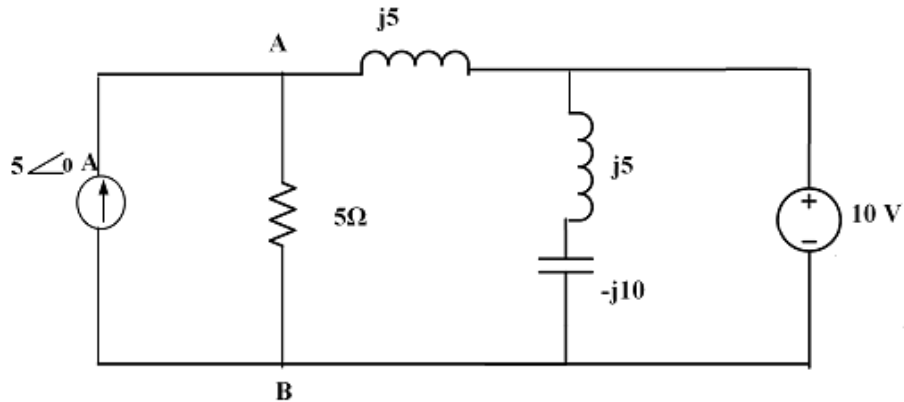
2. Attempt any three of the following:

10x3=30

- (a) (i) Explain the principle of duality.
- (ii) Determine the dual of the circuit shown in Figure



- (b) (i) State the Superposition theorem
(ii) Utilize superposition theorem to find the current through branch A-B in the Figure shown below:



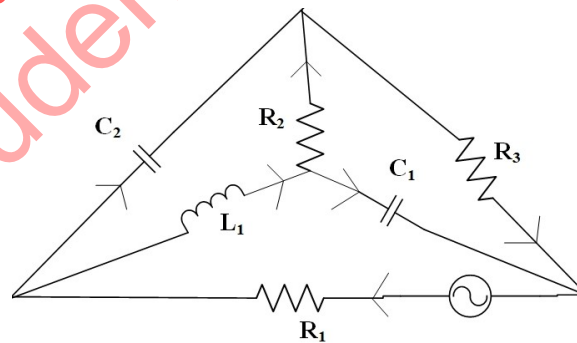
- (c) Determine the response of a series RLC circuit to a step voltage, assuming initial conditions to be zero. Differentiate the responses in terms of damping in the system
(d) For two-port networks, establish, the relation between the transmission parameters and the open-circuit parameters
(e) Test whether the function given below is a Positive Real Function (PRF) or not.

$$= \frac{5 + 18}{+ 9}$$

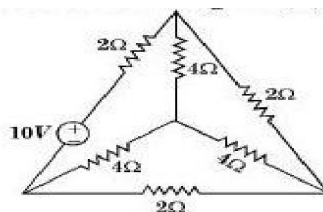
SECTION C

3. Attempt any *one* part of the following: 10x1=10

- (a) For the network shown in Figure, find out the number of possible trees.



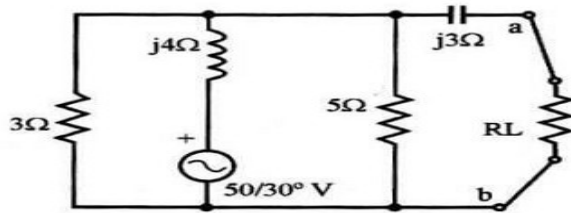
- (b) Draw the graph of the network shown in figure. Select a tree and write
i. Incidence Matrix ii. Tie set matrix iii. Cut-set Matrix



4. Attempt any one part of the following:

10x1=10

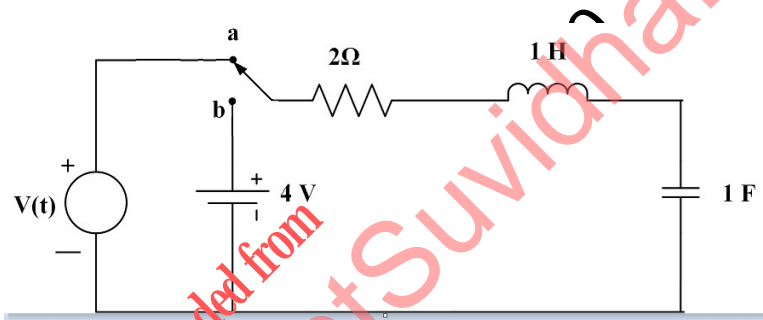
- (a) State and explain Thevenin's theorem, and specify the types of circuits to which it is applicable. Also, state the theorem which is the dual of the above theorem
- (b) What should be the value of R_L so the maximum power can be transferred from the source to R_L for the given figure.



5. Attempt any one part of the following:

10x1=10

- (a) Derive the complete response of a series RL circuit to a step voltage, assuming the initial current through the inductor is zero, indicating the natural and forced response. Plot the response.
- (b) In the circuit shown, switch is initially at position 'a' in Fig. 6. After steady state condition is reached, when $t = 2$ and $t = 2$, switch is now thrown to a position 'b'. Determine the current in the circuit.



6. Attempt any one part of the following:

10x1=10

- (a) Currents I_1 and I_2 entering ports 1 and 2 respectively of a two port network are given by the following equations:
 $I_1 = 0.5 V_1 - 0.2 V_2$ and $I_2 = -0.2 V_1 + 0.5 V_2$ where V_1 and V_2 are the voltages at ports 1 and 2, respectively, find the ABCD parameters of the network
- (b) Determine the hybrid parameters of the network with the following data:
 (i) Output terminals short circuited
 $V_1 = 25V, I_1 = 1A, I_2 = 2A$
 (ii) With input terminals open-circuited
 $V_1 = 10V, V_2 = 50V, I_2 = 2A$

7. Attempt any one part of the following:

10x1=10

- (a) (i) State the properties of Hurwitz Polynomial.
 (ii) What are the necessary and sufficient conditions of a Network function for a stable network?
- (b) Test the immittance function for L-C/R-C/ R-L synthesis condition and synthesize the Cauer Form II network for

$$Z(s) = \frac{s + 4}{3s^2 + 24s + 36}$$