Printed Pages: 02 **Sub Code:KEE 403**

Paper Id: 238572 **Roll No.** | | | | | | | | | | |

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.

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

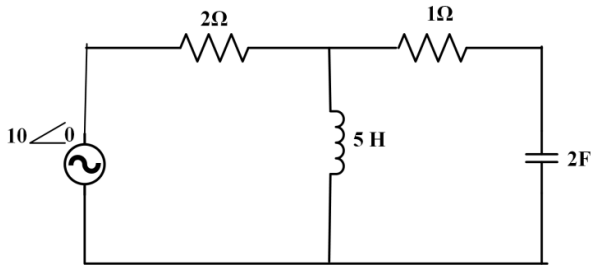
(c) Derive the expression of maximum power transferred for ac circuits.
(d) State Reciprocity theorem.
(e) Differentiate between natural response and forced response in circuit analysis.
(f) In a series RLC circuit, discuss (i) underdamped (ii) overdamped conditions.
(g) Define 'Z' and 'Y' parameters 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**

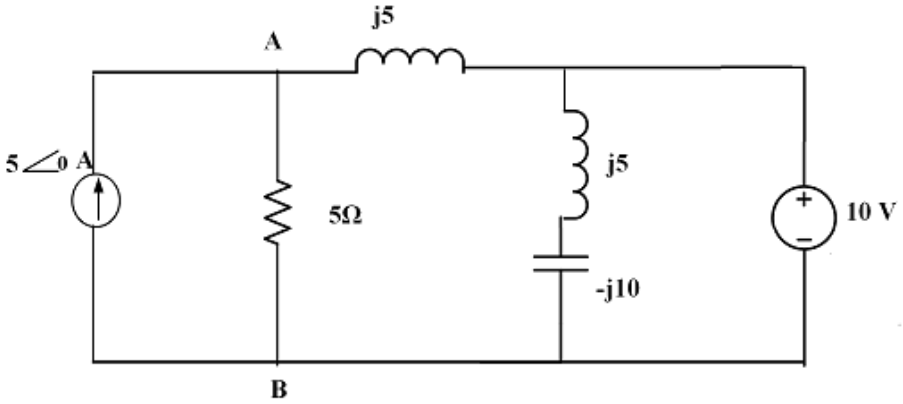
(a) (i) Explain the principle of duality.

(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

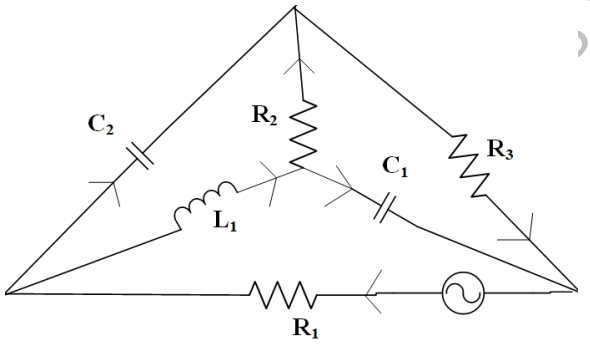
(e) Test whether the function given below is a Positive Real Function (PRF) or not.

$$F(s) = \frac{5s^2 + 18}{s(s^2 + 9)}$$

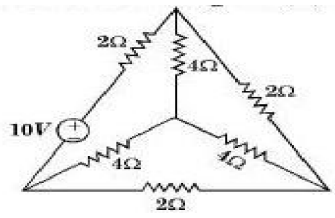
SECTION C

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

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



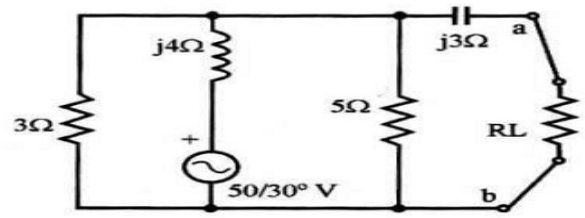
(b) Draw the graph of the network shown in figure. Select a tree and write
i. Incidence Matrix ii. Tie set matrix iii. Cut-set Matrix



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

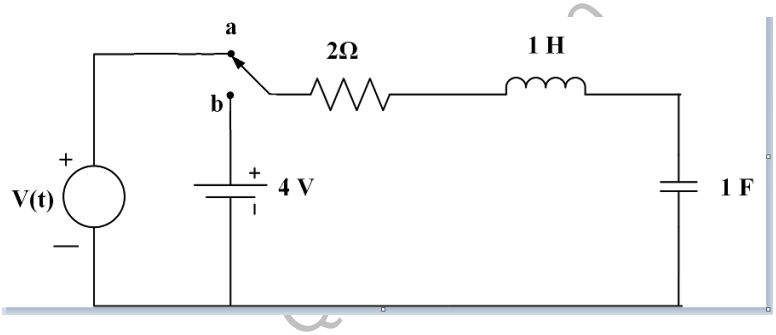
(b) What should be the value of RL so the maximum power can be transferred from the source to RL for the given figure.



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 $i(0-) = 2\,A$ and $Vc(0-) = 2V$, 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
$I_2 = -0.2V_1 + V_2$ 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

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