

Roll No:

BTECH

(SEM. IV) THEORY EXAMINATION 2025-26  
NETWORKS ANALYSIS & SYNTHESIS

TIME: 3 HRS

M.MARKS: 70

**Note:** Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt all questions in brief.

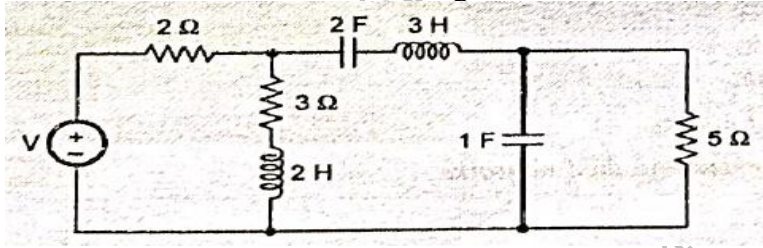
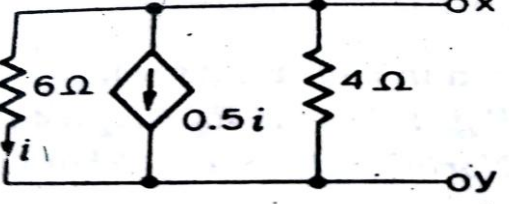
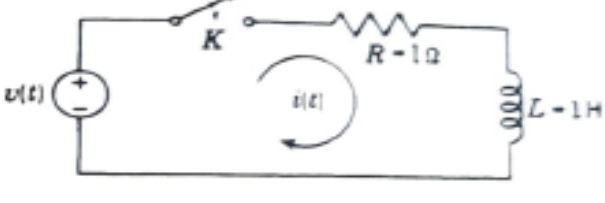
02 x 7 = 14

| Q no. | Question                                                                                 | CO | Level |
|-------|------------------------------------------------------------------------------------------|----|-------|
| a.    | What do you mean by "GRAPH" and "ORIENTED GRAPH" in circuit theory?                      | 1  | K2    |
| b.    | State and explain the Tellegen's theorem.                                                | 2  | K2    |
| c.    | Calculate the time constant for first-order RC networks.                                 | 3  | K2    |
| d.    | Explain the concept of poles and zeros in network functions.                             | 4  | K2    |
| e.    | Distinguish between a driving point function and a transfer function.                    | 4  | K2    |
| f.    | Distinguish between the Foster I and Foster II form.                                     | 5  | K2    |
| g.    | Why are active filters preferred over passive filters in integrated circuit (IC) design? | 5  | K2    |

SECTION B

2. Attempt any three of the following:

07 x 3 = 21

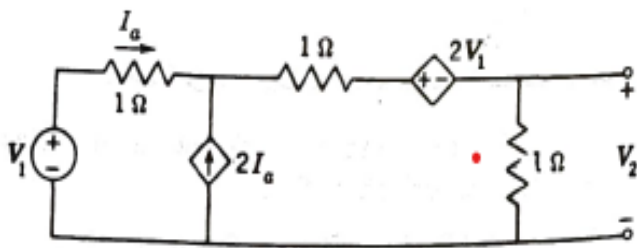
| Q no. | Question                                                                                                                                                                                                                                                                                                                              | CO | Level |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|
| a.    | <p>Draw the dual of the network shown in figure 01.</p>  <p>Figure No. 01</p>                                                                                                                                                                     | 1  | K2    |
| b.    | <p>Find Norton's equivalent circuit to the left of terminal x-y in figure 02</p>  <p>Figure No. 02</p>                                                                                                                                            | 2  | K3    |
| c.    | <p>In the network shown in the figure 03, <math>v(t) = 0</math> for <math>t &lt; 0</math>, and <math>v(t) = t</math> for <math>t \geq 0</math>. Show that <math>i(t) = t - 1 + e^{-t}</math> for <math>t \geq 0</math>.</p>  <p>Figure No. 03</p> | 3  | K3    |

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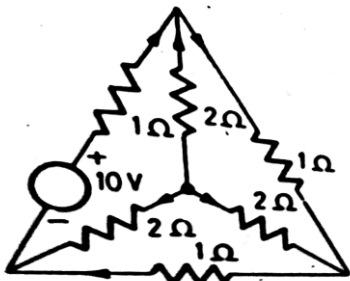
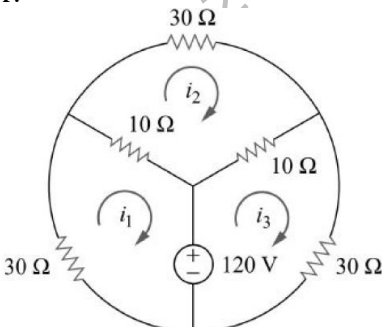
M.MARKS: 70

|    |                                                                                                                                                                                                                                                         |   |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|
| d. | <p>The given network shown in figure 04 contains resistors and controlled sources. For this network, compute <math>G_{12} = V_2/V_1</math>.</p>  <p>Figure No. 04</p> | 4 | K3 |
| e. | <p>What do you mean by "ACTIVE" and "PASSIVE" filters? What are the advantages and disadvantages of active filters over passive filters? Discuss the different types of active and passive filters.</p>                                                 | 5 | K2 |

**SECTION C**

3. Attempt any *one* part of the following:

07 x 1 = 07

| Q no. | Question                                                                                                                                                                                                                                             | CO | Level |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|
| a.    | <p>In the given network shown in figure 05, determine the branch current &amp; branch voltage using cut-set matrix?</p>  <p>Figure No. 05</p>                     | 1  | K2    |
| b.    | <p>In the given network shown in figure 06, determine the <math>i_1</math>, <math>i_2</math> and <math>i_3</math> using tie-set matrix?</p>  <p>Figure No. 06</p> | 1  | K2    |

Roll No:

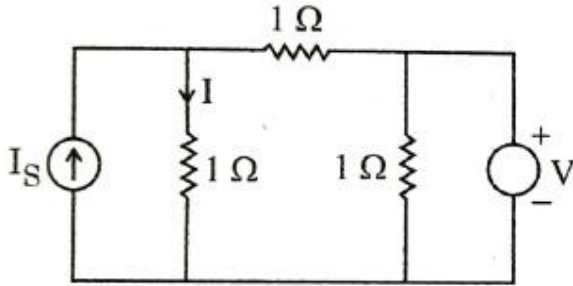
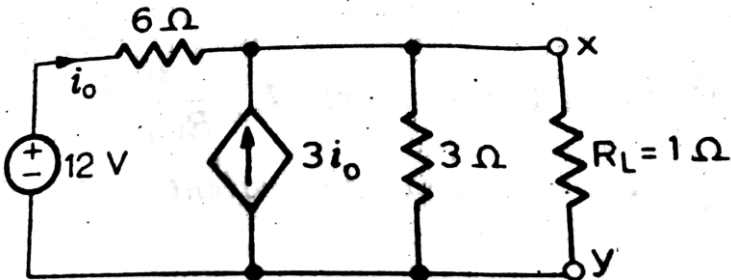
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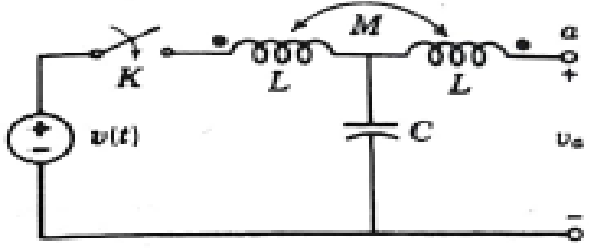
**4. Attempt any one part of the following:**

**07 x 1 = 07**

| Q no. | Question                                                                                                                                                                                                                                                                                                       | CO | Level |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|
| a.    | <p>In the circuit shown figure 07, <math>I = 1 \text{ Amp}</math> for <math>I_s = 0 \text{ Amp}</math>. Determine the value of <math>I</math> for <math>I_s = 2 \text{ Amp}</math>.</p>  <p align="center">Figure No. 07</p> | 2  | K3    |
| b.    | <p>Find the current through <math>R_L</math> in the circuit of figure 08 using Thevenin's theorem.</p>  <p align="center">Figure No. 08</p>                                                                                | 2  | K3    |

**5. Attempt any one part of the following:**

**07 x 1 = 07**

| Q no. | Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | CO | Level |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|
| a.    | <p>In the network shown in the figure 09, consists of two coupled coil and a capacitor. At <math>t = 0</math>, the switch <math>K</math> closed connecting a generator of voltage, <math>v(t) = V \sin (t/\sqrt{MC})</math>. Show that <math>v_a(0^+) = 0</math>, <math>\frac{dv_a}{dt}(0^+) = (V/L)\sqrt{M/C}</math>, and <math>\frac{d^2v_a}{dt^2}(0^+) = 0</math></p>  <p align="center">Figure No. 09</p> | 3  | K4    |
| b.    | <p>The circuit shown in figure 10 consists of a resistor and a relay with inductance <math>L</math>. The relay is adjusted so that it is actuated when the current through the coil is <math>0.008 \text{ Amp}</math>. The switch <math>K</math> is closed at <math>t = 0</math>,</p>                                                                                                                                                                                                             | 3  | K4    |

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and it is observed that the relay is actuated when  $t = 0.1 \text{ sec}$ . Find: (a) the inductance  $L$  of the coil, (b) current  $i(t)$  for  $t \geq 0$ .

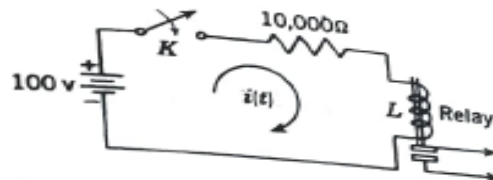


Figure No. 10

6. Attempt any one part of the following:

07 x 1 = 07

| Q no. | Question                                                                                                                                                                                                                                     | CO | Level |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|
| a.    | <p>The network shown in the figure 11 consists of a resistive <math>T</math> and a resistive <math>\pi</math> network connected in parallel. For the element values given, determine the <math>y</math> parameters.</p> <p>Figure No. 11</p> | 4  | K3    |
| b.    | <p>Determine <math>g</math> and <math>h</math> - parameter in the given network shown in figure 12.</p> <p>Figure No. 12</p>                                                                                                                 | 4  | K3    |

s7. Attempt any one part of the following:

07 x 1 = 07

| Q no. | Question                                                                                                                            | CO | Level |
|-------|-------------------------------------------------------------------------------------------------------------------------------------|----|-------|
| a.    | <p>Obtain both Cauer I and II realizations of the driving point function given by:</p> $Z(s) = \frac{10s^4 + 12s^2 + 1}{2s^3 + 2s}$ | 5  | K2    |
| b.    | <p>Explain the properties of positive real function. LC function and RL functions.</p>                                              | 5  | K2    |