GUJARAT TECHNOLOGICAL UNIVERSITY

BE 3 SEMESTER – OLD PAPER – W25 TO S26 – QUESTION BANK

Subject Name & Code: Network Theory - BE03000161

Chapter 1: Circuit Variables and Circuit Elements and Sources

Repeated Questions:

None identified.

Other Important Questions:

1. Sources, Dot Convention and Network Elements (Theory):

- **Q.** List out independent and dependent electrical sources with their symbols. **(WINTER 2025, 3 Marks)**
- **Q.** For the transformer shown in the figure with 3 winding with their winding directions over the limbs, mark the dots on the terminals according Dot convention theorem. [Diagram required – refer to the original question paper] **(WINTER 2025, 4 Marks)**
- **Q.** Explain the following electrical network elements with suitable examples: (i) Linear and Non-Linear elements (ii) Bilateral and Unilateral elements (iii) Active and Passive elements (iv) Lumped and Distributed Networks. **(SUMMER 2026, 4 Marks)**

2. Equivalent Capacitance (Numerical):

- **Q.** Find the equivalent capacitance for the circuit shown below [Diagram required – refer to the original question paper] **(SUMMER 2026, 3 Marks)**

Chapter 2: Nodal Analysis and Mesh Analysis of resistive Circuits

Repeated Questions:

None identified.

Other Important Questions:

1. Source Transformation (Theory):

- **Q.** Discuss the rules and limitations of source transformation in network simplification. **(SUMMER 2026, 3 Marks)**

2. Nodal and Mesh Analysis (Numerical):

- **Q.** Determine the current through load resistor using source transformation techniques. [Diagram required – refer to the original question paper] **(WINTER 2025, 4 Marks)**
- **Q.** For the given network, determine the current in 4Ω resistors using Mesh Analysis. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks)**
- **Q.** Determine the current i in the circuit shown in figure using Nodal analysis. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks OR)**
- **Q.** Find V_1, V_2, V_3 by the nodal method for the given circuit. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks)**
- **Q.** Find the value of mesh currents in the circuit shown below. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks OR)**

Chapter 3: Circuit Theorems and Their Applications in Electric Networks

Repeated Questions:

1. Maximum Power Transfer Theorem:

- **Q.** State Maximum Power Transfer theorem and explain in brief. Derive the condition for maximum power transfer to the load for DC and AC circuits. **(WINTER 2025, 7 Marks; SUMMER 2026, 4 Marks)**

2. Dual Networks:

- **Q.** Draw dual of the given network. [Diagram required – refer to the original question paper] **(WINTER 2025, 3 Marks; SUMMER 2026, 3 Marks OR)**

3. Millman's Theorem:

- **Q.** State and explain Millman's theorem. **(WINTER 2025, 4 Marks OR; SUMMER 2026, 7 Marks)**

Other Important Questions:

1. Network Theorems (Theory):

- **Q.** State the Superposition Theorem. List its limitations. **(WINTER 2025, 3 Marks)**
- **Q.** Give statements for Reciprocity Theorem and Compensation Theorem **(SUMMER 2026, 4 Marks)**

2. Network Theorems (Numerical):

- **Q.** Draw Thevenin's equivalent circuit across terminal AB of the given network. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks)**
- **Q.** Find the value of I_X using Superposition theorem in the circuit shown below. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks OR)**
- **Q.** Find the Thevenin's voltage and Thevenin's resistance for the circuit of given below across terminal-ab [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks)**
- **Q.** Find current through 15 ohm resistance in the circuit shown in figure using superposition theorem. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks OR)**

Chapter 4: Time domain response of First order RL and RC circuits

Repeated Questions:

1. Time Constant:

- **Q.** Define the time-constant. Explain the significance of the time-constant. **(WINTER 2025, 3 Marks OR; SUMMER 2026, 3 Marks OR)**

2. Transient Response of First Order Circuits:

- **Q.** Obtain the transient response of a first order system using a suitable example. / Analyse the transient response of a first-order RL or RC circuit and illustrate it with a suitable example. **(WINTER 2025, 7 Marks; SUMMER 2026, 7 Marks)**

Other Important Questions:

1. Transient and Steady-State Response (Theory):

- **Q.** Differentiate between transient response and steady-state response. **(SUMMER 2026, 3 Marks)**

2. First Order Circuits (Numerical):

- **Q.** A series R-C circuit is connected to a constant d.c. voltage source V through switch K, as shown in figure. Initially the switch is kept open for very long time. Obtain the expression for the current $i_c(t)$ through capacitor for t>0. [Diagram required – refer to the original question paper] **(WINTER 2025, 4 Marks OR)**
- **Q.** Find i and v if the switch is opened at t = 0 after keeping it closed for a long time. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks OR)**

Chapter 5: Time domain response of Second order linear circuits

Repeated Questions:

None identified.

Other Important Questions:

None identified.

Chapter 6: Initial conditions

Repeated Questions:

1. Equivalent Circuits at t=0^{+} and t=∞:

- **Q.** Draw and explain briefly the equivalent circuit of the charged and uncharged inductor and capacitor at $t=0^{+}$ and t=∞ (infinity). / Explain the initial and final conditions of capacitors and inductors with the help of appropriate equivalent circuits. **(WINTER 2025, 4 Marks; SUMMER 2026, 4 Marks OR)**

Other Important Questions:

1. Initial Conditions (Numerical):

- **Q.** The switch is closed at t=0. Find out value of i_c d^2i/dt^2 at $t=0^{+}$. The value of R is 10Ω, L is 1H and 100V is applied. Assume initial current of inductor to be zero. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks OR)**

Chapter 7: Laplace Transform Analysis and Circuit Applications

Repeated Questions:

None identified.

Other Important Questions:

1. Laplace Transform and Inverse Laplace Transform (Numerical):

- **Q.** Find the Laplace Transform of e^{-at} cos wt. **(WINTER 2025, 3 Marks)**
- **Q.** Find the value of L {t cos bt}. **(SUMMER 2026, 3 Marks)**
- **Q.** Find the inverse Laplace transform of the function F(s) = log[(s+3)/(s+4)] **(SUMMER 2026, 4 Marks OR)**

2. Initial and Final Value Theorems (Theory):

- **Q.** State initial and final value theorem with appropriate equation in term of Laplace Transformation. **(WINTER 2025, 3 Marks OR)**

Chapter 8: Laplace Transform Analysis and Transfer Function Applications

Repeated Questions:

None identified.

Other Important Questions:

None identified.

Chapter 9: Two-Port Networks

Repeated Questions:

1. Z-Parameters in Terms of Y-Parameters:

- **Q.** Derive z-parameters in terms of y-parameters. / Discuss the interrelationship between Z-parameters and Y-parameters and derive the required expressions for a two-port network. / Derive and explain the transformation of Y-parameters into Z-parameters for a two-port network. **(WINTER 2025, 4 Marks; SUMMER 2026, 7 Marks; SUMMER 2026, 4 Marks OR)**

Other Important Questions:

1. Two-Port Parameters (Theory):

- **Q.** List out and write the equation of h-parameters and ABCD-parameters. **(WINTER 2025, 3 Marks)**
- **Q.** Explain condition of reciprocity and symmetry of two port network in terms of z-parameter. **(WINTER 2025, 7 Marks)**

2. Two-Port Parameters (Numerical):

- **Q.** Calculate the h-parameters of the given two-port network. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks OR)**

Chapter 10: Introduction to Network Topology

Repeated Questions:

None identified.

Other Important Questions:

1. Graph Theory Definitions and Relations (Theory):

- **Q.** Define (1) Oriented Graph (2) Incidence matrix (3) Tree **(WINTER 2025, 3 Marks OR)**
- **Q.** Define the following terms: i) Planner graph ii) Incident Matrix iii) Tie-set matrix iv) Sub-graph **(SUMMER 2026, 4 Marks)**
- **Q.** Derive the relation between incidence matrix, fundamental tie-set matrix and fundamental cut-set matrix. **(WINTER 2025, 7 Marks OR)**

2. Graphs and Matrices (Numerical):

- **Q.** The reduced incidence matrix of an oriented graph is as shown below. A = [0 −1 1 0 0; 0 0 −1 −1 −1; −1 0 0 0 1] (rows separated by semicolons). a) Draw the graph b) How many trees are possible? c) Write the tie set matrix d) Write the cut set matrix **(WINTER 2025, 4 Marks)**
- **Q.** The incidence matrix of a graph is given below: A = [−1 0 1 1 −1 0; 1 −1 0 0 0 −1; 0 1 −1 −1 1 1] (rows separated by semicolons). i) Draw the graph ii) How many trees are possible? iii) Write the reduced incidence matrix **(SUMMER 2026, 4 Marks)**

Chapter 11: Introduction to Passive Network Synthesis

Repeated Questions:

None identified.

Other Important Questions:

1. Positive Real Functions (PRF):

- **Q.** Write down the necessary and sufficient conditions for positive real function (PRF). **(WINTER 2025, 4 Marks OR)**
- **Q.** Explain the concept of PRF. **(SUMMER 2026, 3 Marks)**

2. Hurwitz Polynomial:

- **Q.** List down the properties of Hurwitz polynomial. **(SUMMER 2026, 3 Marks OR)**

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