

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-3 SEMESTER –OLD PAPER– W22 TO S25- QUESTION BANK

Subject Name & Code:

Electrical Circuit Analysis- 3130906

Unit 1: Network Theorems (20% Weightage)

Repeated Questions:

1. **State and Explain Superposition Theorem.**
 - (WINTER 2024 - Q1(b) - 03 Marks)
 - (SUMMER 2024 - Q1(a) - 03 Marks)
 - (SUMMER 2023 - Q2(b) - 04 Marks)
 - (SUMMER 2025 - Q1(a) - 03 Marks)
 - **Appeared in 4 out of 6 papers.**
2. **Explain Norton's Theorem.**
 - (WINTER 2024 - Q1(a) - 03 Marks)
 - (SUMMER 2024 - Q1(b) - 03 Marks)
 - (WINTER 2023 - Q1(a) - 03 Marks)
 - **Appeared in 3 out of 6 papers.**
3. **State and explain Maximum Power Transfer Theorem. (Often with a numerical)**
 - (WINTER 2024 - Q2(c) OR - 07 Marks)
 - (SUMMER 2024 - Q2(b) - 04 Marks)
 - (WINTER 2022 - Q1(b) - 04 Marks)
 - (SUMMER 2025 - Q1(c) - 07 Marks - Numerical)
 - **Appeared in 4 out of 6 papers.**
4. **Numerical on finding current/voltage using Thevenin's Theorem.**
 - (WINTER 2024 - Q1(c) - 04 Marks)
 - (WINTER 2023 - Q1(c) - 07 Marks)
 - (WINTER 2022 - Q2(b) - 04 Marks - Find voltage across 4Ω)
 - **Appeared in 3 out of 6 papers.**
5. **Numerical on Node Analysis.**
 - (SUMMER 2024 - Q3(c) OR - 07 Marks)
 - (WINTER 2022 - Q2(c) - 07 Marks)
 - (SUMMER 2023 - Q2(c) - 07 Marks - Find V_1, V_2, V_3)
 - (WINTER 2023 - Q4(c) OR - 07 Marks)
 - **Appeared in 4 out of 6 papers.**

Other Important Questions:

6. **State and explain Reciprocity theorem.**
 - (WINTER 2022 - Q1(a) - 03 Marks)
7. **Develop a step-by-step solution using the Superposition Theorem.**
 - (WINTER 2023 - Q1(b) - 04 Marks)
8. **Numerical on finding voltage using Superposition Theorem.**

- (WINTER 2022 - Q1(c) - 07 Marks - Voltage across 30Ω)
- 9. **Numerical on Mesh Analysis.**
 - (WINTER 2022 - Q2(c) OR - 07 Marks - Voltage across 4Ω)
 - (SUMMER 2025 - Q2(c) - 07 Marks - Current through 10Ω)
 - (SUMMER 2023 - Q1(c) - 07 Marks - Voltage across 5Ω)
 - (WINTER 2023 - Q2(c) OR - Find mesh currents i_1, i_2, i_3)
- 10. **Explain the concept of duality and draw a dual network.**
 - (SUMMER 2023 - Q2(a) - 03 Marks)
- 11. **In terms of two terminal elements, define: Unilateral, Passive, Time-variant elements.**
 - (WINTER 2024 - Q3(a) OR - 03 Marks)
 - (SUMMER 2024 - Q3(a) OR - 03 Marks)

Unit 2: Solution of First and Second Order Networks (20% Weightage)

Repeated Questions:

1. **Explain the initial conditions in different passive elements and their importance.**
 - (WINTER 2024 - Q2(a) - 03 Marks)
 - (SUMMER 2024 - Q2(a) - 03 Marks)
 - (WINTER 2023 - Q3(a) - 03 Marks)
 - **Appeared in 3 out of 6 papers.**
2. **Explain/Discuss why current in an inductor and voltage across a capacitor cannot change instantaneously.**
 - (WINTER 2024 - Q3(b) - 04 Marks)
 - (SUMMER 2025 - Q3(a) - 03 Marks)
 - **Appeared in 2 out of 6 papers (Highly fundamental concept).**
3. **Numerical on finding initial conditions ($i(0+)$, $di/dt(0+)$, $d^2i/dt^2(0+)$) after switching.**
 - (SUMMER 2024 - Q2(c) - 07 Marks)
 - (SUMMER 2025 - Q3(b) - 04 Marks)
 - (WINTER 2022 - Q3(a) - 03 Marks - Find i at $t=0+$)
 - **Appeared in 3 out of 6 papers.**
4. **Explain in detail the transient response in a series R-C circuit with DC excitation.**
 - (WINTER 2024 - Q2(c) - 07 Marks)
 - (SUMMER 2024 - Q2(c) OR - 07 Marks)
 - **Appeared in 2 out of 6 papers.**
5. **Derive the step response of an R-L series circuit using the Laplace Transform method.**
 - (WINTER 2024 - Q2(b) - 04 Marks)
 - (SUMMER 2024 - Q3(c) - 07 Marks)
 - (WINTER 2022 - Q3(b) OR - 04 Marks)
 - **Appeared in 3 out of 6 papers.**

Other Important Questions:

6. **What is time constant? What is its significance? (For RL/RC circuits)**
 - (SUMMER 2024 - Q3(a) - 03 Marks)
 - (WINTER 2023 - Q3(c) OR - 07 Marks)
 - (WINTER 2022 - Q3(b) - 04 Marks)
 - (SUMMER 2025 - Q3(b) - 04 Marks)
7. **Solve for current $i(t)$ in a switched RL/RC/RLC circuit (using Classical or Laplace).**
 - (WINTER 2022 - Q3(c) - 07 Marks)
 - (WINTER 2022 - Q4(c) - 07 Marks - Laplace)
 - (SUMMER 2023 - Q3(c) - 07 Marks)
 - (SUMMER 2025 - Q3(c) - 07 Marks - Capacitor voltage at $t=5s$)
 - (SUMMER 2025 - Q3(c) OR - 07 Marks - Series RLC current)
8. **Prepare a table for equivalent branch initial/final conditions for R, L, C.**
 - (SUMMER 2023 - Q3(a) - 03 Marks)
 - (SUMMER 2023 - Q3(a) OR - 03 Marks)
9. **Describe the solution of a non-homogeneous differential equation for a particular integral.**
 - (WINTER 2024 - Q5(b) - 04 Marks)
 - (SUMMER 2024 - Q5(b) - 04 Marks)

Unit 3: Sinusoidal Steady State Analysis (20% Weightage)

Repeated Questions:

1. **Explain the importance of the Dot convention in coupled circuits with an example.**
 - (WINTER 2024 - Q3(a) - 03 Marks)
 - (SUMMER 2024 - Q3(b) - 04 Marks)
 - (WINTER 2023 - Q3(a) OR - 03 Marks)
 - **Appeared in 3 out of 6 papers.**
2. **Provide a detailed explanation of an ideal transformer.**
 - (WINTER 2024 - Q3(c) - 07 Marks)
 - (WINTER 2023 - Q2(a) - 03 Marks)
 - **Appeared in 2 out of 6 papers.**
3. **Specify the terms: (i) RMS values (ii) Apparent power (iii) Complex power.**
 - (WINTER 2024 - Q4(a) OR - 03 Marks)
 - (SUMMER 2025 - Q5(a) - 03 Marks - also includes Power Factor)
 - **Appeared in 2 out of 6 papers.**
4. **Numericals on Three-Phase Circuits (Balanced/Unbalanced).**
 - (WINTER 2022 - Q4(c) - 07 Marks - Power in unbalanced delta)
 - (SUMMER 2023 - Q1(b) - 04 Marks - Unbalanced star/delta currents)
 - (SUMMER 2025 - Q5(c) - 07 Marks - Currents in unbalanced delta)
 - **Appeared in 3 out of 6 papers.**

Other Important Questions:

5. **Find the equivalent inductance of series-connected coupled inductors.**
 - (SUMMER 2025 - Q3(a) OR - 03 Marks - Numerical)
6. **Enlighten the interpretation of the “j” operator.**
 - (SUMMER 2023 - Q1(a) - 03 Marks)
7. **For an unknown impedance in an AC circuit, find its value given current and voltage.**
 - (SUMMER 2025 - Q5(b) - 04 Marks)
 - (SUMMER 2025 - Q5(c) OR - Find Z)
8. **Discuss Resonance in series R-L-C circuits.**
 - (SUMMER 2025 - Q5(a) OR - 03 Marks)

Unit 4: Electrical Circuit Analysis Using Laplace Transforms (20% Weightage)

Repeated Questions:

1. **Define Poles and Zeros of a network function. Explain their significance.**
 - (WINTER 2024 - Q3(c) OR - 07 Marks)
 - (SUMMER 2024 - Q4(b) - 04 Marks)
 - (WINTER 2022 - Q4(a) - 03 Marks)
 - (WINTER 2023 - Q4(c) - 07 Marks)
 - **Appeared in 4 out of 6 papers.**
2. **Prove Initial and Final Value Theorems.**
 - (WINTER 2024 - Q4(c) - 07 Marks)
 - (WINTER 2023 - Q3(c) - 07 Marks)
 - **Appeared in 2 out of 6 papers.**
3. **State the advantages of the Laplace transform method over the classical method.**
 - (WINTER 2024 - Q4(c) OR - 07 Marks)
 - (SUMMER 2024 - Q5(c) - 07 Marks)
 - **Appeared in 2 out of 6 papers.**
4. **Obtain the Laplace transform of standard functions (Ramp, Parabola, Hyperbolic).**
 - (WINTER 2024 - Q4(a) - 03 Marks - Hyperbolic)
 - (SUMMER 2024 - Q3(b) OR - 04 Marks - Ramp)
 - (WINTER 2024 - Q3(b) OR - 04 Marks - Parabola)
 - (SUMMER 2025 - Q4(a) - 03 Marks - $f(t)=di/dt$)
 - **A very frequent topic.**

Other Important Questions:

5. **Draw transform networks for inductor (with initial current) and capacitor (with initial voltage).**
 - (SUMMER 2025 - Q4(a) OR - 03 Marks)
6. **Solve a differential equation using Laplace transforms (with initial conditions).**
 - (SUMMER 2025 - Q4(c) - 07 Marks)
7. **Derive step response of a series R-C circuit using Laplace transform.**
 - (SUMMER 2025 - Q4(b) - 04 Marks)
8. **Explain the difference between Zero Radian frequency and Zero Neper frequency.**
 - (SUMMER 2023 - Q4(b) - 04 Marks)
 - (SUMMER 2025 - Q4(b) OR - 04 Marks)
9. **Find the transform impedance $Z(s)$ and plot its poles and zeros.**
 - (SUMMER 2025 - Q4(c) OR - 07 Marks)
10. **What are the properties of Laplace transformation?**
 - (WINTER 2023 - Q3(b) OR - 04 Marks)

Unit 5: Two Port Network and Network Functions (20% Weightage)

Repeated Questions:

1. **Derive the expression of Y-parameters in terms of Z-parameters.**
 - (WINTER 2024 - Q4(b) - 04 Marks)
 - (SUMMER 2024 - Q4(b) - 04 Marks)
 - (SUMMER 2025 - Q2(b) - 04 Marks)
 - **Appeared in 3 out of 6 papers.**
2. **Define H-parameters / Find h-parameters for a given network.**
 - (SUMMER 2024 - Q4(a) - 03 Marks)
 - (WINTER 2023 - Q5(a) OR - 03 Marks)
 - (WINTER 2022 - Q5(b) - Find h from equations)
 - (SUMMER 2023 - Q5(c) OR - Find h-parameters)
 - **Appeared in 4 out of 6 papers.**
3. **Find out the reciprocity condition for h-Parameters / Y-Parameters / Z-Parameters.**
 - (WINTER 2024 - Q5(a) - 03 Marks - for h)
 - (WINTER 2022 - Q5(a) OR - for Y)
 - (SUMMER 2023 - Q5(a) - for Z)
 - (SUMMER 2023 - Q5(a) OR - for ABCD)
 - **A very frequent concept.**
4. **Numericals on finding Z, Y, or ABCD parameters for a given circuit.**
 - (SUMMER 2024 - Q4(c) - 07 Marks - Find Z)
 - (SUMMER 2024 - Q5(c) OR - 07 Marks - Find Y)
 - (WINTER 2022 - Q5(c) - 07 Marks - Find Z)
 - (WINTER 2022 - Q5(c) OR - 07 Marks - Find Transmission)
 - (SUMMER 2025 - Q2(c) OR - 07 Marks - Find Z)
 - (SUMMER 2025 - Q5(c) - 07 Marks - Find Y)
 - **The most frequent and high-weightage question type in this unit.**

Other Important Questions:

5. **What is the condition of symmetry for all different two-port parameters?**
 - (WINTER 2024 - Q4(b) OR - 04 Marks)
 - (WINTER 2023 - Q5(a) - 03 Marks)
6. **Draw and explain the equivalent circuit of a two-port network in terms of (i) Y-parameters (ii) h-parameters.**
 - (WINTER 2024 - Q5(c) - 07 Marks)
 - (SUMMER 2025 - Q2(a) - 03 Marks - for Z-parameters)
7. **Obtain ABCD parameters in terms of Z-parameters (or other parameters).**
 - (WINTER 2023 - Q5(c) - 07 Marks)
 - (WINTER 2022 - Q5(b) - 04 Marks)
 - (SUMMER 2025 - Q5(b) OR - 04 Marks - ABCD in terms of Y)
8. **Generalize the relationship of h-parameters to y-parameters.**
 - (WINTER 2023 - Q5(b) - 04 Marks)
9. **Draw and explain dependent controlled sources.**
 - (SUMMER 2024 - Q5(a) OR - 03 Marks)
