

CBCS SCHEME

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21EC43

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Circuits and Controls

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Use the nodal analysis to find the value of V_x in the circuit shown in Fig. Q1(a), such that current through $(2 + 3j) \Omega$ impedance is zero. (10 Marks)

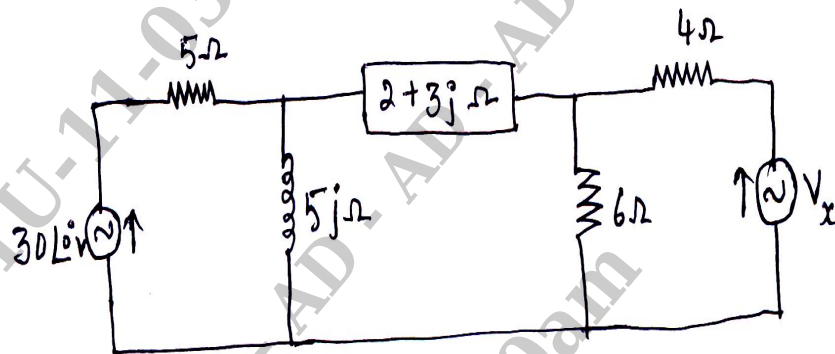


Fig. Q1 (a)

- b. Use Mesh current method to determine the current in the capacitor C_1 of the bridge network shown in Fig. Q1(b). (10 Marks)

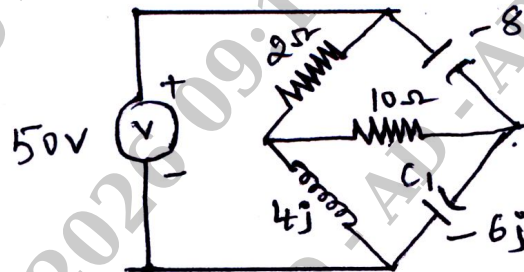


Fig. Q1 (b)

OR

- 2 a. Find the current through the 6Ω resistor in the Network shown in Fig. Q2(a) using super position principle. (06 Marks)

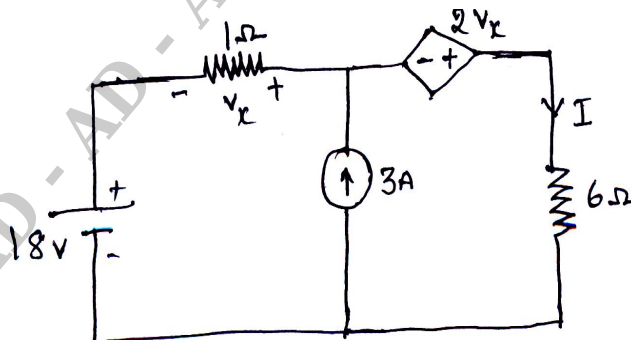


Fig. Q2 (a)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. For the circuit shown in the Fig. Q2(b), replace the network at terminal AB with Thevenin's and Norton's equivalent circuit. Also write program to find Thevenin's and Norton's equivalent circuit. (06 Marks)

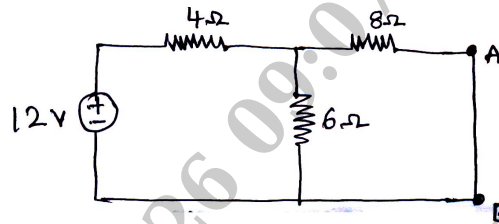


Fig. Q2 (b)

- c. State and prove Maximum Power Transfer Theorem. (08 Marks)

Module-2

- 3 a. Obtain the Z and Y parameters of the two Port Network shown in Fig. Q3(a). (12 Marks)

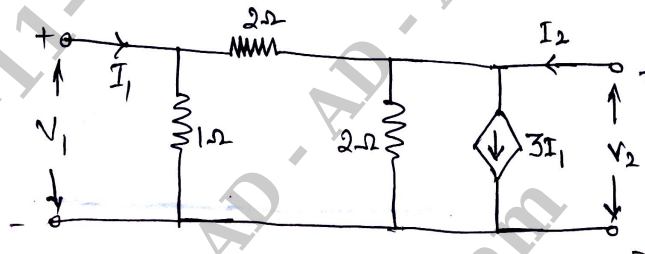


Fig. Q3 (a)

- b. Find the transmission (or) general parameters for the circuit shown in Fig. Q3(b). (08 Marks)

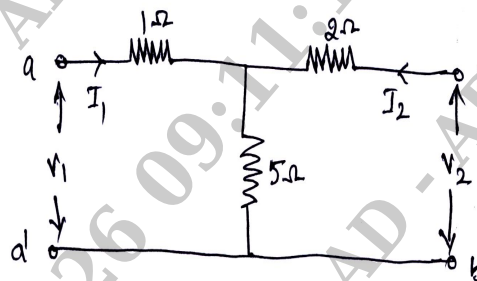


Fig. Q3 (b)

OR

- 4 a. State and prove Initial value theorem and Final value theorem. (06 Marks)
 b. Derive the Laplace transform of unit step, unit ramp and unit impulse time functions. (06 Marks)
 c. Find the equivalent impedance for the circuit shown in Fig. Q4(c) in Laplace domain. (08 Marks)

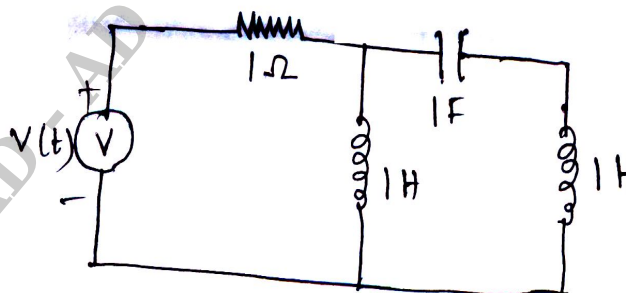


Fig. Q4 (c)

Module-3

- 5 a. With block diagram, explain Manually controlled and Automatically controlled control system with example. (08 Marks)
- b. Find the transfer function of the Electrical Network shown in Fig. Q5(b). (06 Marks)

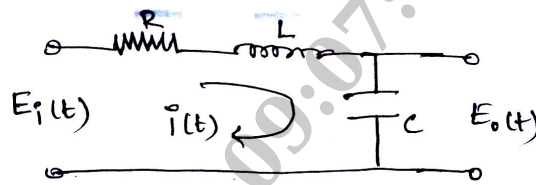


Fig. Q5 (b)

- c. Determine the transfer function $C(S) / R(S)$ of the system shown in Fig. Q5(c). (06 Marks)

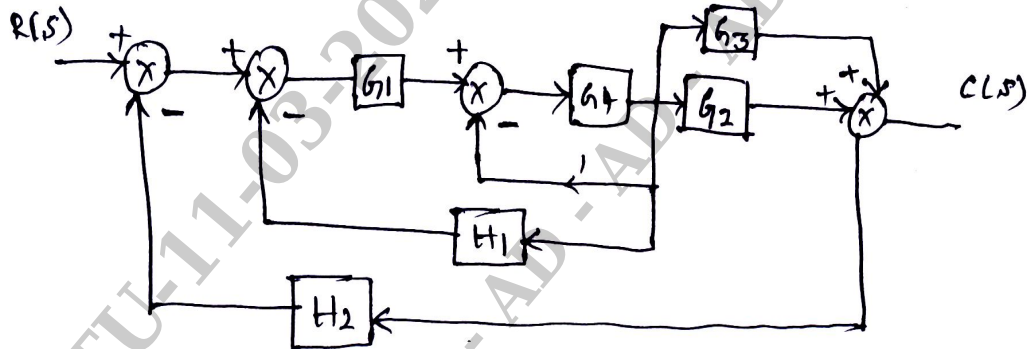


Fig. Q5 (c)

OR

- 6 a. Find the value Y_1 / X_1 for the block diagram shown in Fig. Q6(a). (06 Marks)

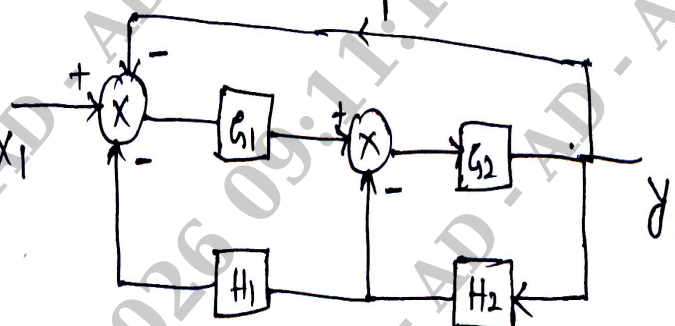


Fig. Q6 (a)

- b. List the properties of signal flow graph. (04 Marks)
- c. Using Mason's gain formula, find the gain of the system shown in Fig. Q6(c). (10 Marks)

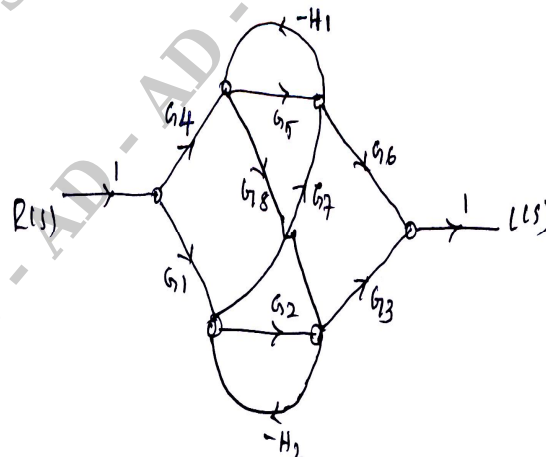


Fig. Q6 (c)

Module-4

- 7 a. Derive an expression of first order system for an unit step signal. (08 Marks)
 b. Write the expression or equations for Delay time , Rise time , Peak time , Maximum overshoot and Settling time for undamped system. (06 Marks)
 c. For the characteristics equation given : $3S^4 + 10S^3 + 5S^2 + 5S + 2 = 0$. Find whether system is stable or unstable using Routh stability criterion. (06 Marks)

OR

- 8 a. Derive an expression for undamped second order system for unit step signal. (08 Marks)
 b. Define Stability. Explain the conditions for stability with respect to control systems. (06 Marks)
 c. For the system of equation given : $S^6 + S^5 + 5S^4 + 3S^3 + 2S^2 - 4S - 8 = 0$, find whether stable or unstable using RH criteria. (06 Marks)

Module-5

- 9 a. Sketch the Root Locus for the system , whose Open loop transfer function is

$$G H(s) = \frac{K}{S(s+2)(s+4)}$$
 (10 Marks)
 b. Obtain the state model for the following electrical network shown in Fig. Q9(b). (10 Marks)

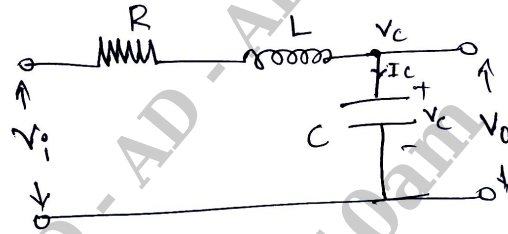


Fig. Q9 (b)

OR

- 10 a. Find the bode plot for $G H(s) = K S^n$. (06 Marks)
 b. Find the points which lie on Root Locus for the system

$$G H(s) = \frac{K(s^2 + 2s + 1)}{S^2(s+2)(s+3)(s+4)}$$

Also write a program to find Root Locus of Open Loop poles and zeros. (04 Marks)

- c. Consider a control system with state model :

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \end{bmatrix} [u] \quad ; \quad \begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$u =$ unit step. Compute the state transition matrix and there from find the state response $x(t)$. (10 Marks)
