CBCS SCHEME

USN

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.***

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.

Module-1

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

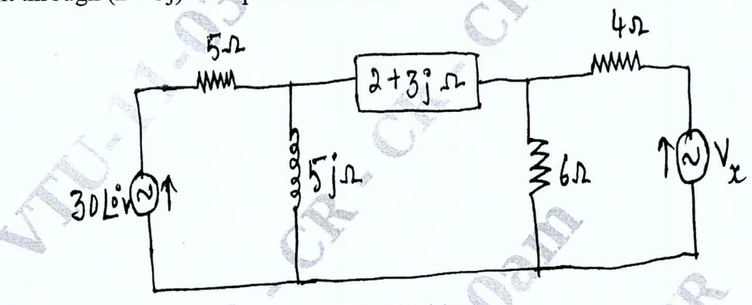


Fig. Q1 (a)

b. Use Mesh current method to determine the current in the capacitor C1 of the bridge network shown in Fig. Q1(b). **(10 Marks)**

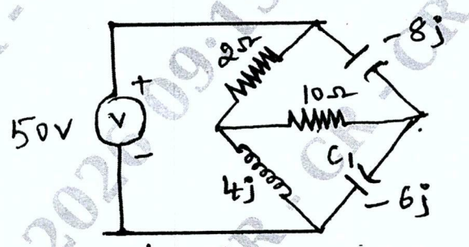


Fig. Q1 (b)

OR

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

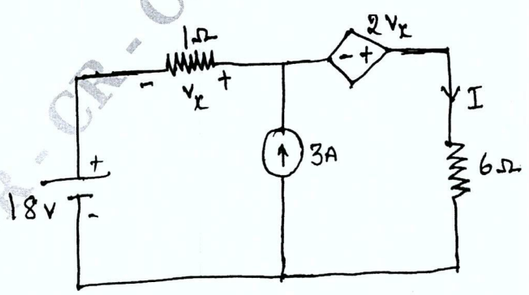


Fig. Q2 (a)

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)**

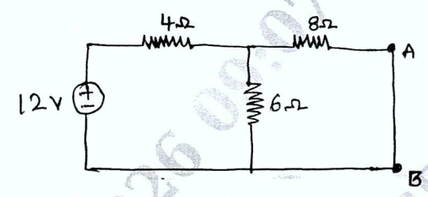


Fig. Q2 (b)

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)**

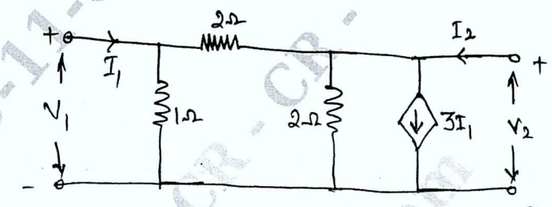


Fig.Q3 (a)

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

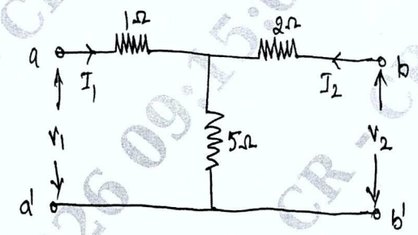


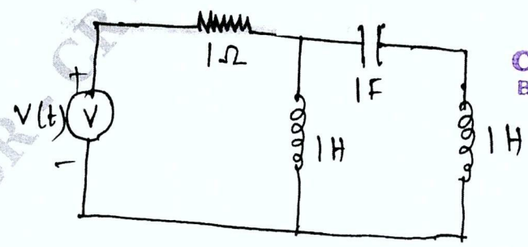
Fig. Q3 (b)

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)**



CMRIT LIBRARY
BANGALORE - 560 037

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)**

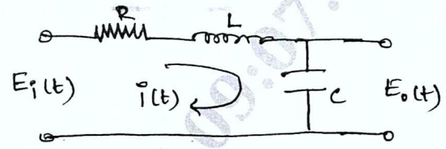


Fig.Q5 (b)

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

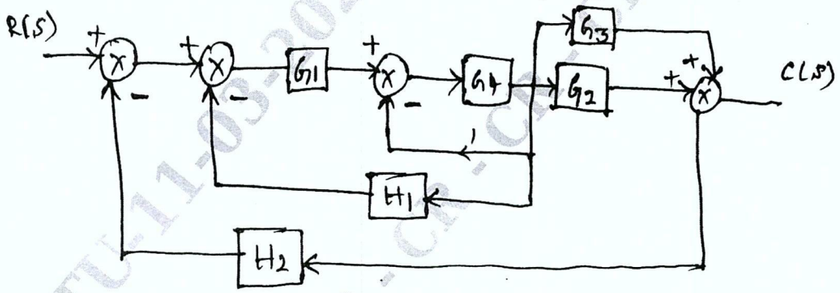


Fig. Q5 (c)

OR

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

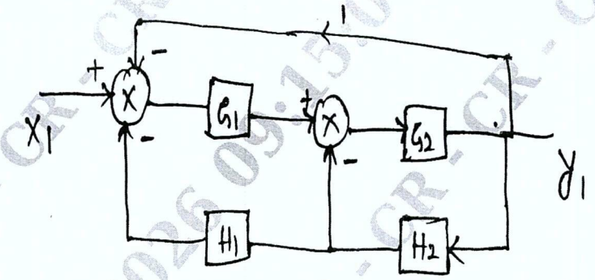
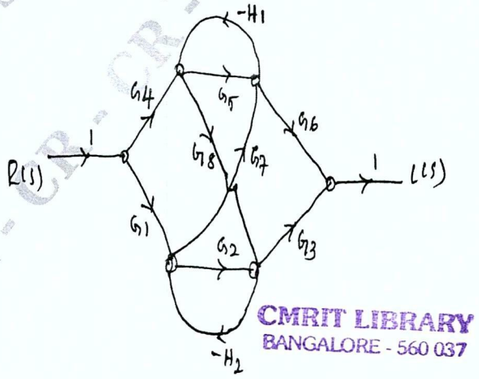


Fig. Q6 (a)

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)**



CMRIT LIBRARY
BANGALORE - 560 037

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)**

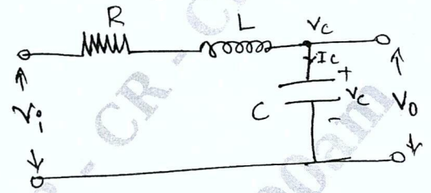


Fig. Q9 (b)

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 :

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

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

CMRIT LIBRARY
BANGALORE - 560 037

* * * * *