CBCS SCHEME

USN

21EC43

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Circuits and Controls

Time: 3 hrs. Max. Marks: 100

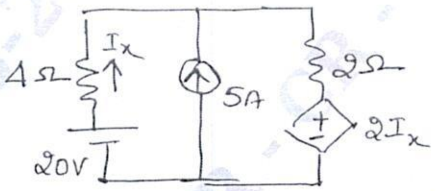
Note : *Answer any FIVE full questions, choosing ONE full question from each module.*

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

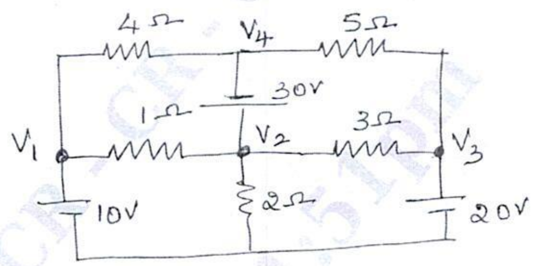
1 a. State superposition theorem and using superposition theorem, determine I_x for the circuit in Fig. Q1(a). **(08 Marks)**

Fig. Q1(a)



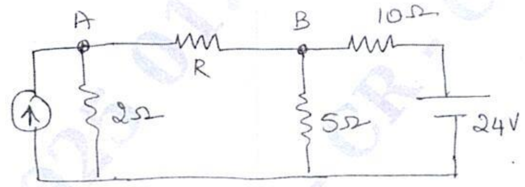
b. Determine the node voltages for the network shown in Fig. Q1(b) using nodal analysis. **(06 Marks)**

Fig. Q1(b)



c. Find the value of R such that maximum power transfer can take place for the circuit shown in Fig. Q1(c). Also find the maximum power delivered. **(06 Marks)**

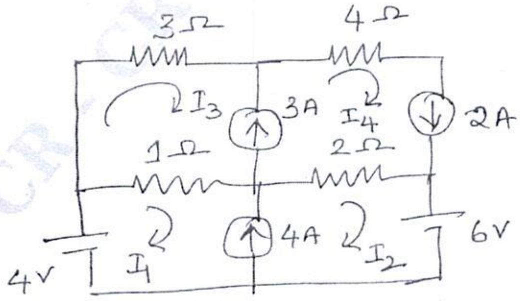
Fig. Q1(c)



OR

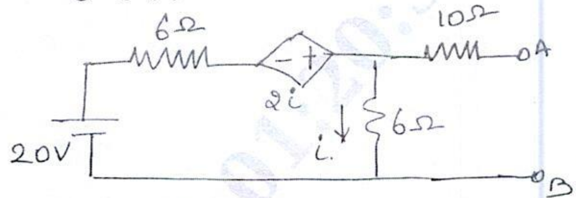
2 a. Determine the mesh current for the network shown in the Fig. Q2(a) using mesh analysis method. **(06 Marks)**

Fig. Q2(a)



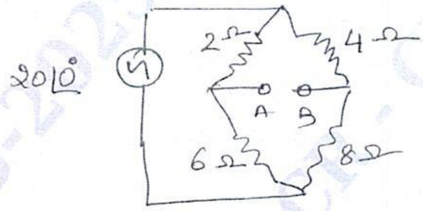
b. State Thevenin's theorem and determine the Thevenins equivalent network between A & B for the network shown in Fig. Q2(b). **(08 Marks)**

Fig. Q2(b)



c. Obtain Norton's equivalent circuit for the network shown in Fig. Q2(c). **(06 Marks)**

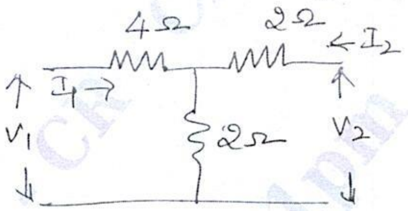
Fig. Q2(c)



Module-2

3 a. Determine 'Z' parameter for the network shown in Fig. Q3(a). **(06 Marks)**

Fig. Q3(a)



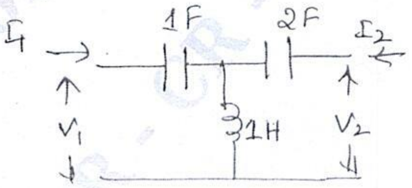
b. Given $I(s) = \dfrac{2s+5}{(s+1)(s+2)}$. Determine the initial and final value of i(t) using initial and final value theorem. **(08 Marks)**

c. For the given Z parameter equation, find ABCD parameter.
$V_1 = 6I_1 + 20I_2$
$V_2 = 20I_1 + 40I_2$. **(06 Marks)**

OR

4 a. Determine Z parameter and 'h' parameter for the network shown in Fig. Q4(a). **(10 Marks)**

Fig. Q4(a)



b. Determine 'Z' and 'Y' parameter for the network shown in Fig. Q4(b). **(10 Marks)**

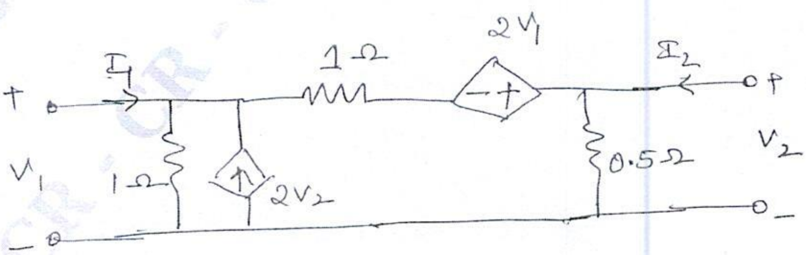


Fig. Q4(b)

Module-3

5 a. Define Open loop system and closed loop system and mention all the merits and demerits of open loop and closed loop system. **(06 Marks)**

b. Write differential equation for the network given in Fig. Q5(b). **(06 Marks)**

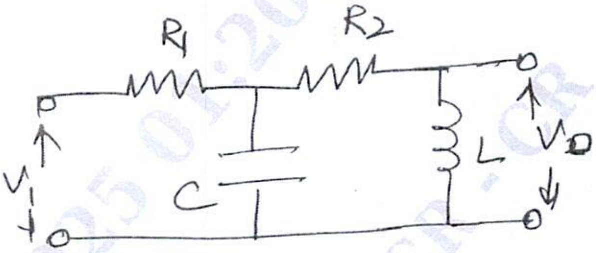


Fig. Q5(b)

c. Obtain transfer function for the given signal flow in Fig. Q5(c). **(08 Marks)**

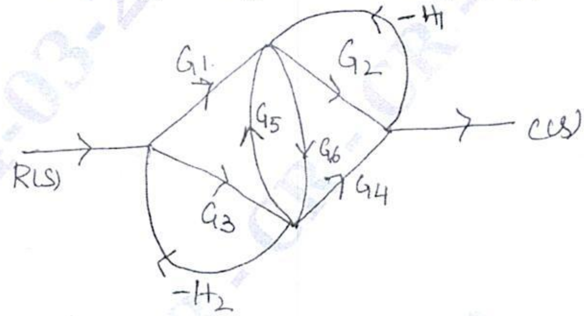


Fig. Q5(c)

OR

6 a. Simplify the given block as shown in Fig. Q6(a) using block reduction method and find its transfer function. **(10 Marks)**

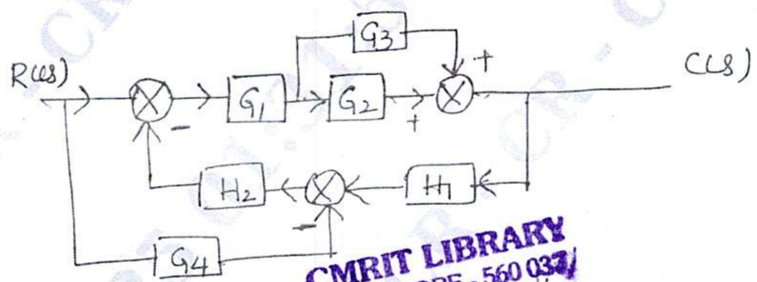


Fig. Q6(a)

b. Draw signal flow graph for the given block as shown in Fig. Q6(b) and obtain transfer function using Mason's Gain formula. **(10 Marks)**

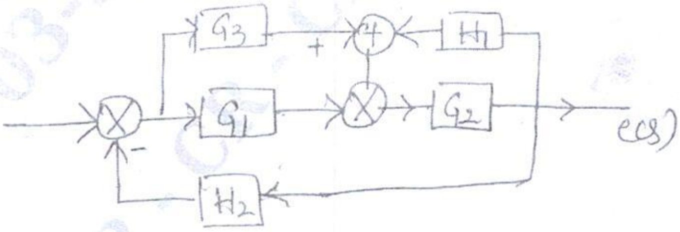


Fig. Q6(b)

Module-4

7 a. Obtain the time response of a second order system subjected to unit step input for under damped oscillation. **(08 Marks)**

b. Check the stability of the given characteristic equation using Routh Hurwitz criteria. The characteristic equation is F(s).

$F(s) = s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16$. Also find roots on RHS , LHS and on imaginary axis. **(06 Marks)**

c. A second order system is given by

$$\frac{C(s)}{R(s)} = \frac{25}{s^2+6s+25}$$. Find Rise time , Settling time , Peak over shoot and Peak time. **(06 Marks)**

OR

8 a. Using RH criteria find K_{mar} and 'w' at K_{mar} given characteristic equation $s^4 + 22s^3 + 10s^2 + s + k = 0$. **(06 Marks)**

b. For a system having $G(s) = \frac{15}{(s+1)(s+3)}$ and $H(s) = 1$.

Find W_n , damping ratio ζ , W_d and θ. Also find $C(t)$, T_p , M_p and T_s (for 2% variance). **(08 Marks)**

c. For the given characteristics equation $F(s) = s^2 + 4s + 4$. Using RH criteria determine the stability of the system and determine roots lying between $S = 0$ and $S = -1$. **(06 Marks)**

Module-5

9 a. Obtain the Root locus for the given transfer function

$$G(s)\,H(s) = \frac{K}{s(s+3)(s^2+3s+11.25)}.$$

Find the range of 'K' for stability. **(10 Marks)**

b. Find the state model equation for the differential equation given below :

$$\frac{dy^4}{dt^4} + 10\frac{d^3y}{dt^3} + 10\frac{d^2y}{dt^2} + \frac{dy}{dt} + y(t) = 10x(t).$$ **(10 Marks)**

OR

10 a. Find the state transition matrix for

$$A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}.$$ **(08 Marks)**

b. Explain properties of state transition matrix. **(06 Marks)**

c. A unity feedback control system has $G(s) = \frac{80}{s(s+2)(s+20)}$.

Draw a Bode plot and find W_{gc} and W_{pc}. Comment on stability. **(06 Marks)**

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