CBCS SCHEME

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18SM53

Fifth Semester B.Tech. Degree Examination, Jan./Feb. 2023
Control Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is closed loop control system? Briefly explain. **(10 Marks)**

b. Explain with a schematic diagram working of manually operated closed loop control system. **(10 Marks)**

OR

2 a. What are Controllers? Explain with block diagram PI and PID controllers? **(10 Marks)**

b. Give the comparison of open loop control system with closed loop control system. **(10 Marks)**

Module-2

3 a. Derive the differential equation of first order electrical system. **(10 Marks)**

b. Define transfer function of control system. Write a note on block diagram. **(10 Marks)**

OR

4 a. Reduce the given block diagram and write the overall transfer function of the system shown in Fig.Q.4(a) and determine:

$\frac{C(S)}{R(S)}$ if $G_1 = H_1 = 1$, $G_2 = H_2 = 2$, $G_3 = H_3 = 3$. **(10 Marks)**

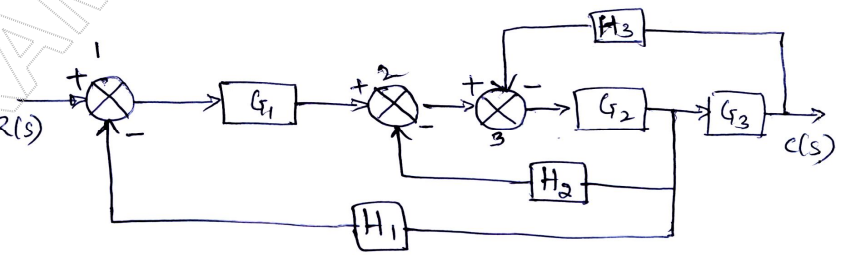

Fig.Q.4(a)

b. Using the signal flow graph and Mason gain formula, obtain the overall transfer function of the system shown in Fig.Q.4(b). **(10 Marks)**

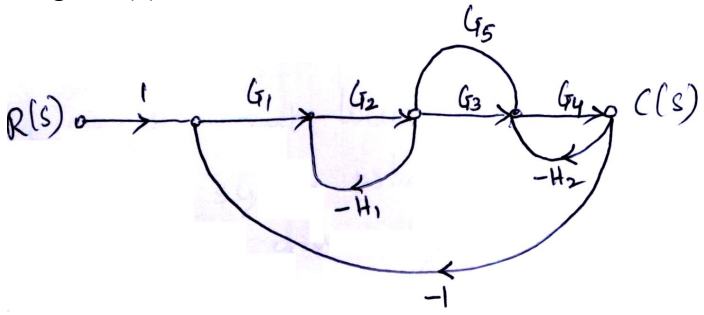

Fig.Q.4(b)

Module-3

5 a. Determine the TYPE and ORDER of the following system for which open loop transfer function are given as follows:

i) $G(S)H(S) = \frac{K}{S(1+S)(1+10S)(1+20S)}$

ii) $G(S)H(S) = \frac{100(S-1)}{S^2(S+5)(S+6)}$. **(10 Marks)**

b. A unity feedback system is characterized by an open loop transfer function

$G(S) = \frac{10}{S^2+2S+6}$.

Determine the following, when the system is subjected to a unit step input:

i) Undamped natural frequency
ii) Damping ratio
iii) Peak ovreshoot
iv) Peak time
v) Settling time. **(10 Marks)**

OR

6 a. Sketch the root locus for a negative feedback system whose open loop transfer function is given by

$G(S)H(S) = \frac{K}{S(S+3)(S^2+3S+4.5)}$. **(10 Marks)**

b. What are the different types of test inputs R(S)? Briefly explain with diagram. **(10 Marks)**

Module-4

7 a. Briefly explain the relationship between time and frequency response. **(10 Marks)**

b. Sketch the polar plot of the system having transfer function

$G(S) = \frac{1}{(1+0.1S)}$. **(10 Marks)**

OR

8 a. Obtain the Nyquist diagram for the system $G(S)H(S) = \frac{100}{(1+2S)}$ and ascertain its stability. **(10 Marks)**

b. Write a note on:

i) Frequency domain analysis
ii) Relative stability
iii) Polar plot. **(10 Marks)**

Module-5

9 a. Define State. Explain the state model. **(10 Marks)**

b. Draw a block diagram for the general second-order, single-input, single output system.

$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}a_{11} & a_{12}\\ a_{21} & a_{22}\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}b_1\\ b_2\end{bmatrix}u(t) \qquad y(t) = \begin{bmatrix}c_1 & c_2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + d\,u(t)$. **(10 Marks)**

OR

10 a. Briefly explain the state models of electrical systems. **(10 Marks)**

b. Write a note on state equations and its matrix representation. **(10 Marks)**

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