CBCS SCHEME

USN AY15MS001

15MA73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Control Engineering

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain and state the characteristic of the following controller:
i) Integral Controller
ii) Proportional + Integral (08 Marks)
b. What are the requirements of an ideal control system? Explain briefly. (08 Marks)

OR

2 a. Explain feed back control system with an example. (08 Marks)
b. Explain open loop and closed loop control system. (08 Marks)

Module-2

3 a. For the mechanical system shown in Fig.Q.3(a) write down the mathematical mode and differential (08 Marks)

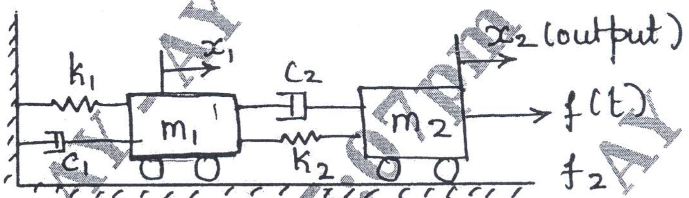

Fig.Q.3(a)

b. Obtain the governing differential equation for a DC motor (Armature controlled). (08 Marks)

OR

4 a. Reduce the given block diagram and write the overall transfer function of the system shown in Fig.Q.4(a). (08 Marks)

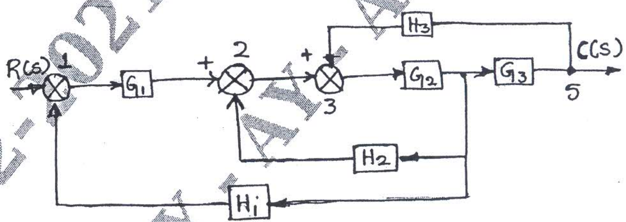

Fig.Q.4(a)

b. For the signal flow graph shown in Fig.Q.4(b). Determine the transfer function C(s)/R(s) using Mason's gain formula. (08 Marks)

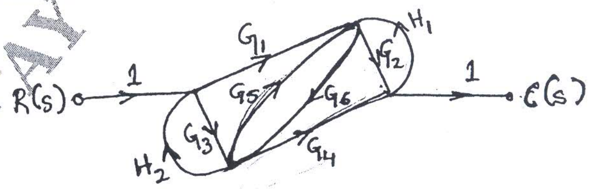

Fig.Q.4(b)

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-3

5 a. The open loop transfer function of a unity negative feedback control system is $G(S)=\dfrac{25}{S(S+5)}$. Obtain maximum overshoot, peak time, rise time and setting time. **(08 Marks)**

b. Derive the expressions for peak time interms of ξ and w_n for a second order control system. **(08 Marks)**

OR

6 $G(S)H(S)=\dfrac{K}{S(S+3)(S+5)}$

Draw root locus. Determine for damping ratio = 0.6, i) Closed loop dominant poles ii) Damped natural frequency iii) Gain K. **(16 Marks)**

Module-4

7 Construct the complete Nyquist plot for a unity feedback control system whose open-loop transfer function is $G(S)H(S)=\dfrac{K}{S(S^2+2S+2)}$. Find the maximum value of K for which the system is stable. **(16 Marks)**

OR

8 For a certain control system $G(s)H(s)=\dfrac{k}{s(s+2)(s+10)}$. Sketch the Nyquist plot and calculate the range of values of K for stability. **(16 Marks)**

Module-5

9 a. Explain series compensated system with block diagram. **(06 Marks)**

b. Obtain the state model for the mechanical system shown in Fig.Q.9(b). Assume $x_1(t)$ as output. **(10 Marks)**

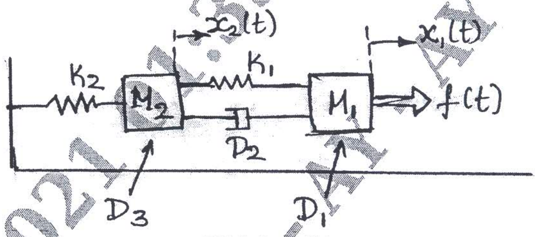

Fig.Q.9(b)

OR

10 a. Define the following:

i) State ii) State variable iii) State vector iv) State space v) State trajectory. **(05 Marks)**

b. Consider the system with state equation

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -6 & -11 & -6\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 0\end{bmatrix}u(t)$$

Estimate the state controllability by

i) Kalman's test ii) Gibert's test. **(11 Marks)**

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