CBCS SCHEME

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15MA73

Seventh Semester B.E. Degree Examination, July/August 2021
Control Engineering

Time: 3 hrs. Max. Marks:80

Note: ***Answer any FIVE full questions.***

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.

1 a. With an example and block diagram, explain the closed loop control system. **(05 Marks)**
b. Explain the requirements of an ideal control system (any six). **(06 Marks)**
c. Compare open loop and closed loop control system (any five). **(05Marks)**

2 Explain with block diagram and transfer function the following controllers:
i) Proportional integral
ii) PID controller. **(16 Marks)**

3 a. Write the differential equations governing the mechanical systems shown in Fig Q3(a), Also F-V and F-C analogous circuits.

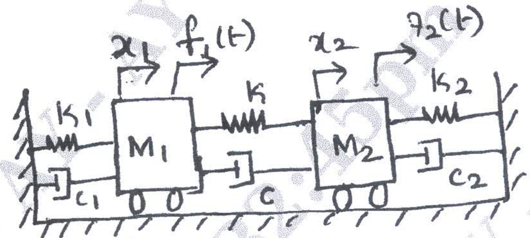

Fig Q3(a) **(12 Marks)**

b. Explain the significance of a transfer function stating its advantages and features. **(04 Marks)**

4 a. Reduce the block diagram to its simple form and obtained transfer function. [Refer Fig. Q4(a)].

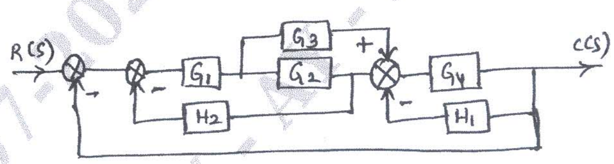

Fig.Q4(a) **(08 Marks)**

b. Obtain the overall transfer function $\frac{C(s)}{R(s)}$ of the SFG given in Fig Q4(b).

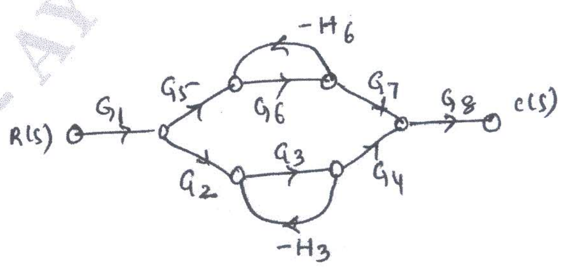

Fig.Q4(b) **(08 Marks)**

5 a. Derive an expression of a second order system subjected to an unit step input for an underdamped system. **(08 Marks)**

b. Check the stability of the system with the characteristic equation : $S^6 + 5s^5 + 3s^4 + 16s^2 - 64s - 48 = 0$. Find W. **(08 Marks)**

6 Plot the root locus for the system with $G(s)H(s) = \frac{K}{s(s^2+4s+10)}$. Comment on the stability of the system. **(16 Marks)**

7 A unity feedback control system has $G(s) = \frac{80}{s(s+2)(s+20)}$. Draw the bode plot. Determine Gain margin, phase margin Gain cross over frequency, phase cross over frequency. **(16 Marks)**

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

9 a. Determine the state observability of the following system.

$$A = \begin{bmatrix} -1 & 1 & 0 \\ 0 & -3 & 2 \\ 0 & 0 & -8 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad C = [1\ 0\ 1].$$ **(06 Marks)**

b. Obtain the state equations of the mechanical system shown in Fig.Q9(b).

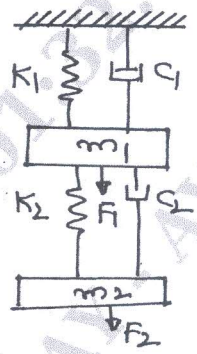

Fig.Q9(b) **(10 Marks)**

10 a. Is the system represented by

$\dot{x}_1 = x_2 + 4 \qquad \dot{x}_2 = -x_1 - 2x_2 + 4$ controllable? **(06 Marks)**

b. Obtain the state equations of the Electrical system shown in fig.Q10(b). **(10 Marks)**

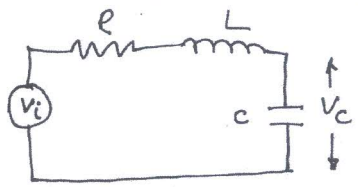

Fig.Q10(b)

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