CBCS SCHEME

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18EE61

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Control Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Distinguish between open loop and closed loop control system with examples. **(06 Marks)**

b. Find the transfer function of the electrical network shown in Fig.Q1(b) in phase load form:

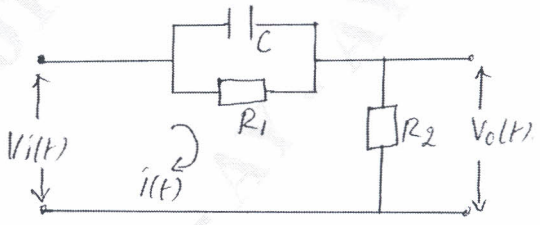

Fig.Q1(b) **(06 Marks)**

c. For the mechanism system shown in Fig.Q1(c):
(i) Draw the mechanical network
(ii) Write the differential equations
(iii) Draw electrical network by force voltage analogy.

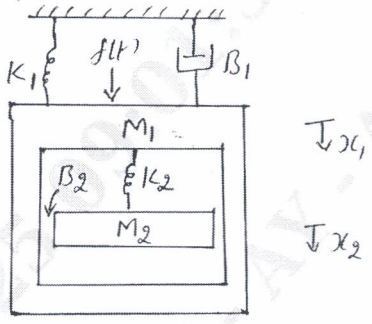

Fig.Q1(c) **(08 Marks)**

OR

2 a. Define servo motor. Compare AC servomotor and DC servo motor. **(04 Marks)**

b. For the mechanical system shown in Fig.Q2(b), obtain the equation of motion for masses M_1 and M_2 and find $\frac{X_2(s)}{F(s)}$.

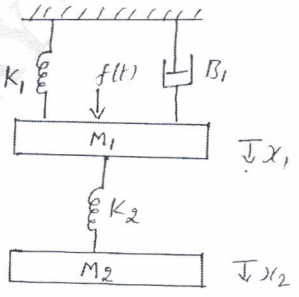

Fig.Q2(b) **(08 Marks)**

b. Draw the corresponding signal flow graph of given block diagram shown in Fig.Q4(b) and find $\frac{C(s)}{R(s)}$.

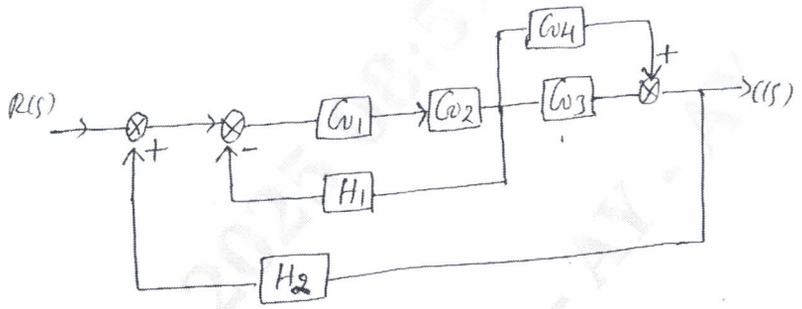

Fig.Q4(b) **(08 Marks)**

c. Explain Mason's gain formula indicating each term. **(04 Marks)**

Module-3

5 a. Define the following for an under damped second order system:
(i) Rise time (ii) Peak overshoot (iii) Settling time **(06 Marks)**

b. Derive an expression for under damped response of a second order feedback control system for unit step input. **(08 Marks)**

c. The characteristic equation of the system is given by $s^4 + 22s^3 + 10s^2 + 2s + K = 0$. Using RH criterion, find the range of K for which the system is stable. **(06 Marks)**

OR

6 a. What are the difficulties encountered while assessing R-H criteria and how do you eliminate these difficulties? Explain with examples. **(06 Marks)**

b. Derive an expression for rise time and peak time for a second order system excited by a step input. **(08 Marks)**

c. Evaluate the static error constants for unity feedback system with $G(s) = \frac{10}{s(1+0.1s)}$. Obtain the steady state error when the input is $r(t) = a_0 + a_1 t + \frac{a_2 t^2}{2}$. **(06 Marks)**

Module-4

7 a. Write notes on: (i) Break away point (ii) Asymptotes **(04 Marks)**

b. Show that part of root locus of a system with $G(s)H(s) = \frac{K(s+3)}{s(s+2)}$ is a circle having centre $(-3, 0)$ and radius at $\sqrt{3}$. **(08 Marks)**

c. Sketch the root locus plot for the open loop transfer function $G(s)H(s) = \frac{K}{s(s+2)(s+3)}$. **(08 Marks)**

OR

8 a. Explain the angle and magnitude condition of root locus. **(06 Marks)**

b. Sketch the bodes magnitude and phase diagram for

$$G(s)H(s) = \frac{5}{s(1+0.5s)(1+0.05s)}$$ **(08 Marks)**