CBCS SCHEME

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15EC43

Eighth Semester B.E. Degree Examination, Jan./Feb. 2021
Control System

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Compare open loop and closed loop control system and give one practical example of each. **(04 Marks)**

b. Draw the electrical network based on Torque-current analogy give all the performance equations for the Fig.Q.1(b). **(08 Marks)**

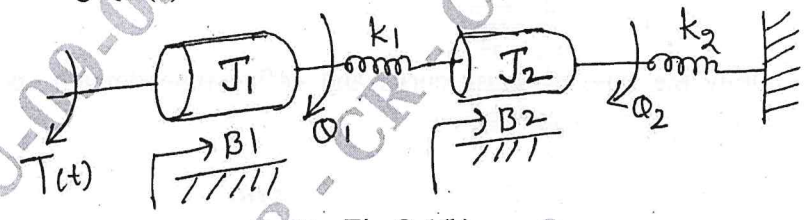

Fig.Q.1(b)

c. Write block diagram reduction rules. **(04 Marks)**

OR

2 a. Using the block diagram reduction rules find $\frac{C(s)}{R(s)}$ for the Fig.Q.2(a). **(08 Marks)**

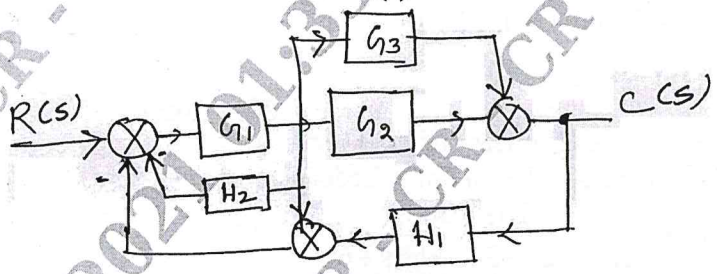

Fig.Q.2(a)

b. Obtain the T.F by using Mason's gain formula for the Fig.Q.2(b). **(08 Marks)**

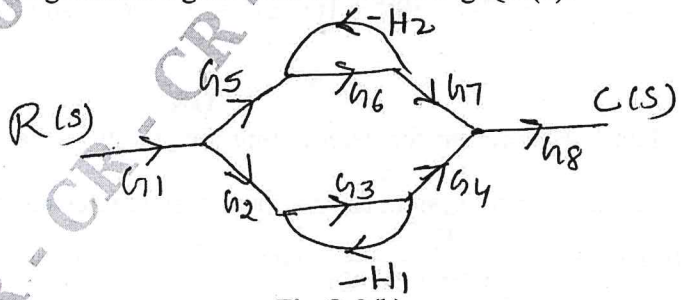

Fig.Q.2(b)

Module-2

3 a. Find K_1 so that $\epsilon = 0.35$. Find the corresponding time domain specifications for the Fig.Q.3(a). **(05 Marks)**

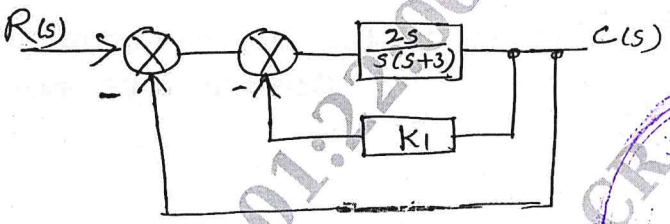

Fig.Q.3(a)

b. For unity feed back control system with $G(S) = \frac{10(s+2)}{s^2(s+1)}$. Find:

i) The static error coefficients
ii) Steady state error when the input

$$R(s) = \frac{3}{s} + \frac{2}{s^2} + \frac{1}{3s^3}$$ **(06 Marks)**

c. Draw the time response curve and define time domain specifications, for second order system for unit step input. **(05 Marks)**

OR

4 a. Explain the effect of ξ on second order system performance. **(04 Marks)**

b. Explain the effects of PI and PD controllers on the performance of second order system. **(08 Marks)**

c. Find K_P and K_V for the system with open loop transfer function as

$$G(s)H(s) = \frac{10(s+2)(s+3)}{s(s+1)(s+4)(s+5)}$$

where input is $r(t) = 3 + t$. **(04 Marks)**

Module-3

5 a. Explain basic concept of Root locus. **(03 Marks)**

b. The open loop T.F of unity feedback system is given by

$$G(s) = \frac{K(s+3)}{s(s^2+2s+3)(s+5)(s+6)}$$

Find the value of K of which closed loop system is stable. **(07 Marks)**

c. A unity feedback control system is described by the characteristic equation $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. Find its stability using R-H criterion. **(06 Marks)**

OR

6 a. Explain R-H criterion for determining the stability of a system and mention its limitations. **(04 Marks)**

b. A feedback control system has an open loop transfer function,

$$G(s)H(s) = \frac{K}{s(s+3)(s^2+2s+2)}$$. Draw the root locus as K varies from 0 to ∞. **(12 Marks)**

Module-4

7 a. List the limitations of lead and lag compensations. **(04 Marks)**

b. Sketch the Bode plot for the T.F $= \frac{300(s^2+2s+4)}{s(s+10)(s+20)}$ Find, phase margin and gain margin. **(08 Marks)**

c. Write a note about gain margin in brief. **(04 Marks)**

OR

8 a. Draw the polar plot of $G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}$. **(08 Marks)**

b. Sketch the Nyquist plot for a system with $G(s)H(s) = \frac{10(s+3)}{s(s-1)}$ comment on closed loop stability. **(08 Marks)**

Module-5

9 a. Explain the sampling process with the help of unit impulse train. **(06 Marks)**

b. What is diagonalization of a matrix explain with suitable example? **(05 Marks)**

c. Obtain the state model of the system represented by the differential equation.

$$\frac{d^3y(t)}{dt^3} + 6\frac{d^2y(t)}{dt^2} + 11\frac{dy(t)}{dt} + 10y(t) = 3u(t)$$ **(05 Marks)**

OR

10 a. Define the following terms:
i) State variable
ii) State space
iii) State trajectory. **(06 Marks)**

b. Obtain the state model of the given electrical system for the Fig.Q.10(b) **(06 Marks)**

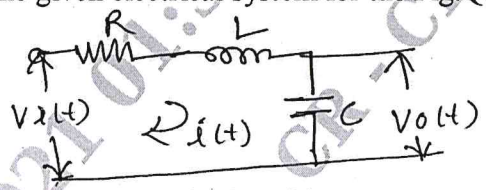

Fig.Q.10(b)

c. State the advantages and disadvantages of digital control system. **(04 Marks)**

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