CBCS SCHEME

USN

18EE61

Sixth Semester B.E. Degree Examination, June/July 2023
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. What is Control System? Compare open loop with closed loop control system. **(05 Marks)**

b. Explain Rotational motion of mechanical system. **(05 Marks)**

c. For the Mechanical System shown in Fig.Q1(c). Obtain f – v analogous electrical system.

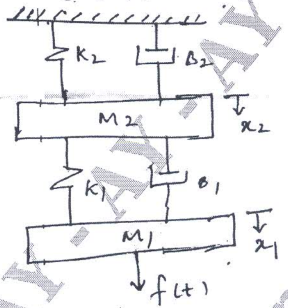

Fig.Q1(c) **(10 Marks)**

OR

2 a. Define open loop, closed loop and feedback control system. Mention one example on each type. **(05 Marks)**

b. Explain A.C. servomotor. **(07 Marks)**

c. Determine transfer function of mechanical system shown in Fig.Q2(c). Take θ_2 as output.

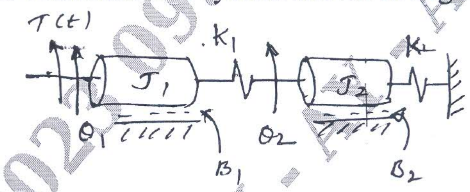

Fig.Q2(c) **(08 Marks)**

Module-2

3 a. What is block diagram? List the properties of block diagram. **(05 Marks)**

b. Derive an expression for open loop transfer function (OLTF) and closed loop transfer function (CLTF). **(05 Marks)**

c. For the block diagram shown in Fig.Q3(c). Determine the transfer function C(s)/R(s) using block diagram algebra.

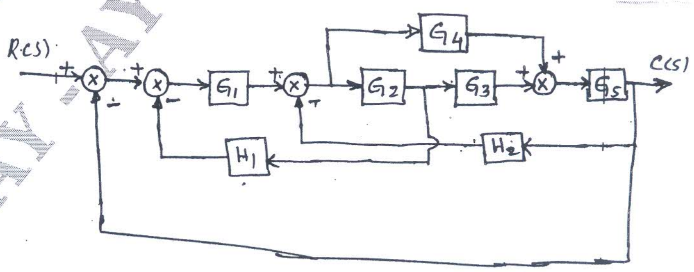

Fig.Q3(c) **(10 Marks)**

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.

OR

4 a. Define :
i) Source and sink node
ii) Loop and loop gain
iii) Forward path. (05 Marks)

b. Explain Mason's gain formula. (05 Marks)

c. For the signal flow graph shown in Fig.Q4(c), obtain overall transfer function using Mason's gain formula.

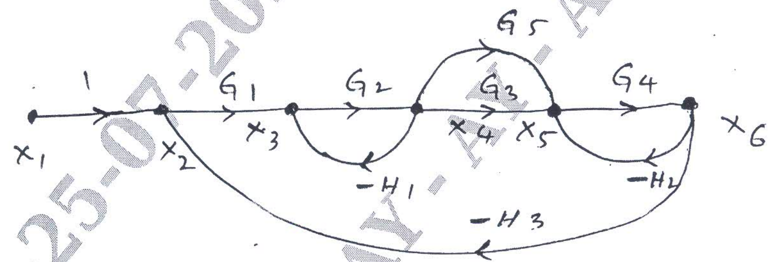

Fig.Q4(c) (10 Marks)

Module-3

5 a. Derive an expression of second order system response for step input (under damped system). (06 Marks)

b. An UFBCS has $G(s) = \frac{20(s+1)}{s^2(s^2+6s+8)}$.
Find :
i) Static error coefficient
ii) Steady state error for step, ramp and parabolic input. (06 Marks)

c. A second order system is given by $\frac{C(s)}{R(s)} = \frac{25}{s^2+6s+25}$. Find transient specification for unit step and assume 2% tolerance. (08 Marks)

OR

6 a. Explain difficulties and remedy of R – H criterion. (06 Marks)

b. Check the stability of the given characteristic equation using R – H criteria :
$s^4 + 2s^3 + 4s^2 + 6s + 8 = 0$. (06 Marks)

c. A UFBCS has $G(s) = \frac{k(s+13)}{s(s+3)(s+7)}$. Using R – H criteria, calculate the range of 'K' for which the system is stable. (08 Marks)

Module-4

7 a. Explain :
i) Angle of asymptotes
ii) Break away points. (04 Marks)

b. Sketch the root locus of UFBCS having $G(s) = \frac{k(s+1)}{s(s+2)(s^2+2s+2)}$. Mark the salient points. (16 Marks)

OR

8 a. Define :
i) Gain margin (GM)
ii) Phase Margin (PM). **(04 Marks)**

b. Construct the bode plot of a UFBCS with $G(s) = \frac{10(s+10)}{s(s+2)(s+5)}$. Find gain Margin and phase margin. Comment of stability. **(16 Marks)**

Module-5

9 a. Explain the Nyquist stability criteria. **(08 Marks)**

b. Sketch the Nyquist plot for the system with $G(s)H(s) = \frac{4s+1}{s^2(s+1)(2s+1)}$. **(12 Marks)**

OR

10 a. What is lead compensation? Explain the procedure to design lead–lag compensation in frequency domain. **(08 Marks)**

b. Explain :
i) PI controller
ii) PD controller. **(12 Marks)**

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