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.

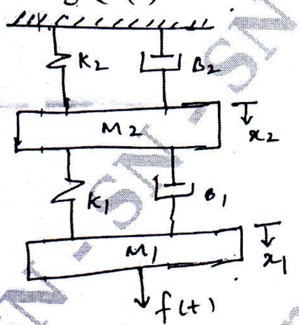

Fig.Q1(c) **(10 Marks)**

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.

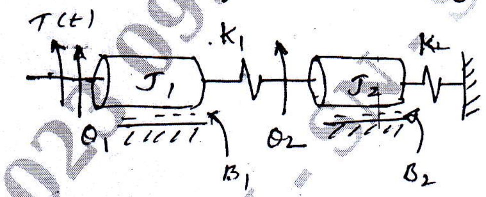

Fig.Q2(c) **(08 Marks)**

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.

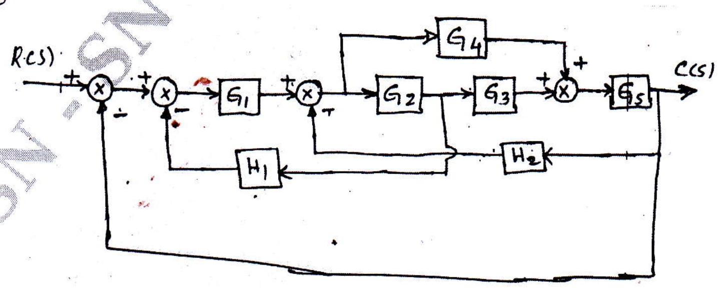

Fig.Q3(c) **(10 Marks)**

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.

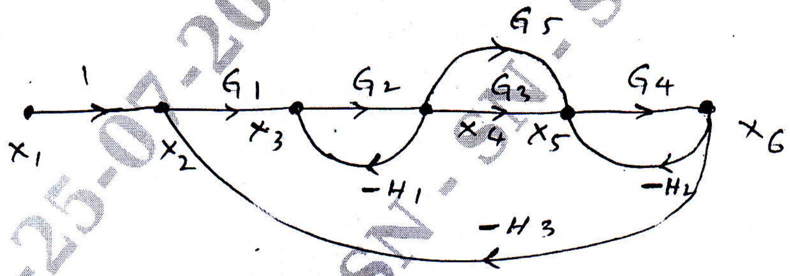

Fig.Q4(c) **(10 Marks)**

Module-3

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

b. An UFBCS has $G(s) = \dfrac{20(s+1)}{s^2(s^2+6s+8)}$.

   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 $\dfrac{C(s)}{R(s)} = \dfrac{25}{s^2+6s+25}$. 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 $G(s) = \dfrac{k(s+13)}{s(s+3)(s+7)}$. 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 $G(s) = \dfrac{k(s+1)}{s(s+2)(s^2+2s+2)}$. 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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