II B. Tech II Semester Supplementary Examinations, December - 2023
LINEAR CONTROL SYSTEMS
(Common to ECE&EIE)

Time: 3 hours   **Max. Marks: 70**

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
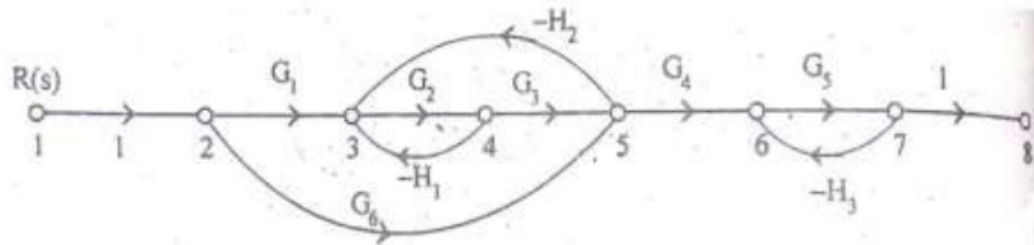~~~~~~~~~~~~~~~~~~~~~~~~~

UNIT-I

1 a) Define transfer function. Write the importance of transfer function in linear control systems.   [7M]

   b) What is the advantage of mathematical model of a system? Write the differential equations governing to translational and rotational mechanical systems.   [7M]

Or

2 a) Write the important differences between open loop and closed loop systems with suitable examples.   [7M]

   b) Discuss different Characteristics and their effects of Feed-Back Control system.   [7M]

UNIT-II

3 a) Derive the Transfer Function for the field-controlled D.C servomotor with neat Sketch.   [10M]

   b) Find the overall transfer function of the system whose signal flow graph is shown below.   [4M]

Or

4 a) A unity feed-back system is characterized by an open loop transfer function G(s) = k/s(s+10).Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K , determine Ts, Tp and Mp for a unit step input   [7M]

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b) Determine the transfer function for the block diagram shown in Figure 1. [7M]
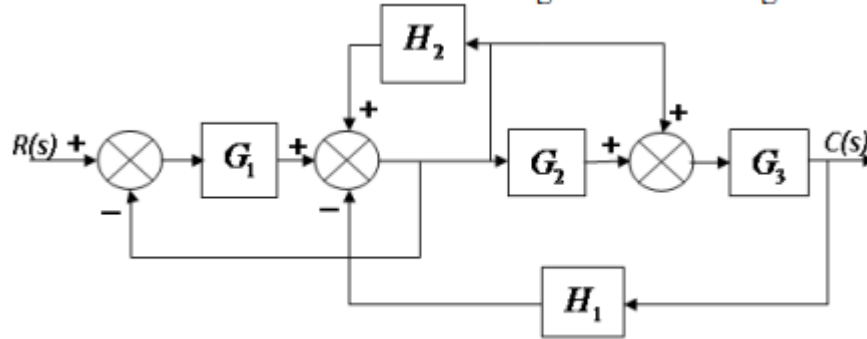

Figure: 1

UNIT-III

5. a) Construct R-H criterion and determine the stability of a system representing the characteristics equation $S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5 = 0$ Comment on location of the roots of the characteristics equation. [7M]

   b) Sketch the root locus of the system whose open loop transfer function is [7M]

   $$G(s)H(s) = \frac{K}{S(S+1)(S+2)}$$

   Or

6. a) What is the effect of addition of pole to a transfer function on Root Locus? [7M]

   b) Determine the range of K for stability of unity feedback system using Routh stability criterion whose transfer function [7M]

   $$\frac{C(s)}{R(s)} = \frac{K}{S(S^2 + S + 1)(S + 2) + K}$$

UNIT-IV

7. a) Define phase margin and gain margin. [5M]

   b) Sketch the Bode Magnitude plot for the transfer function [9M]

   $$G(s) = \frac{K}{S(S+1)(S+50)}.$$

   Or

8. a) Derive the expressions for frequency domain specifications of a second order system. [10M]

   b) Draw a polar plot for $G(s) = \frac{1}{S(1+ST_2)}$. [4M]

UNIT-V

9. Design a phase lag network for a plant with the open loop transfer function $G(s) = \frac{5}{S(1+0.1S)^2}$ to have a phase margin of 45^0. Verify the performance of the compensated system with the specification. [14M]

   Or

10 a) Explain about the concept of controllability and Observability. [7M]

b) Consider the RLC network shown in figure. Write the state variable representation. [7M]

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