PVP 20

Code: 20EC3404

II B.Tech - II Semester – Regular Examinations – JULY 2022

CONTROL SYSTEMS ENGINEERING
(ELECTRONICS & COMMUNICATION ENGINEERING)

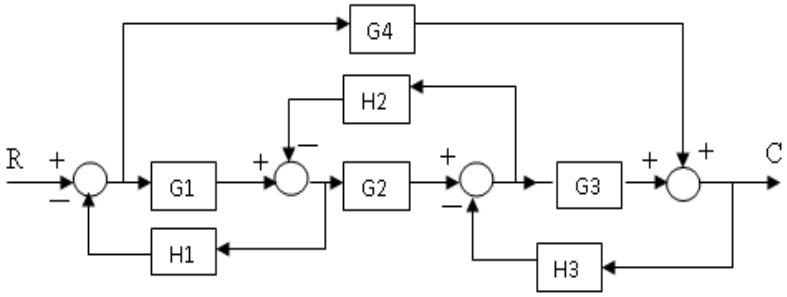
Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. a) Discuss the effect of feedback on Gain, Stability. 4 M

   b) Sketch the equivalent signal flow graph and compute the overall transfer function using Mason's gain formulae.

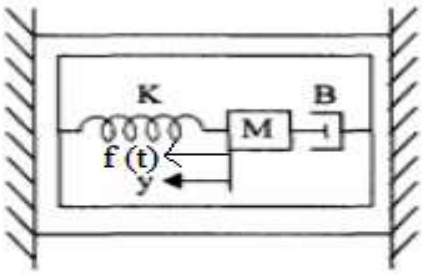


10 M

OR

2. a) Distinguish between Open loop and Closed loop Systems. 7 M

   b) Obtain the transfer function for the following mechanical translational system.



$$T(s) = \frac{Y(s)}{F(s)}$$

7 M

UNIT – II

3. a) Explain the effect of Proportional control action on the performance of a second order system. 4 M

   b) The open-loop transfer function of a unity feedback control system is given by $G(S) = \frac{9}{S(S+3)}$. Find the natural frequency of response, damping ratio, damped frequency and time constant. 10 M

OR

4. a) Deduce the expressions for peak overshoot and rise time of a standard second order under damped system. 7 M

   b) For unity feedback control system the open loop transfer function $G(S) = \frac{10(S+2)}{S^2(S+4)}$. Find the e_{ss} when the input is $r(t) = 3 - 2t + 3t^2$, and find K_p, K_v, and K_a. 7 M

UNIT-III

5. a) Give the necessary and sufficient condition for stability in R-H criteria. 4 M

   b) Sketch the root locus of the system whose open loop transfer function is $G(S)H(S) = \frac{K}{S(S+2)(S+4)}$. 10 M

OR

6. a) Explain the construction rules of root locus. 7 M

   b) Using R-H criteria find the stability of the system whose characteristic equation is given by

   $P(s)=s^6+2s^5+8s^4+12s^3+20s^2+16s+16$. 7 M

UNIT – IV

7. a) Explain gain margin, phase margin, gain crossover frequency and phase crossover frequency. 4 M

   b) Sketch the polar plot for the following open loop transfer function.

$$G(S) = \frac{10}{S(S+1)(S+3)}$$ 10 M

OR

8. a) Explain principle of arguments. 4 M

   b) Sketch the Bode plot for the following transfer function and determine the system gain K for which the magnitude plot crosses the 0 db line at ω = 15 rad/sec.

$$G(S) = \frac{K}{S(S+1)(1+0.1S)(1+0.01S)}.$$ 10 M

UNIT – V

9. a) Explain state transition matrix. State and prove its properties. 7 M

   b) Find the state transition matrix for the following matrix,

$$A = \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}.$$ 7 M

OR

10. a) Describe the term state variable. Explain the advantages of state space representation. 4 M

b) Find controllability and observability of the given system

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \\ \dot{X}_3 \end{bmatrix} = \begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 11 \\ 1 \\ -14 \end{bmatrix} [u] \text{ and } y = \begin{bmatrix} -3 & 5 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

10 M