

R13

Code No: 115DU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, March - 2024

CONTROL SYSTEMS ENGINEERING
(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

- 1.a) List out the advantages of transfer function. [2]
- b) Explain the effect of feedback on overall gain. [3]
- c) What is the time response of the first order system? [2]
- d) Distinguish between type and order of a system. [3]
- e) How R-H criterion is useful in plotting root locus? [2]
- f) What is the need of angle of asymptotes in Root-locus? [3]
- g) Mention the advantages of Bode plot. [2]
- h) Define gain and phase margins. [3]
- i) Define Controllability and Observability. [2]
- j) What are the merits of state variable technique? [3]

PART - B

(50 Marks)

- 2.a) Distinguish the open loop and closed loop control systems.
- b) Explain the effect of feedback on sensitivity and stability of a system. [5+5]

OR

- 3.a) Explain the advantages of signal flow graph over block diagram representation.
- b) For the signal flow graph shown in figure 1, determine the gain X_5/X_1 using Mason's gain formula. [5+5]

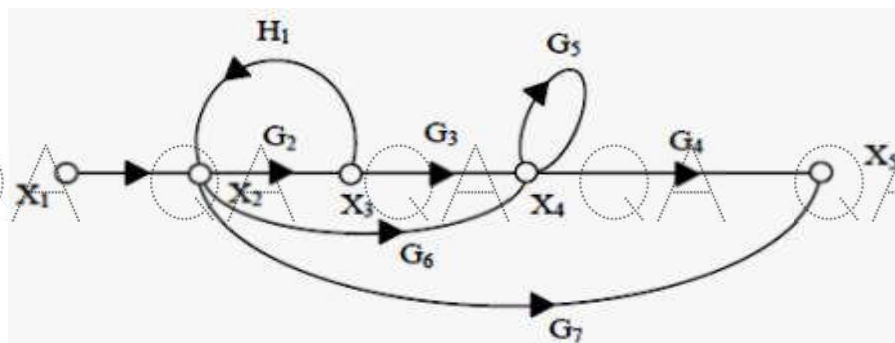


Figure 1

4.a) Damping factor and natural frequency of the system are 0.12 and 84.2 rad/sec respectively. Determine the rise time (t_r), peak time (t_p), maximum peak overshoot (m_p) and settling time (t_s).

b) Explain error constants K_p , K_v and K_a for type II system. [5+5]

OR

5. State and explain the effects of P, PI and PID controller on the system dynamics. [10]

6. A unity feedback control system is represented by the open loop transfer function $G(S) = K(S+9)/S(S+4)(S+5)$

a) Using Routh criterion, obtain the range of value of K for the system to be stable.

b) Identify if $K=1$, all these roots of the characteristic equation of the system having damping factor greater than 0.5. [5+5]

OR

7. Sketch the root locus plot of a unit feedback system with the open loop transfer function $G(S) = K/S(S+3)(S+5)$. [10]

8. Sketch the Bode plot for $G(S) = 100/S(S+4)(S+9)$. [10]

OR

9. Analyze on Lead, Lag and Lag-Lead compensators with a neat diagram and also explain their importance. [10]

10.a) State and prove the properties of state transition matrix.

b) A system is described by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u \quad y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Check the controllable and observability of the system. [5+5]

OR

11.a) Explain about diagonalization procedure.

b) Explain controllable and observability applied to linear time invariant system. [5+5]

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