

Code No: 115DU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech III Year I Semester Examinations, March - 2017****CONTROL SYSTEMS ENGINEERING****(Common to ECE, ETM)****Time: 3 hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

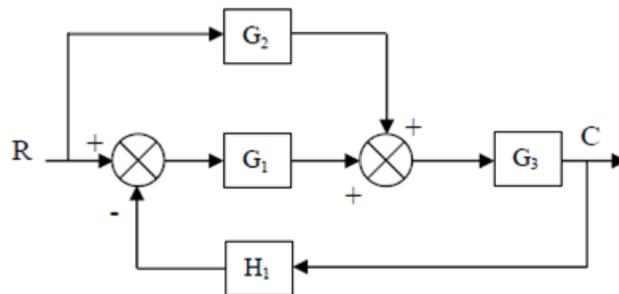
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A**(25 Marks)**

- 1.a) Define transfer function. What are its limitations? [2]
- b) Give classification of control systems. [3]
- c) What is the difference between type and order of the system? [2]
- d) What are the standard test signals [3]
- e) What is the effect of adding poles to $G(s)H(s)$ on the root loci? [2]
- f) Write limitations of Routh's stability. [3]
- g) Draw the pole zero location of lag compensator. [2]
- h) Define phase margin and gain margin. [3]
- i) Define Observability. [2]
- j) Write Properties of State Transition Matrix. [3]

PART - B**(50 Marks)**

- 2.a) Illustrate at least two applications of feedback control systems.
- b) Determine the transfer function $C(S)/R(S)$ for the following block diagram. [5+5]

**OR**

- 3.a) What is feedback? Explain the effects of feedback.
- b) What are differences between block diagram reduction and signal flow graph reduction? [5+5]
- 4.a) Derive the time response of second order under damped system due to unit step input.
- b) Why derivative controller is not used in control systems? What is the effect of PI controller on the system performance? [5+5]

5. Find the Error coefficients for step, ramp and parabolic inputs for unity feed-back system having the forward transfer function. [10]

$$G(s) = \frac{14(s+3)}{s(s+5)(s^2+2s+2)}$$

6. Sketch the root locus plot of a unity feedback system whose open loop T.F is [10]

$$G(s) = \frac{K(s^2-2s+2)}{(s+2)(s+3)(s+4)}$$

OR

7. The characteristic equations of two systems are given below

a) $S^4 + 21S^3 + 21S^2 + 36S + 20 = 0$

b) $S^5 + 6S^4 + 3S^3 + 2S^2 + S + 1 = 0$

Find whether the systems are stable or not using RH Criterion. [10]

8. The open loop transfer function of certain unity feedback control system is given by $G(S) = \frac{k}{s(s+4)(s+8)}$. It is desired to have the phase margin to be at least 33° and velocity error constant $K_v = 30 \text{ Sec}^{-1}$. Design a phase lag series compensator. [10]

OR

9. Sketch the Bode plot for the system $G(s) = \frac{25}{s(1+s)(1+0.1s)}$. Hence find gain cross over frequency and phase cross over frequency. [10]

10. Given $X(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$. Find the unit step response when, $X(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ [10]

OR

- 11.a) Discuss the significance of State Space Analysis.

- b) Consider the matrix. Compute e^{At} . [5+5]

$$A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$$