

**R13**

Code No: 115DU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, January/February - 2023

**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.

Normal graph sheets are required:

**PART - A**

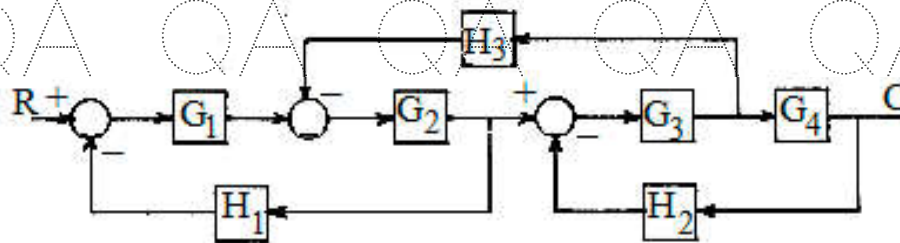
(25 Marks)

- 1.a) Why is negative feedback invariably preferred in a closed loop system? [2]
- b) Write the importance of Signal flow graph in control systems. [3]
- c) What is the time response of the first order system? [2]
- d) What are the test signals? [3]
- e) Discuss asymptotes. [2]
- f) What are the limitations of Routh Hurwitz criteria? [3]
- g) What is lag compensator? [2]
- h) Define phase margin. [3]
- i) Define controllability. [2]
- j) Explain: i) State ii) Sate variables iii) State space representation. [3]

**PART - B**

(50 Marks)

2. Find the transfer function of the system represented by the following figure. [10]



OR

- 3.a) Write the difference between open lop and closed loop systems. [6]
- b) What is feedback? Explain the effects of feedback. [4]

4.a) Find out the output of the critically damped second order system when the input applied to the system is unit step input.

b) Define time domain specifications. [5+5]

OR

5.a) Explain error constants  $K_p$ ,  $K_v$  and  $K_a$  for type II system.

b) Explain the effect of PD control on the performance of control system. [5+5]

6.a) A unity feedback control system has an open loop transfer function  $G(S)=K/s(s^2+4s+13)$ . Find i) Angle of asymptotes, centroid ii) Angle of departure.

b) How many roots of the following polynomial are in the right half, left half of s-plane and on the  $j\omega$  axis.  $P(s)=s^5+2s^4+2s^3+4s^2+s+2=0$  [5+5]

OR

7. Draw the root locus for the unity feedback system whose open loop transfer function is

$G(s) = \frac{k(s+1)}{(s-1)(s+2)(s+4)}$  find the range of k for which the system is stable. [10]

8.a) Draw and explain polar plots for type-0, type-1 and type-2 systems.

b) Enlist the step-by-step procedure for the construction of Nyquist plots. [5+5]

OR

9.a) Explain the different steps to be followed for the design of lead compensator using Bode plot.

b) Write short notes on PID controllers. [5+5]

10.a) Develop the state model for a system characterized by the following differential equation

$$d^3 y/dt^3 + 6d^2 y/dt^2 + 11dy/dt + 6y = u(t).$$

b) Discuss the significance of state Space Analysis. [5+5]

OR

11.a) Given the transfer function of the system as  $\frac{y(s)}{U(s)} = \frac{s^2+3s+3}{s^3+2s^2+3s+1}$ . Write the state variable model.

b) State and prove the properties of state transition matrix. [5+5]

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