

R18

Code No: 155AR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

CONTROL SYSTEMS

(Common to ECE, EIE)

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) What is the basic rule used for block diagram reduction technique? [2]
- b) Write the force balance equation of an ideal mass, ideal dashpot and ideal spring element. [3]
- c) List the time domain specifications. [2]
- d) Define Centroid. How do you determine the centroid and angle of asymptotes in root locus technique? [3]
- e) What is Polar plot? [2]
- f) Define Phase Margin, Gain Margin with reference to Bode plot. [3]
- g) What is the function of P and I Controllers? [2]
- h) Define the terms Steady State Accuracy and transient accuracy of the system. [3]
- i) Define Controllability. [2]
- j) State the properties of state transition matrix. [3]

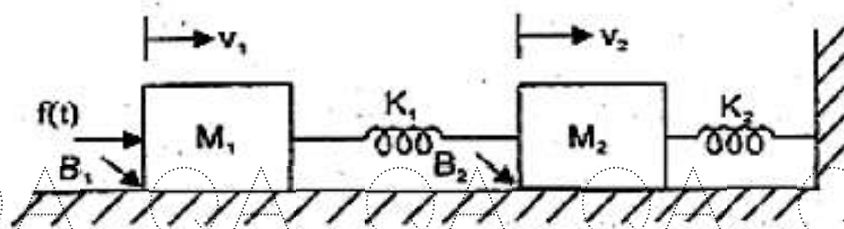
PART – B

(50 Marks)

2. Compare the Open loop and Closed loop Control Systems with examples in detail. [10]

OR

3. Determine the Force voltage and Force current analogy for given mechanical system. [10]



4. The characteristic polynomial of a system is $s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 24s^2 + 23s + 15 = 0$. Determine the location of roots on s-plane and hence the stability of the system. [10]

OR

5. Sketch the root locus of the system whose open loop transfer function is $G(s) = K/s(s+2)(s+4)$. Find the value of K so that the damping ratio of the closed loop system is 0.5. [10]

QA

QA

QA

QA

QA

QA

QA

QA

6. Sketch the polar plot for the following transfer function, Determine phase margin and gain margin. [10]

QA

QA

QA

$$G(s) = \frac{k}{s^2(1+s)(1+2s)}$$

QA

QA

QA

QA

OR

7. Sketch the Bode plot of the given system and determine the phase margin and gain margin of the system. [10]

QA

QA

QA

$$G(s) = \frac{20(0.1s+1)}{s^2(0.2s+1)(0.02s+1)}$$

QA

QA

QA

QA

8. Explain the step by step procedure of Root-loci method of feedback controller design. [10]

OR

9. Discuss the Analog and Digital implementation of controllers. [10]

10. Consider a system with state model given below:

QA

QA

QA

QA

QA

QA

QA

QA

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 5 \\ -24 \end{bmatrix} u; \quad y = [1 \quad 0 \quad 0]x + [0]u$$

Verify, the system is observable and controllable. [10]

OR

11. Explain about diagonalization and also obtain the state model of the given transfer function. [10]

QA

QA

QA

QA

QA

QA

QA

QA

$$\frac{Y(S)}{U(S)} = \frac{5}{s^2 + 6s + 7}$$

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA

QA