

Code No: 125DU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, July/August - 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.

PART - A

(25 Marks)

- 1.a) Explain the effect of negative feedback in control systems. [2]
- b) Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system. [3]
- c) What are standard test signals? [2]
- d) What is meant by un-damped response? [3]
- e) What is the need of angle of asymptotes in Root-locus? [2]
- f) Write the remedies if an entire row is zero while computing elements in R-H array. [3]
- g) Draw the pole-zero plot of Lag compensator. [2]
- h) What are the advantages of Bode plot? [3]
- i) Define Observability. [2]
- j) Give the properties of state transition matrix. [3]

PART - B

(50 Marks)

- 2.a) Reduce the block diagram shown in figure 1 and find the Y/X.

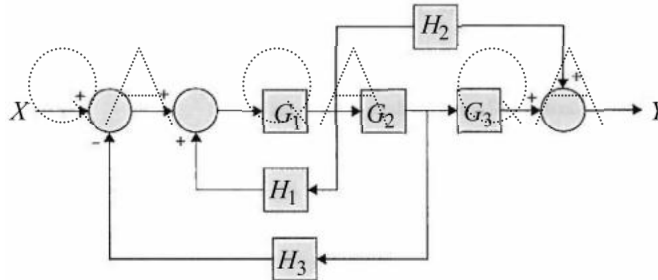


Figure 1

- b) Derive the transfer function for the parallel RLC network subjected to unit step voltage. [5+5]

OR

QA QA QA QA QA QA QA QA QA QA QA

3.a) Obtain the transfer function $X_1(s)/F(s)$ for the mechanical system as shown in figure 2.

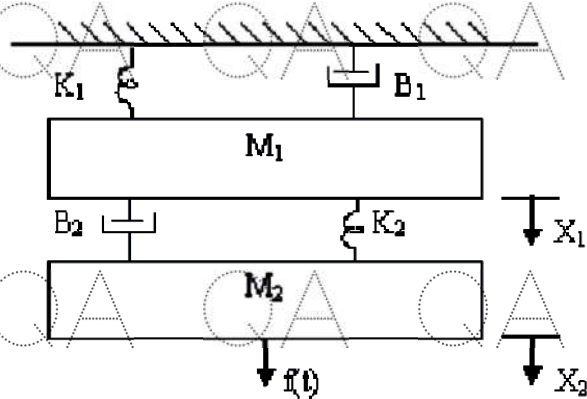


Figure 2

b) Using block diagram reduction technique, determine $C(s)/R(s)$ for the following system [5+5]
(Figure 3).

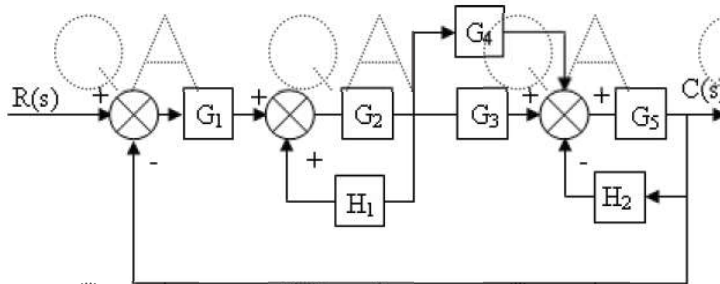


Figure 3

4.a) Determine the step, ramp and parabolic error constants for the unity feedback control system. The forward path transfer function is $G(S) = \frac{50}{S(S+2)(S+5)}$.

b) The open loop transfer function of a feedback control system is given by

$$G(S)H(S) = \frac{K(S+1)}{S(1+Ts)(1+2S)}$$

Determine the error coefficients and errors due to the unit positional inputs, unit ramp input and unit parabolic input if $K=10$ and $T=4$. [5+5]

OR

5. Obtain the transient response of a second-order system subjected to unit step input. [10]

6.a) The forward path transfer function of unity feedback control system is given by $G(S) = \frac{K(10+S)(20+S)}{S^2(S+2)}$, apply Routh-Hurwitz criterion to determine the stability

of the closed-loop system as a function of K .

b) Define Root locus and explain procedure to sketch the Root Locus for a given transfer function. [5+5]

OR

QA QA QA QA QA QA QA QA QA QA QA

QA QA QA QA QA QA QA G

7.a) Plot the root locus pattern for a system whose forward path transfer function is

$$G(s)H(s) = \frac{K(s+1)}{s(s+2)(s^2+2s+5)}$$

QA

b) A feedback control system has an open loop transfer function of

$$G(S)H(S) = \frac{Ke^{-s}}{S(S^2+2S+1)}$$

Determine the maximum value of K for the closed loop stability. [5+5]

8. Explain the different steps to be followed for the design of lead compensator in frequency domain. [10]

QA

OR

9. A system is given by $G(s) = \frac{4S+1}{S^2(s+1)(2s+1)}$. Sketch the Nyquist plot and hence determine the stability of the system. [10]

QA

10. Obtain the state model for a system whose transfer function is $T(s) = \frac{s^2+3s+3}{s^3+2s^2+3s+1}$. Thereby Investigate the contrallbility and observability of the system. [10]

OR

11. Obtain the state space representation for a system whose transfer function is given by

$$\frac{Y(s)}{U(s)} = \frac{6s^3+4s^2+3s+10}{s^3+8s^2+4s+20}$$

[10]

QA

QA

QA

QA

QA

QA

QA

G

---ooOoo---

QA

QA

QA

QA

QA

QA

QA

G

QA

QA

QA

QA

QA

QA

QA

G

QA

QA

QA

QA

QA

QA

QA

G