Code No: 115DU

R13

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.

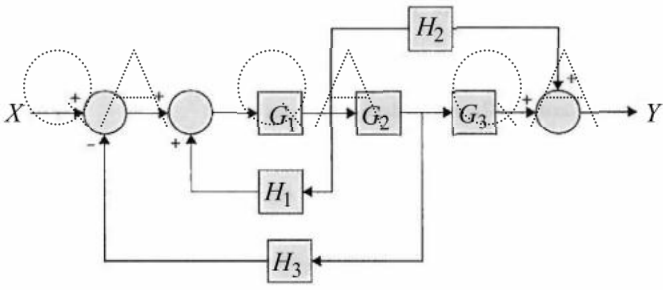

Figure 1

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

OR

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

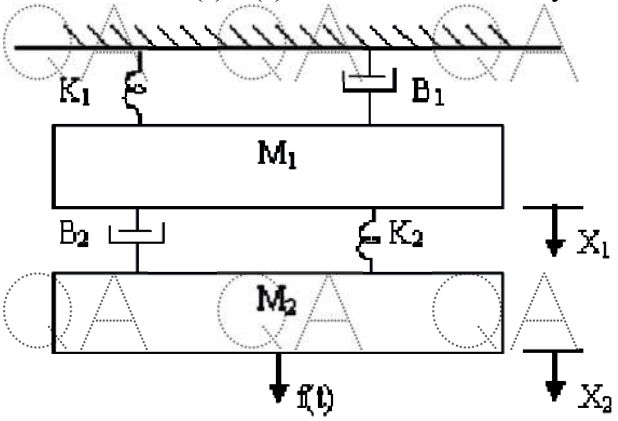

Figure 2

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

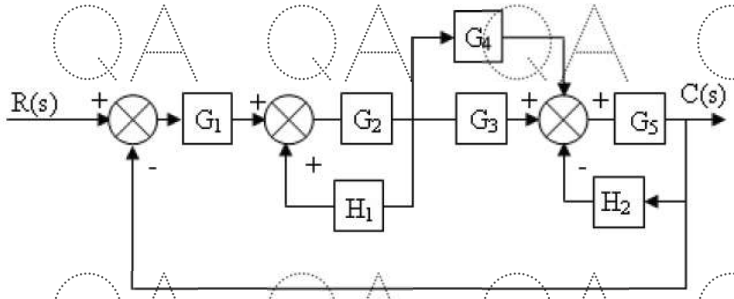

Figure 3

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

7.a) Plot the root locus pattern for a system whose forward path transfer function is $G(s)H(s)=\frac{K(s+1)}{s(s+2)(s^2+2s+5)}$.

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]

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]

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]

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