R13

Code No: 115DU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November - 2015
CONTROL SYSTEMES ENGINEERING
(Electronics and Communication Engineering)

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) What are the advantages of closed loop system compared to open loop system? [2]
  b) Discuss the effect of feedback on overall gain. [3]
  c) Give the expression for the rise time of the step response for a second order system. [2]
  d) Define the static error constants. [3]
  e) How R-H criterion is useful in plotting root locus? [2]
  f) What is Routh's stability criterion? [3]
  g) Draw the pole zero plot for lag-lead compensator. [2]
  h) What are the advantages of Bode plot? [3]
  i) Define controllability. [2]
  j) State any four properties of STM. [3]

PART - B (50 Marks)

2.a) Give the f-v analogy of mechanical translational system and electrical system.
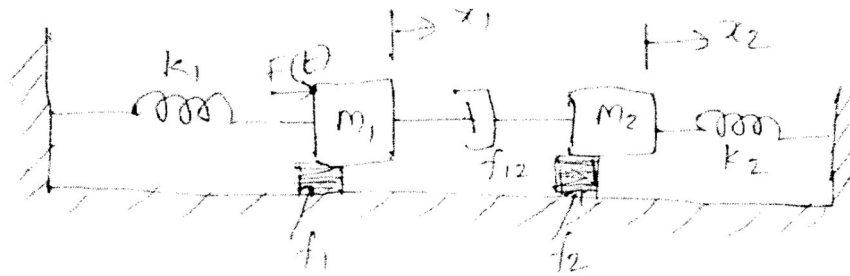 b) Derive the transfer function of the mechanical system shown in figure 1. [3+7]

Figure.1

OR

3.a) Give the f-i analogy of mechanical rotational system and electrical system.
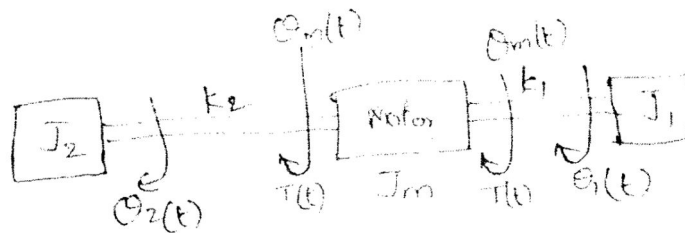 b) Derive the transfer function of the mechanical system shown in figure 2. [3+7]

Figure.2

4.a) For a unity feedback system given by $G(s) = \dfrac{20(s+2)}{s(s+3)(s+4)}$.

   i) Find the static error constants ii) Find the steady state error for r(t) = 3 u(t) + 5 tu(t).

b) Explain about standard test signals.   [7+3]

OR

5.a) A servo mechanism is characterized by the differential equation.

   $\dfrac{d^2c}{dt^2} + 6.4\dfrac{dc}{dt} + 160[0.46c - r] = 0$. Find the value of damping ratio.

b) Explain about time domain specifications.   [5+5]

6.a) Sketch the root locus of $G(s)H(s) = \dfrac{K}{s(s+2)(s^2+2s+5)}$.

b) What is the effect of adding poles to G(s)H(s).   [7+3]

OR

7.a) What is the effect of adding zeros to G(s)H(s).

b) Sketch the root locus plot of $G(s)H(s) = \dfrac{K}{s(s+1)(s+3)}$.   [3+7]

Draw the Bode magnitude and phase angle plots for the transfer function

$G(s) = \dfrac{2000(s+1)}{s(s+10)(s+40)}$.   [10]

OR

9.a) What is compensator? Explain about lead compensator.

b) Explain about frequency domain specifications.   [6+4]

10.a) Derive STM using laplace transform method.

b) Diagonalize the system matrix given below.

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix}.$$

    [4+6]

OR

11.a) What is observability? Explain the tests for observability.

b) Check whether the system represented by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \quad \text{is observable or not.}$$

    [4+6]

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