Code No: 115DU **R13**

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]

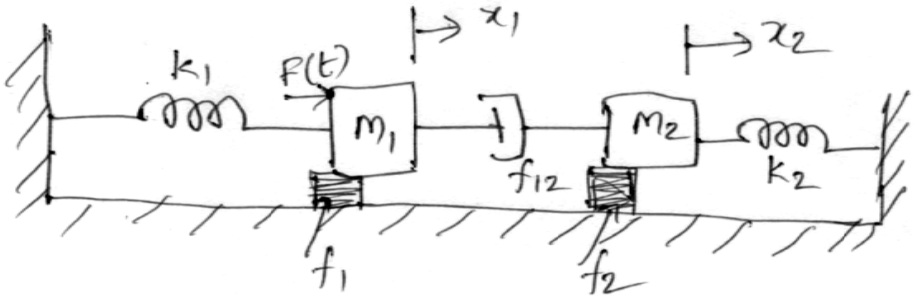

Figure.1

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]

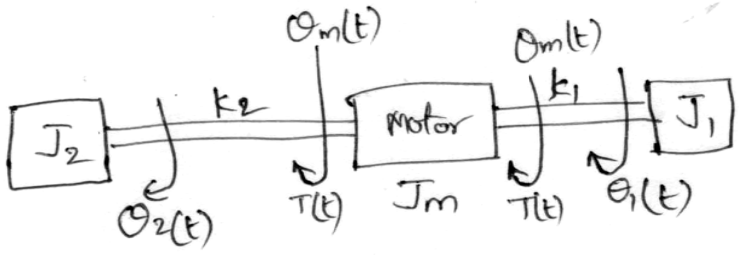

Figure.2

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]

8. 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

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -6 & -11 & -6\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u$$ is observable or not. [4+6]

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