6E 6071

Roll No. _____ [Total No. of Pages : 3]

6E6071

B.Tech. VI Semester (Main/Back) Examination, May-June 2015

Electrical Engineering

6EE1A Modern Control Theory

(Common for EE, EX)

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions, selecting **one question** from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

1. Give concept of linear vector space. Describe state model of linear systems. **(16)**

OR

1. Derive state model of mechanical system given in Fig. 1

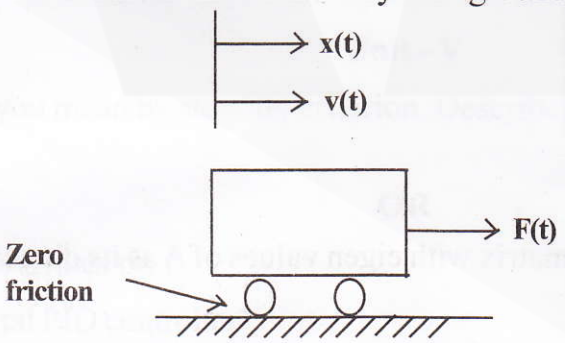

Fig. 1 Mechanical system

Take $z_1(t)$ and $z_2(t)$ as new variables given by

$z_1(t) = 2x(t) + v(t)$

$z_2(t) = x(t) + v(t)$

Write state equations for $z_1(t)$ & $z_2(t)$. **(16)**

Unit - II

2. a) Differentiate between physical & phase variables. (6)

b) For a transfer function given below, write state equations,

$$T(s)=\frac{Y(s)}{U(s)}=\frac{b}{s^n+a_1s^{n-1}+.....a_{n-1}s+a_n}.$$ (10)

OR

2. a) Describe Jordan canonical form in detail. (6)

b) Consider the transfer function

$$\frac{Y(s)}{U(s)}=\frac{b_0s^3+b_1s^2+b_2s+b_3}{s^3+a_1s^2+a_2s+a_3}$$

Derive state space equations. (10)

Unit - III

3. a) Define eigen values. Describe properties of state transition matrix. (12)

b) Describe controllability. (4)

OR

3. a) For a matrix A given as,

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

Prove that $\Lambda = M^{-1}AM$

Where Λ is a diagonal matrix with eigen values of A as its diagonal elements. (12)

b) Describe state transition matrix. (4)

Unit - IV

4. a) Describe how signal is reconstructed from sampled data signal. (8)

b) Describe z - transfer function. Define properties of one sided z - transform. (8)

OR

4. a) Define sampled data control system. (4)

b) Complete the following table,

	F(s)	F(z)
(1)	1/s	?
(2)	?	$\frac{Tz}{(z-1)^2}$
(3)	$\frac{1}{s^3}$	?
(4)	$\frac{1}{(s+a)^2}$	?
(5)	?	$\frac{z(1-e^{-aT})}{(z-1)(z-e^{-aT})}$
(6)	$\frac{w}{s^2+w^2}$	?
(7)	$\frac{s+a}{(s+a)^2+w^2}$	?
(8)	$\frac{1}{s+a}$	?

(12)

Unit - V

5. What do you mean by stability criterion. Describe Jury stability criteria in detail. **(16)**

OR

5. Write short notes on :
   a) Digital PID controller
   b) Adaptive control. **(16)**