

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)

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

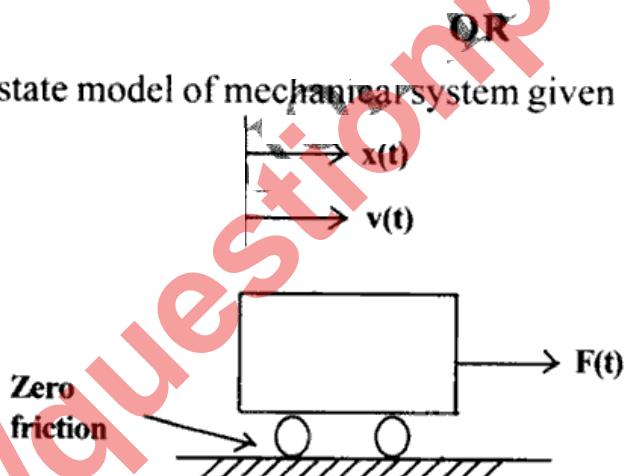


Fig. 1 Mechanical system

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,

$$T(s) = \frac{Y(s)}{U(s)} = \frac{b}{s^n + a_1 s^{n-1} + \dots + a_{n-1} s + a_n} . \quad (10)$$

OR

2. a) Describe Jordan canonical form in detail. (6)
b) Consider the transfer function

$$\frac{Y(s)}{U(s)} = \frac{b_0 s^3 + b_1 s^2 + b_2 s + b_3}{s^3 + a_1 s^2 + a_2 s + a_3}$$

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,

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

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)	$\frac{1}{s+a}$?

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)