29|4|2016

6E6071

Roll No. ____________ Total No of Pages: 4

6E6071
B. Tech. VI-Sem. (Main & Back) Exam., April/May-2016
Electrical Engineering
6EE1A Modern Control Theory
(Common for EE & EX)

Time: 3 Hours **Maximum Marks: 80**
Min. Passing Marks (Main & Back): 26

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 may suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT-I

Q.1 (a) Explain the advantages of modern control theory. Also compare conventional and modern control theory. [8]

(b) Derive the state variable model for the system shown in figure 1. [8]

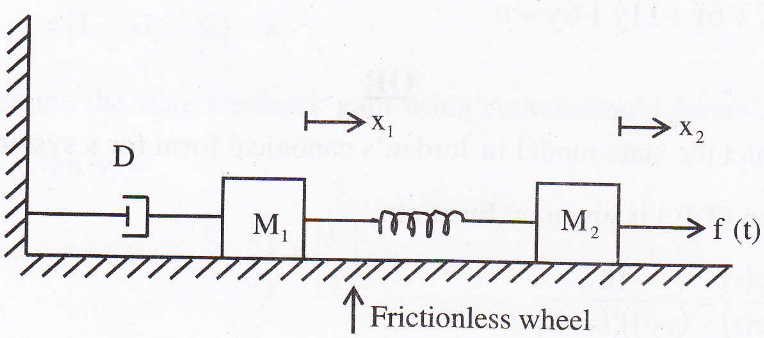

Figure - 1

OR

Q.1 (a) (i) Define domain and range of a function with a suitable example. [4]

(ii) For the function $y = \frac{4}{5-x}$; [4]

Find domain and range.

(b) Write the state equation for the circuit shown in figure 2. [8]

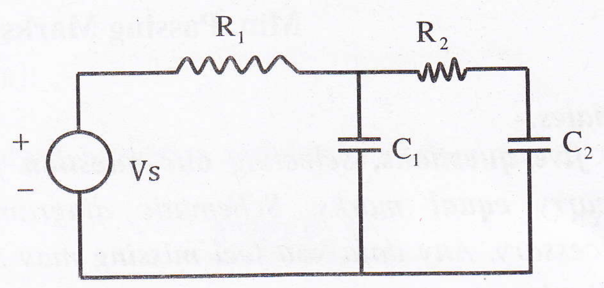

Figure 2

UNIT-II

Q.2 (a) Express the following transfer function (T.F.) in state model. [8]

$$\frac{y(s)}{u(s)} = \frac{1}{s^3 + 6s^2 + 11s + 6}$$

(b) Construct a state model for a system characterized by the differential equation: [8]

$$\dddot{y} + 6\ddot{y} + 11\dot{y} + 6y = u$$

OR

Q.2 (a) Construct the state model in Jordan's canonical form for a system whose transfer function (T.F.) is given by function: [8]

$$\frac{y(s)}{u(s)} = \frac{10}{(s+1)^2(s+2)}$$

(b) Consider a stare model given below: [8]

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -3 & -4 \end{bmatrix}; \quad b = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix};$$

$$C = [40 \quad 10 \quad 0]; \quad d = 0$$

Find the transfer function (T.F.)

UNIT-III

Q.3 (a) (i) Define Eigen value and Eigen vectors. [4]

(ii) Explain Cayley – Hamilton theorems. [4]

(b) Find the Eigen values and Eigen vectors of the matrix. [8]

$$\begin{bmatrix} -2 & 1 & 1 \\ -11 & 4 & 5 \\ -1 & 1 & 0 \end{bmatrix}$$

OR

Q.3 (a) The state equation of a system are given below. Define if the system is completely controllable and observable. [8]

$$\dot{x} = \begin{bmatrix} -6 & 2 & -4 \\ -18 & 3 & -8 \\ -6 & 1 & -3 \end{bmatrix} x + \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix} u$$

$$y = [1 \quad -1 \quad 2] \; x$$

(b) Determine the state feedback gain using Ackermann's formula matrix K for the plant given by – [8]

$$\dot{x} = Ax + Bx = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} x$$

UNIT-IV

Q.4 (a) Find the Z – transform of f (k) = K+ Sin2K ; $K \geq 0$. [8]

(b) Define and prove Initial and find value theorems. [8]

OR

Q.4 (a) Find the Z – transform of following function: [8]

$$f(n) = \frac{a^n}{(n)!}$$

(b) Explain signal reconstruction with a suitable example. [8]

UNIT-V

Q.5 (a) Write a note on digital PID controller. [8]

(b) Explain Jury's stability criterion. [8]

OR

Q.5 (a) Explain a model reference adaptive system with first order control system. [8]

(b) State and Explain Bilinear transformation. [8]
