

6E6071

Roll No. 58

Total No of Pages: **4**

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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]

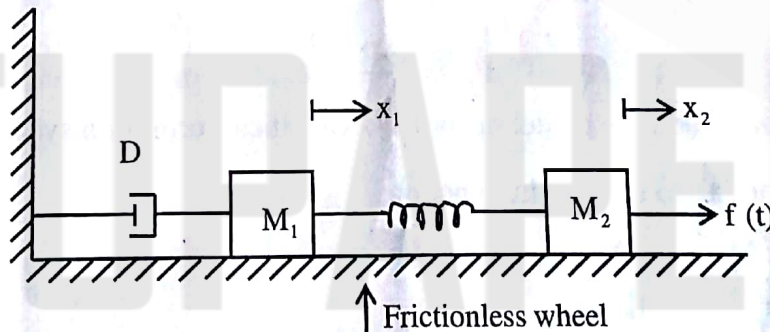


Figure - 1

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[11600]

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]

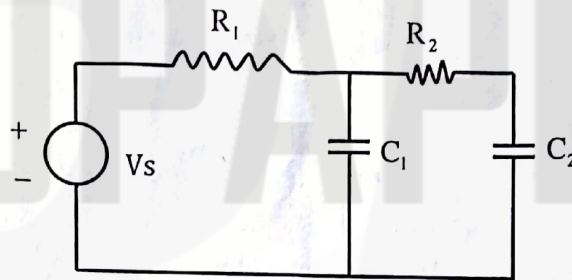


Figure 2

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]

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

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 state model given below: [8]

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

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

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]

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

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

(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 $f(k) = K + \sin 2K$; $K \geq 0$. [8]

(b) Define and prove Initial and final 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]