

6E6071

Roll No. _____

[Total No. of Pages : 3]

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B.Tech. VI Semester (Main & Back) Examination, April/May 2017

Electrical & Electronic Engineering

6EX1A Modern Control Theory

EE,EX

Time : 3 Hours

**Maximum Marks : 80
Min. Passing Marks : 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 suitable be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.

Unit-I

1. a) Determine the domain of following function : (4)

$$f(x) = \sqrt{4x - 8}$$

- b) Show that the vectors are linearly dependent (4)

$$\alpha_1 = [2, 3], \alpha_2 = [1, 1], \text{ and } \alpha_3 = [4, 5]$$

- c) Explain in brief about time invariant system. (4)

- d) Write a short note on linear and non linear system. (4)

OR

1. a) Show that the vectors $x_1 = (1, -1, -2, -4), x_2 = (2, 3, -1, -1), x_3 = (3, 1, 3, -2)$, and $x_4 = (6, 3, 0, -7)$ are linearly dependent. Also find relationship among them. (4)

- b) Find the domain of function $f(x) = \frac{\sqrt{-x}}{(x-3)(x+5)}$. (4)

- c) Write a short note on Relaxedness and causality of a system. (4)

- d) Define domain and range of function with suitable examples. (4)

Unit-II

2. a) Construct the state model for a system characterized by the differential equation. (8)

$$y'' + 5y' + 7y + 9y = 8u$$

- b) Express the following transfer function (Tf) in a state model

$$\frac{y(s)}{u(s)} = \frac{1}{s^3 + 6s^2 + 11s + 6} \quad (8)$$

OR

2. a) Find the state model for following transfer function (Tf): (8)

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

- b) Construct the state model in Jordan's canonical form for a system whose

transfer function (Tf) is given by $\frac{y(s)}{u(s)} = \frac{10}{(s+1)^2(s+2)}$. (8)

Unit-III

3. a) Derive the ackermann's formula for the evaluation of state feedback gain. (8)

- b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & -6 \\ 2 & -2 & 3 \end{bmatrix}$. (8)

OR

3. a) A system characterized by the transfer function $\frac{y(s)}{u(s)} = \frac{2}{s^3 + 6s^2 + 11s + 6}$. Test the controllability and absorbability of the system. (8)

- b) Consider the state equation: (8)

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

Obtain the state transition matrix

Unit-IV

(2×8=16)

4. Find the z transform of following function :
i) $x(n) = (-1)^n u(n)$
ii) $x(n) = (1/4)^n u[-n+3]$

OR

4. Define and prove initial and final value theorem.

(16)

Unit-V

(8)

(8)

5. a) Write a short note on modeling of sample-hold circuits.
b) Write a short note on stability in z-plane.

OR

5. a) Write a short note on digital PID controllers.
b) Write a short note on adaptive control system.

(8)

(8)