

BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - VI ELECTRICAL :SUMMER- 2022
SUBJECT : MODERN CONTROL SYSTEMS

Day : Friday
Date : 17-06-2022

S-13328-2022

Time : 02:30 PM-05:30 PM
Max. Marks : 60

N.B.:

- 1) All questions are **COMPULSORY**.
 - 2) Figures to the right indicate **FULL** marks.
 - 3) Use of non-programmable **CALCULATOR** is allowed.
 - 4) Assume suitable data if necessary.
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- Q.1 a)** Derive the state model of general time invariant system control system. (05)
- b)** Draw and explain the block diagram representation of the state model of linear single - input – single - output system. (05)

OR

- Q.1 a)** Explain in brief about characteristic equation, Eigen values and Eigen vectors. (05)
- b)** Explain state space representative using phase variables. (05)
- Q.2 a)** Describe the derivation for determination of transfer function from state model. (05)
- b)** Determine the transfer function for the system given below (05)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & -2 \\ 4 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

OR

- Q.2 a)** Explain the concept of diagonalization of the system matrix with distinct and repeated roots. (05)
- b)** Consider a matrix A given by $A = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix}$. (05)
Compute diagonal matrix and state transition matrix.

- Q.3 a)** Explain the concept of describing function. (05)
- b)** Explain the derivation of describing function of various non-linear elements. (05)

OR

- Q.3 a)** Explain stability analysis using describing function. (05)
- b)** State the merits and demerits of describing function method. (05)

P.T.O.

- Q.4 a)** State the significance of z-transform for analysis of discrete time systems. (05)
- b)** Determine the z transform of the function defined as $f(k) = \frac{a^k}{k!}$. (05)

OR

- Q.4 a)** Define Z transform. State the properties of z-transform. (05)
- b)** Determine the z-transform of the following discrete time signal $f(k) = u(k-1)$ (05)

- Q.5 a)** Explain with diagram state space representation of discrete time systems. (05)
- b)** Explain the solution of state equations for linear time-invariant discrete time systems. (05)

OR

- Q.5** Determine the solution of the discrete time (10)

$$x(k+1) = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(k)$$

Where, $u(k)=1$ for $k=0, 1, 2, \dots$

Assume that initial conditions as $x(0) = \begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$.

- Q.6 a)** Write short on Robust control system. (05)
- b)** Write short note on fuzzy logic system. (05)

OR

- Q.6 a)** Write short note on artificial neural network. (05)
- b)** Explain practical applications of following: (05)
- i) Robust control system
 - ii) Fuzzy logic system

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