R15

Code No: 127CG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, May/June - 2019
DIGITAL CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) State and explain Sampling theorem. [2]
b) Define z-transforms. Mention limitations of z-transform. [3]
c) Define state and state variables of a dynamic system. [2]
d) For a given pulse transfer function, the state space representation is not unique. Justify. [3]
e) Define zero state response and zero input response. [2]
f) Explain the stability conditions of closed loop systems in the Z plane over in the S plane. [3]
g) Write the advantages and disadvantages of phase lead compensators. [2]
h) Explain the steady -state error analysis of discrete data control systems. [3]
i) Give the concept of state feedback controllers. [2]
j) Draw the block diagram of full order observer. [3]

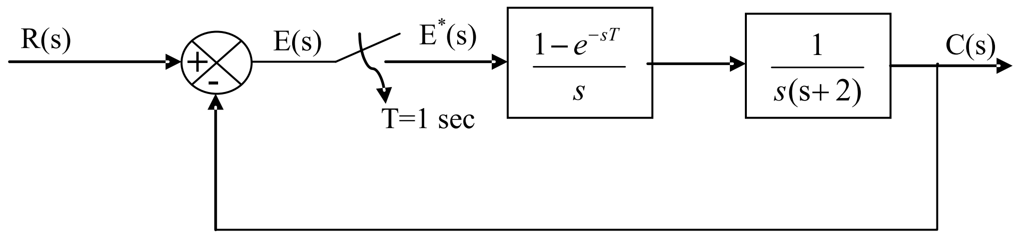
PART-B

(50 Marks)

2.a) Describe the sample and hold operations.
b) Find the inverse Z transform of $\dfrac{z(4z-2)}{(z-1)(z-2)^2}$. [4+6]

OR

3.a) Prove that the transformation $z = e^{sT}$ maps the left half of the s-plane into the unit circle in the z-plane.
b) Obtain the pulse transfer function for the system shown in the Figure. [4+6]



4.a) State and explain the concept of controllability and observability.

b) For the following state variable model

$$x(k+1)=\begin{bmatrix}0.8 & 1\\ 0 & 0.9\end{bmatrix}x(k)+\begin{bmatrix}0\\ 1\end{bmatrix}u(k)$$

$$y(k)=\begin{bmatrix}1 & 0\end{bmatrix}x(k)$$

Investigate the controllability and Observability. [4+6]

OR

5.a) Explain discretization of continuous time state space equations.

b) For the continuous time system $G(s)=\frac{1}{s+10}$, obtain the continuous time state space representation of the system. Also obtain the discrete time state space representation and the pulse transfer function of the system. [4+6]

6.a) Discuss the stability analysis of discrete control system using Bilinear transformation.

b) A discrete time system $x(k+1) = Ax(k)+Bu(k)$ has the system matrix $A=\begin{bmatrix}0.5 & p\\ 1 & \frac{1}{4}\end{bmatrix}$. For what value of '$p$' is the system stable? [4+6]

OR

7. Discuss the primary strips and complementary strips. Explain their significance in the stability analysis. [10]

8.a) Explain the design procedure of Digital Controllers using frequency response methods.

b) Discuss the design procedure of PID controller in discrete time control systems. [5+5]

OR

9.a) Explain the design procedure of discrete time control system in the w-plane.

b) Discuss the design procedure of discrete time control system through lead-lag compensator. [5+5]

10.a) Derive the Ackerman's formula.

b) Discuss the design of reduced order observer with neat block diagram. [5+5]

OR

11. A discrete time system is described by

$$x(k+1)=\begin{bmatrix}1 & -0.5\\ -0.5 & 0.5\end{bmatrix}x(k)+\begin{bmatrix}2\\ 1.5\end{bmatrix}u(k)$$

$$y(k)=\begin{bmatrix}0.5 & 0.5\end{bmatrix}x(k)+3.5u(k)$$

. Design a state feedback control algorithm with *u(k)=-KX(k)* which places the closed loop characteristic root at $\pm j0.5$. [10]

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