Code No: **R42021** **R10** **Set No. 1**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2016

DIGITAL CONTROL SYSTEMS

(Electrical and Electronics Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
*****

1 a) Explain in detail about the non periodic signals with neat sketch. [7]
b) Explain about the scaling and shifting operator. [8]

2 a) Find the Z-transform of (i) Unit Ramp (ii) $f(t) = e^{-at}$ Cosωt [8]
b) State and prove the following Z-Transform theorem
i) Initial value theorem ii) final value theorem [7]

3 a) Explain any two types of Analog to digital Converters with neat Circuit. [8]
b) Describe the sample and hold operations. [7]

4 a) Obtain the state transition matrix of the following discrete time system
$x(k+1) = Gx(k) + Hu(k)$
$y(k) = Cx(k)$
Where $G = \begin{bmatrix} 0 & 1 \\ -3 & -3 \end{bmatrix}$, $H = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$, $C = [1 \quad 1]$ [8]
b) What are state space representations of discrete time system and Explain them. [7]

5 a) Explain the Concepts of controllability and observability. [7]
b) Investigate the controllability and observability of the digital system.
$x(k+1) = \begin{bmatrix} -1 & 0 \\ 1 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(k)$ and $y(k) = [1 \quad 1]\, x(k)$ [8]

6 a) List the difference between the Jury stability test and stability analysis using bilinear transformation coupled with Routh stability criterion. [7]
b) Using Jury stability criterion find the range of K, for which the characteristic equation $Z^3+Kz^2+1.5Kz-(K+1) = 0$ is closed loop stable. [8]

7 a) Explain the design procedure in the W-plane. [7]
b) Discus the review of lag, lead and lead-lag compensator. [8]

8 a) Derive the Ackerman's formula. [8]
b) Explain about the design concept of state feedback controller. [7]

Code No: **R42021** **R10** **Set No. 2**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2016

DIGITAL CONTROL SYSTEMS

(Electrical and Electronics Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
*****

1 a) Explain about the discrete time signals with neat sketch. [8]

b) Explain in detail about the periodic signals with neat sketch. [7]

2 a) Obtain the Z-transform of (i) $f(t) = e^{-at}$ (ii) $f(t) = e^{-at}$ Sinωt. [8]

b) Find the inverse Z-transform of F(Z) =$\frac{1}{z(z-0.1)}$. [7]

3 a) State and prove the sampling theorem. [8]

b) Explain any two types of digital to analog converters with neat circuit. [7]

4 a) Consider the following system.
$$\frac{y(z)}{U(z)} = \frac{z+1}{z^2+1.3z+0.4}$$
Obtain the state space Representation forms of controllable and observable canonical forms. [8]

b) Write the properties of state transition matrix. [7]

5 a) Explain the duality between controllability and observability. [7]

b) Write the Controllability and Observability conditions for Pulse Transfer Function. [8]

6 a) Explain the stability conditions of closed loop system in Z over in the S-plane. [7]

b) Discus the stability analysis of discrete control system using
i) Bilinear transformation ii) Routh stability criterion. [8]

7 a) Write the steady state response specifications. [7]

b) Explain the relation between bilinear transformation and W-plane. [8]

8 a) Explain the necessary and sufficient conditions for design of state feedback controller through place placement. [8]

b) Derive the Ackerman's formula. [7]

Code No: **R42021** **R10** **Set No. 3**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2016

DIGITAL CONTROL SYSTEMS

(Electrical and Electronics Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
*****

1 a) Discuss briefly about the linear time invariant and casual systems. [7]
b) Explain about periodic and non periodic signals with neat sketch. [8]

2 a) Explain about the Elementary functions of Z-Transforms. [7]
b) Obtain the Z transform of the cosine function.

$$x(t) = \begin{cases} cos\omega t, & 0 \le t \\ 0, & t < 0 \end{cases}$$ [8]

3 a) Explain about the R-2R digital to analog converter. [7]
b) Derive the transfer functions for the following data hold circuits.
i) Zero order hold circuit ii) First order hold circuit [8]

4 a) Explain about the observable canonical form and controllable canonical form of state space representation. [8]
b) Determine the inverse of matrix $(zI - G)$,Where

$$G=\begin{bmatrix} 0.1 & 0.1 & 0 \\ 0.3 & -0.1 & -0.2 \\ 0 & 0 & -0.3 \end{bmatrix}$$ [7]

5 a) Write the Controllability and observability conditions for pulse transfer function. [7]
b) Explain about the concept of the Controllability and observability. [8]

6 a) Explain about the concept of constant damping ratio loci. [8]
b) Using Jury's stability criterion, determine the stability of the following discrete time system
i) $z^3+4.4z^2+5z+0.8 =0$ ii) $z^3-1.1z^2-0.1z+0.4 =0$ [7]

7 a) Explain about the digital PID controller with neat sketch. [8]
b) Discuss about the response of a linear time invariant discrete time system to a sinusoidal input. [7]

8 a) What is the necessary and sufficient condition for state observation? [8]
b) Derive the Ackerman's formula. [7]

Code No: **R42021** **R10** **Set No. 4**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2016

DIGITAL CONTROL SYSTEMS

(Electrical and Electronics Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
*****

1 a) Explain about the scaling and shifting operator. [7]

b) Explain about the linear time invariant system with neat sketch. [8]

2 a) Obtain the Z-Transform of [8]

$$f(a) = \begin{cases} a^{k-1}, & k = 1,2,3,.. \\ 0, & k \leq 0 \end{cases}$$

b) State and prove the following Z-transform theorems
i) Initial value theorem ii) Final value theorem [7]

3 a) Explain about the successive-approximation type of A/D converter. [8]

b) Explain the sample-and-hold circuit. [7]

4 a) What are the methods for computation of state transition matrix. Explain any One method. [8]

b) Explain the state transition matrix and its properties. [7]

5 a) Explain the general procedure for obtaining pulse transfer functions. [8]

b) Explain the Duality between controllability and observability. [7]

6 a) Explain the mapping of the left half of the s-plane into the z-plane [7]

b) Construct the Jury stability table for the following characteristic equation.
$P(z) = a_0z^4 + a_1z^3+a_2z^2+a_3z+a_4$, Where $a_0 > 0$. Write stability conditions. [8]

7 a) Define the following transient response specifications.
i) Delay time ii) Rise time iii) Peak time iv) Settling time. [8]

b) Explain the design procedure in w-plane. [7]

8 a) Explain about the minimum-order observer. [8]

b) Explain the necessary and sufficient conditions for design of state feedback controller through place placement. [7]