Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2161007 **Date: 05/05/2017**

Subject Name: Digital Control

Time: 10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1		**Short Questions**	**14**
	1	What is the resolution of 3bit ADC with 5V as a reference?	
	2	Define sampling theorem.	
	3	What are hold circuits?	
	4	Give the relation between s-plane and z-plane.	
	5	In P-D controller, the derivative action plays a significant role in increasing _____ of response. a. Time b. Distance c. Speed d. Volume	
	6	Z transform of function $X(S) = \frac{1}{S}$ is _____	
	7	The closed loop pole of a stable second order system could be a. both real and positive. b. both real and negative. c. complex conjugate with positive real parts. d. one real positive and the other real negative.	
	8	List the methods available to analyze the stability of the system.	
	9	Define state.	
	10	List the different canonical representation.	
	11	Write the discrete state equation.	
	12	What is lag compensation?	
	13	Give the any two advantages of PID controller.	
	14	What is multi rate sampling?	
Q.2	**(a)**	State and prove the Final value theorem.	**03**
	(b)	Explain about the discrete time signals with a neat sketch?	**04**
	(c)	Explain about the digital PID controller with neat sketch.	**07**
		OR	
	(c)	Obtain the block diagram for the following Pulse Transfer function system by Direct Programming $\frac{Y(Z)}{X(Z)} = \frac{2 - 0.6\,Z^{-1}}{1 + 0.5\,Z^{-1}}$	**07**

Q.3	**(a)**	Explain the sampling theorem.	**03**
	(b)	Explain the mapping of the left half of the s-plane into the z-plane.	**04**
	(c)	Explain the block diagram of Digital Control System in detail.	**07**

OR

Q.3	**(a)**	Derive Pulse Transfer function of Closed Loop Control System.	**03**
	(b)	Obtain Inverse z transform of $X(z) = \dfrac{2z^3 + z}{(z-2)^2\,(z-1)}$	**04**
	(c)	Obtain the state space Representation of the following Pulse Transfer Function system in the controllable canonical forms. $\dfrac{Y(Z)}{U(Z)} = \dfrac{Z+1}{Z^2 + 1.3\,Z + 0.4}$	**07**
Q.4	**(a)**	Obtain the z transform of $f(t) = e^{-at}$	**03**
	(b)	Briefly explain Zero order hold circuit.	**04**
	(c)	Using Jury's stability criterion, determine the stability of the following discrete time system $P(Z) = Z^3 - 1.1Z^2 - 0.1\,Z + 0.2 = 0$	**07**

OR

Q.4	**(a)**	What are the different methods available for computing e^{At} ?	**03**
	(b)	Explain in short Quadratic Optimal Control Problem.	**04**
	(c)	Explain the sufficient and necessary conditions for Arbitrary Pole Placement.	**07**
Q.5	**(a)**	Define following terms 1. State Variables 2. State Vector	**03**
	(b)	Explain the concepts of controllability and observability.	**04**
	(c)	Discuss the stability analysis of discrete control system using Bilinear transformation and Routh stability criteria.	**07**

OR

Q.5	**(a)**	Define Similarity transformations.	**03**
	(b)	Explain in short Discretization of continuous state space equation.	**04**
	(c)	Explain Stability improvement by state feedback.	**07**

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