Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VII (New) EXAMINATION – WINTER 2019

Subject Code: 2172007 **Date: 30/11/2019**

Subject Name: Modern Control Systems

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	**(a)**	List advantages of feedback control systems.	**03**
	(b)	Explain (i) steady state response (ii) transient response of control systems.	**04**
	(c)	What is cascade compensation in control system? Why such compensations are needed?	**07**
Q.2	**(a)**	Explain effect of addition of open loop zero on control systems.	**03**
	(b)	What is compensation in control systems? Which compensation techniques are used in practice?	**04**
	(c)	Explain design procedure to design cascade lag compensation using root locus technique.	**07**
		OR	
	(c)	Explain design procedure to design cascade lead compensation using bode plot technique.	**07**
Q.3	**(a)**	Explain angle of departure in root locus technique.	**03**
	(b)	Explain with suitable example that how stability of a control system can be determined using root locus of a given control system.	**04**
	(c)	Explain various steps to design a lag compensator for a given control system using bode plot technique.	**07**
		OR	
Q.3	**(a)**	Explain phase margin and gain margin.	**03**
	(b)	Give comparison between frequency response analysis and time response analysis of control systems.	**04**
	(c)	Consider a unity feedback system with open loop transfer function $G(s) = \frac{K}{s(s+2)}$ Draw root locus of uncompensated system and also design a lead compensator using root locus technique to meet the following specifications. (1) Damping ratio = 0.5 (2) Damped natural frequency = 4 rad/sec	**07**
Q.4	**(a)**	Explain disadvantages of conventional control theory.	**03**
	(b)	Explain about state space modeling.	**04**
	(c)	Obtain transfer function from the following system. $A = \begin{bmatrix} -3 & 1 \\ 0 & -1 \end{bmatrix}$; $B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$; C=[1 1]; D=0	**07**
		OR	
Q.4	**(a)**	Explain model matrix.	**03**
	(b)	Explain the method to derive transfer function for a system from given state space model.	**04**
	(c)	Derive the solution of state equation by Laplace transform technique.	**07**
Q.5	**(a)**	Derive z-transform of sampled exponential function x(t) = e^{-at}	**03**
	(b)	State and prove final value theorem of the z-transform.	**04**

	(c)	Explain the stability analysis of sampled Data control system using Mapping theorem.	**07**

OR

Q.5	**(a)**	Explain relationship between z-domain and s-domain.	**03**
	(b)	Explain stability determination of a control system in z-plane.	**04**
	(c)	Explain pole placement design using state feedback.	**07**

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