Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2712904 **Date: 02/01/2016**

Subject Name: Control System Theory

Time:2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

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

Q.1	**(a)**	Explain both lead & lag compensation based on Root locus and Frequency response approach.	**07**
	(b)	Explain the State Regulator Problem in detail.	**07**
Q.2	**(a)**	Find the State Transition Matrix Φ(t) $\begin{bmatrix} \dot{x1} \\ \dot{x2} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \end{bmatrix}$ and also find $\Phi^{-1}(t)$.	**07**
	(b)	Explain Preliminary Design consideration in time & frequency domain based on Root Locus.	**07**
		OR	
	(b)	Explain the implementation of Digital PD Controller.	**07**
Q.3	**(a)**	Explain Jury Stability Criterion in detail.	**07**
	(b)	Find Controllable canonical form (CCF) of the following. $A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$	**07**
		OR	
Q.3	**(a)**	Explain Controllability & Observability in control system.	**07**
	(b)	The Transfer function of a control system is given by $\frac{Y(s)}{U(s)} = \frac{(S+2)}{s^3 + 5\,s^2 + 23\,s + 24}$ Determine whether the system is completely controllable or not?	**07**
Q.4	**(a)**	Obtain the state model for phase variable form for the Transfer Function $\frac{Y(s)}{U(s)} = \frac{(S+3)}{s^3 + 5\,s^2 + 8\,s + 4}$	**07**
	(b)	Design sliding mode controller so that close loop system falls upon sliding line $\begin{bmatrix} \dot{x1} \\ \dot{x2} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ -10 & -6 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \end{bmatrix} + \begin{bmatrix} 0 \\ 4 \end{bmatrix} u \quad \& \quad F = [1 \quad 0]\, x$	**07**
		OR	
Q.4	**(a)**	Explain Liapunov based stability analysis with suitable example.	**07**
	(b)	Discuss the effect of load disturbance on control system with suitable Example.	**07**

Q.5	**(a)**	Explain the concept of Multivariable system in detail.	**07**
	(b)	Discuss Parameter Optimization in optimal control system.	**07**
		OR	
Q.5	**(a)**	Explain homogeneous state equations in time-domain.	**07**
	(b)	Explain Quadratic Optimal Regulator System.	**07**

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