Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2712904 **Date: 09-01-2015**

Subject Name: Control System Theory

Time: 02:30 pm - 05:00 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 lead-lag compensation based on Root locus and Frequency response approach. **07**

(b) Discuss the effect of load disturbance on control system with suitable Example. **07**

Q.2 **(a)** Obtain e^{at} for the following matrix. **07**

$$A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$$

(b) Explain Preliminary Design consideration in time & frequency domain based on Root Locus. **07**

OR

(b) Explain the implementation of Digital PID Controller. **07**

Q.3 **(a)** Find state space representation of DC motor. **07**

(b) Find Eigen value and Eigen vector of the system having, **07**

$$A = \begin{bmatrix} 0 & 6 & -5 \\ 1 & 0 & -2 \\ 3 & 2 & 4 \end{bmatrix}$$

OR

Q.3 **(a)** Explain Temperature & Position control system. **07**

(b) The Transfer function of a control system is given by **07**

$$\frac{Y(s)}{U(s)} = \frac{(S+2)}{s^3 + 9\,s^2 + 26\,s + 24}$$

Determine whether the system is completely controllable or not?

Q.4 **(a)** Construct the state model for a system characterized by the differential equation, **07**

$$\frac{d^3y}{dt^3} + 8\frac{d^2y}{dt^2} + 15\frac{dy}{dt} + 9y = u$$

(b) Design sliding mode controller so that close loop system falls upon sliding line **07**

$$\begin{bmatrix} \dot{x}1 \\ \dot{x}2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ -7 & -5 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \quad \& \quad F = [1 \quad 0]\, x$$

OR

Q.4 **(a)** Explain Liapunov based stability analysis with suitable example. **07**

(b) Explain variable structure control. Discuss, Where it is used? **07**

Q.5	**(a)**	Explain Infinite Time Regulator Problem in detail.	**07**
	(b)	Discuss Parameter Optimization in optimal control system.	**07**
		OR	
Q.5	**(a)**	Write a brief note on optimal control system.	**07**
	(b)	Explain Quadratic Optimal Regulator System.	**07**

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