

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**

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

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**
 $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ -7 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \quad \& \quad F = [1 \quad 0] x$

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**
