

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## **GUJARAT TECHNOLOGICAL UNIVERSITY**

**M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013**

**Subject code: 710708N**

**Date: 06-01-2014**

**Subject Name: Nonlinear Control Systems**

**Time: 10.30 am – 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.**

**Q1). A. Discuss the different types of non-linearities along with their input output (08) characteristics.**

**Q1). B. Write a short note on limit cycle. (06)**

**Q2). A. Describe the delta method of drawing trajectories. (07)**

**Q2). B. Discuss tracking for non-minimum phase systems. (07)**

**OR**

**Q2). B. Discuss Lyapunov's instability theorem. (07)**

**Q3). A. Find the describing function for saturation. (14)**

**OR**

**Q3). A. Define the following: (14)**

Stability in the sense of Lyapunov, uniform stability, asymptotic stability,

uniform asymptotic stability, global asymptotic stability,

Global uniform asymptotic stability and exponential stability with figures.

**Q4). A. What are singular points? Explain the classification of singular points based on (07) the location of eigen values of the system.**

**Q4). B. Discuss the SISO and MIMO sliding mode control. (07)**

**OR**

**Q4). A. Explain the isoclines method of constructing trajectories.. (07)**

**Q4). B. Discuss the generalizations of LaSalle's invariance principle. (07)**

**Q5). A. Explain in brief the contraction mapping theorems. (07)**

**Q5). B. Discuss the indirect theorem of Lyapunov. (07)**

**OR**

**Q5). A. What are the applications of the small gain theorems. (07)**

**Q5). B. Discuss the Poincare-Bendixson theorem. (07)**

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