Con 5367-07. (REVISED COURSE) CD-7119

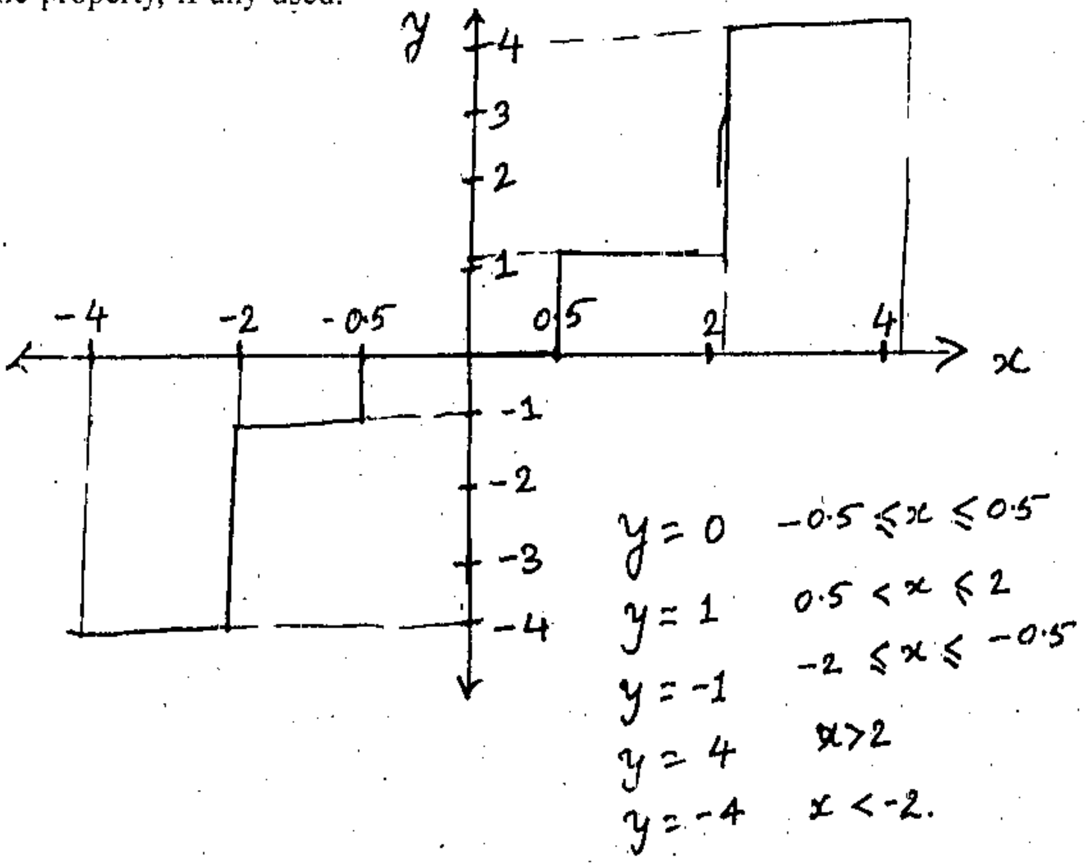
(3 Hours) [Total Marks : 100

N.B. : (1) Attempt any **five** questions.

(2) Assume **suitable data** if **necessary, state** it **clearly** mention the **same**.

(3) **All** questions carry **equal** marks.

1. (a) Consider a Lograthmic quantizer with 02(two) levels. **10**
Calculate describing funciton N(X, W) for this quantizer.
State the property, if any used.



(b) The I/O characteristics of Non-linear device is given by— **10**

$$y = x^2 \frac{dx}{dt} + 2x$$

where 'x' is input and 'y' is o/p.
Derive the Describing function of device.

2. (a) Derive expression for Liapunov's Second Method and explain how it can be applied to investigate the stability of the system. **10**

(b) Consider the Non-linear controller described by $\dot{x}_1 = x_2$; $\dot{x}_2 = -x_1^3 - x_2$. **10**
Prove that this system is globally stable in large using a Liapunov function of the form—

$$V(x) = \alpha x_1^4 + \beta x_1^2 + x_1 x_2 + x_2^2$$

What values of 'α' and 'β' are appropriate ?

3. (a) Using variable gradient Method find a suitable Liapunov's function for the system given by— **10**

$$\dot{x}_1 = x_2 \; ; \; \dot{x}_2 = -x_1^3 - x_2$$

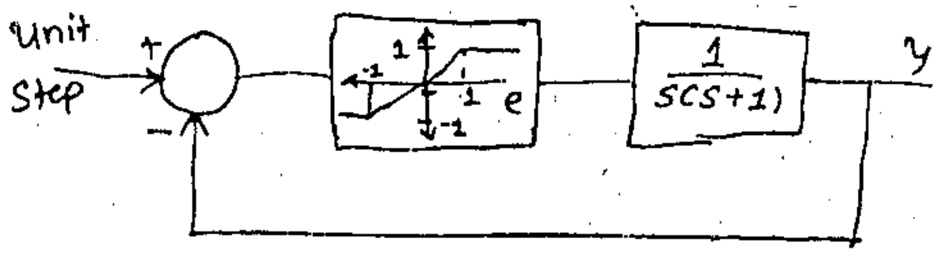
(b) Using Krasoviskii's Method Examine the stability of Equillibrium state x = 0 of the following system— **10**

$$\dot{x}_1 = -x_1 \; ; \; \dot{x}_2 = x_1 - x_2 - x_2^3.$$

4. (a) Draw phase trajectory using Method of Isocline for the system given by--

$$\ddot{y} + 2\dot{y} + 5y = z$$

(b) Using delta Method plot the phase trajectory for system given below—



5. (a) Explain in detail the schemes of Adaptive Control.

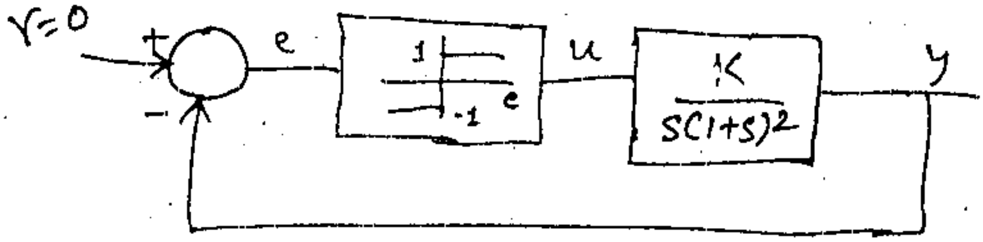
(b) A unity feedback system has Nominal characteristics equation—

$$q(s) = S^3 + 3\ S^2 + 3\ S + 4 = 0.$$

The co-efficients vary as follows—

$$3 \le a_0 \le 5\ ; \quad 1 \le a_1 \le 3\ ; \quad 2 \le a_2 \le 3.$$

6. (a) Using describing function Analysis show that a stable limit cycles exists for all values of $k > 0$ find the amplitude and frequency of the limit cycle when $K = 4$.



(b) The equation of Vander Pol's oscillator is given by—

$$\ddot{y} - \mu\left(1 - y^2\right)\dot{y} + y = 0$$

where μ is constant. Locate and identify the nature of singular points and plot corresponding nature of Trajections for $\mu = 0$; $\mu < 0$; $\mu = 1$.

7. Explain in brief any **four** :—

(a) Jump Resonance

(b) Limit Cycles

(c) Sub-harmonic oscillations

(d) Frequency Amplitude Dependence.

(e) Structured and unstructured uncertainity.

—S—