25/05/2017

Q.P. Code : 798401

3 Hours

Total Marks :80

Instructions: -

- Question **ONE** is compulsory
- Assume suitable data if necessary

Q1. Attempt any **Four**   (20)

  (a) Explain in detail Physical nonlinearity which has memory.

  (b) Draw sinusoidal response of saturation with dead zone nonlinearity and write the response equation.

  (c) Differentiate linear and nonlinear system in detail

  (d) Comment on stability using singular stability.

$$\ddot{y} - 8\dot{y} + 17y = 34$$

  (e) Explain Lyapnov theorem in details.

Q2. (a) Comment on Stability of the state space model given below using suitable Lyapunov function.   (10)
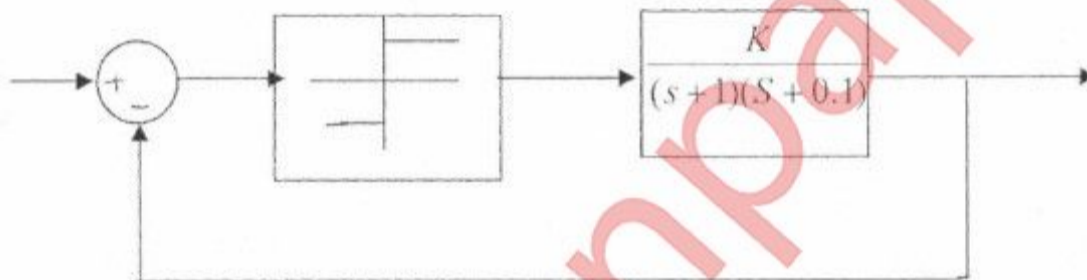
$$X_1 = X_2$$

$$X_2 = -X_1 - X_2$$

  (b) Investigate Stability using Describing function of following system which has unity relay signal

  as a nonlinearity.   (10)

Q3. (a) Determine Stability using Kresovski method.   (10)

$$\dot{x}_1 = -x_1 - x_2^2$$

$$\dot{x}_2 = -x_2$$

  (b) Design IMC controller for plant model $G(s) = \dfrac{(-s + 1)}{(2s + 1)}$ in order to achieve the response with time

  constant of 1.5 Sec.   (10)

Q 4. (a) Design the optimal controller via Riccati equation for system   (10)

$$x = \begin{bmatrix} 0 & 1 \\ 2 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

To minimize the performance index $J = \int_0^\infty (x_1^2 + x_2^2 + u^2)dt$

  (b) Draw Phase trajectory using delta method for given system.   (10)

$$\ddot{x} + 5\dot{x} + 4x = 0$$

TURN OVER

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Q5. (a) Derive the describing function for relay with dead zone   (10)

   (b) For the system described by, investigate variant gradient method to find Lyapnov's function

      For non linear system,   (10)

$$x_1 = -2x_2$$

$$x_2 = -2x_2 + 2x_1 x_2^2$$

Q 6.   (a) Explain Jump resonance for nonlinear system   (06)

      (b) How to comment on stability using singular point.   (08)

      (c) Explain in details about limit cycle.   (06)

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