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Reg. No. : .....

Name : .....

Eighth Semester B.Tech. Degree Examination, April 2014
(2008 Scheme)
08.801 : ADVANCED CONTROL THEORY (E)

Time : 3 Hours Max. Marks : 100

Instruction : *Answer **all** questions from Part – A and **one** full question from **each** Modules of Part – **B**.*

PART – A

1. Distinguish between classical control and modern control approach.
2. Explain the difference between state vector and state trajectory.
3. Explain bush form of state space model.
4. Obtain the block schematic representation of state space model of a linear MIMO system.
5. Obtain the pulse transfer function of a system described by difference equation, hence obtain impulse response

   C (k) – 0.5 C (k – 1) = r (k)
6. Explain sampled data control system with the help of neat block diagram.
7. What is the role of holding circuit in signal reconstruction ? Explain ZOH in detail.
8. Explain incidental and intentional non-linearity with examples.
9. Check whether the following quadratic form is positive definite or not

   $Q = 10x_1^2 + 4x_2^2 + x_3^2 + 2x_1x_2 - 2x_2x_3 - 4x_1x_3$.
10. Differentiate between asymptotic stability and globally asymptotic stability.

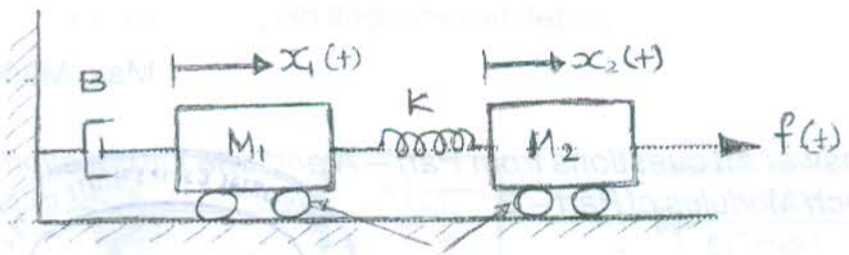
(10×4=40 Marks)

P.T.O.

PART – B

Module – I

11. a) Develop a state space model for the system given below taking $M_1 = M_2 = 1kg$ and B = 1 N–S/m and k = 1 N/m. 10



friction less

b) Determine the state space model of the system using phase variables

$$G(s) = \frac{s+2}{s^3 + 3s^2 + 2s + 10}$$ 10

12. a) For the given state equation 10

$$\dot{X}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix} X(t) + \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix} U(t)$$

Diagonalize the system matrix using eigen vectors and find new state equation.

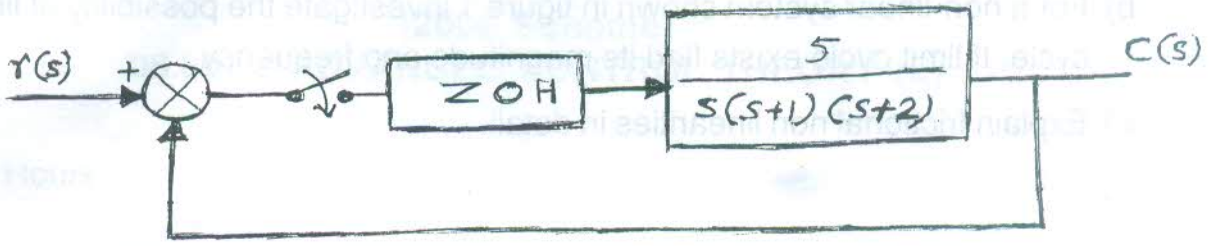
b) Examine controllability and observability of given state equation.

$$\dot{X}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -5 \end{bmatrix} X(t) + \begin{bmatrix} 0 \\ 0 \\ 3 \end{bmatrix} U(t)$$

$$Y = [1 \ 0 \ 0] X(t)$$ 10

Module – II

13. a) Find step response for the given sampled data system. 12



b) If $F(z) = \frac{0.5z}{(z-0.5)(z-0.7)}$ find f (nT). 4

c) State and explain sampling theorem. 4

14. a) Characteristic equation of a system is given as

$D(z) = z^3 - z^2 - 0.2z + 0.1.$

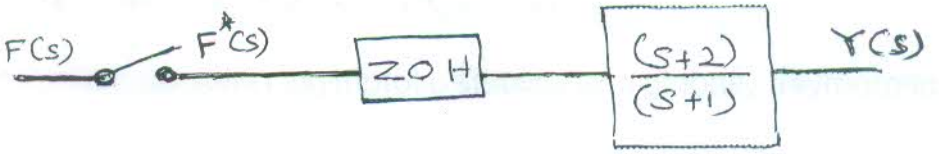
Examine stability of system using Routh's stability criterion. 8

b) Solve the difference equation.

$x(k) - 3x(k-1) + 2x(k-2) = 4^k$

$x(k) = 0$ for $k < 0$. 7

c) A cascade sampled data system is shown in figure obtain overall transfer function of the system. 5



Module – III

15. a) Derive the describing function of staturation non linearity. 8

    b) For a non-linear system shown in figure 1 investigate the possibility of limit cycle. If limit cycle exists find its magnitude and frequency . 8

    c) Explain frictional non linearities in detail. 4

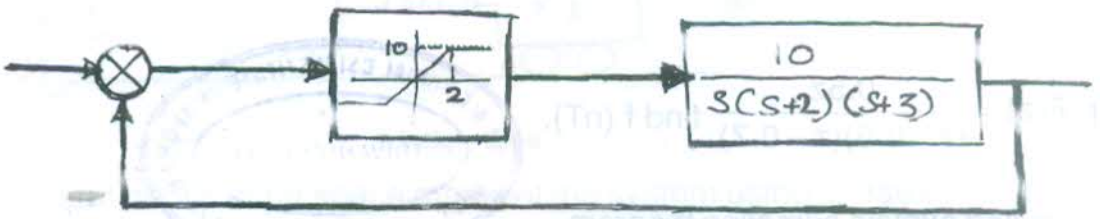


Fig. 1

16. a) Define describing function and explain its significance in analysis of nonlinear system. 4

    b) Define and explain the following terms :

    i) phase plane ii) phase portrait

    iii) phase trajectory. 6

    c) A system described by $\dot{x}_1 = -x_1 + 2x_1^2 x_2$

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

    Using Liapunov's method examine system stability. 10