Reg. No. : .....

Name : .....

Eighth Semester B.Tech. Degree Examination, November 2013
(2008 Scheme)
08.801 : ADVANCED CONTROL THEORY (E)

Time : 3 Hours Max. Marks : 100

***Instruction**: Answer **all** questions from Part **A**. **One full** question from **each** Module of Part **B**.*

PART – A

1. What is state and state variable ? Explain with example.
2. Mention the properties of state transition matrix.
3. Write the canonical form of state model of n^{th} order system.
4. State the condition for controllability by Gilbert's method.
5. Explain the relationship between S-plane and Z-plane poles.
6. What is zero order hold ?
7. Calculate the z transform of the system having the transfer function $\frac{1}{1+2S}$ subjected to a step input sampled at 3 Hz.
8. Explain limit cycles.
9. Explain basic concept of phase plane method.
10. What is frequency entrainment ?

PART – B

Module – 1

11. a) Determine the canonical state model of the system $\dddot{y} + 6\ddot{y} + 11\dot{y} + 6y = \dddot{u} + 8\ddot{u} + 17\dot{u} + 8u$. **10**

    b) A system characterised by the state model $\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u; [x(0)] = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ u = unit step; compute state transition matrix and find the state response i.e. x(t), t > 0. **10**

OR

12. a) Consider the system $\dot{x} = \begin{bmatrix} -1 & 0 & 1 \\ 1 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$ and output $y = [1 \quad 1 \quad 0]x$

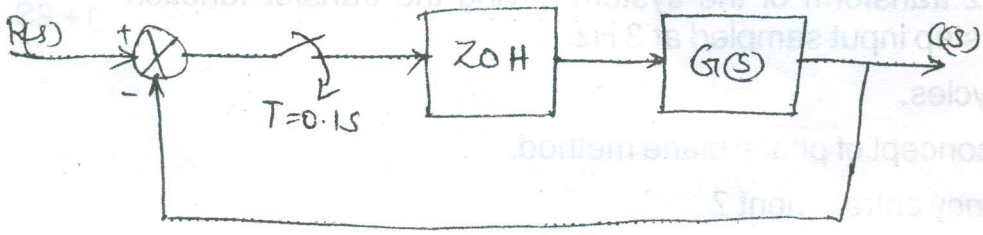
transform the system into controllable canonical form and observable canonical form. 10

b) For the system $\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} u$. By using state feedback control $u = -kx$, it is desired to have closed loop poles at $s = -2 \pm j4$ and $s = -10$. Determine the state feedback gain matrix k. 10

Module – II

13. a) Determine the z transfer function for the system $3c(k+2) + 4c(k+1) + c(k) = r(k+2) + 2r(k+1) - 3r(k)$ where $c(0) = 1$; $c(1) = -2$. Also obtain weighting sequence of the system. 10

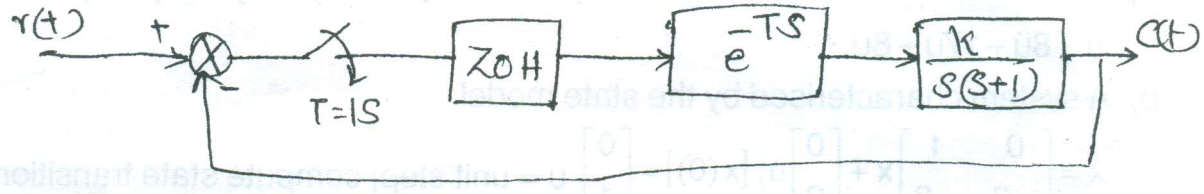
b) Find the unit step response for the temperature control system having the transfer function fo the plant as $G(s) = \frac{4}{s+2}$.



10

OR

14. a) Find the range of k for the system to be stable. 10



b) What is samples and zero order hold ? Explain frequency response characteristics of zero order holding device. 10

Module – III

15. a) Explain different types of non linearities. Derive the describing function for deadzone non linearity. **10**

b) Determine asymptotic stability of the system by Liapunov's second method

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -1 & -1 \end{bmatrix} X$$ **10**

OR

16. a) Explain the stability analysis of non linear systems using phase trajectories. Describe the construction of phase trajectories. **10**

b) The system with saturation non linearity is given in fig. Investigate the stability of the system by describing function method. **10**