

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0205

Roll No.

--	--	--	--	--	--	--	--	--	--

B.Tech

**(SEM VII) ODD SEMESTER THEORY EXAMINATION 2009-10
ADVANCED CONTROL SYSTEM**

*Time : 3 Hours]**[Total Marks : 100***Note :** *Attempt all questions.***1** Attempt any **two** parts : **10×2=20**

- (a) Discuss the controllability and observability concepts in control system. Also investigate the controllability and observability of the following system,

$$x(k+1)=[3 \ -3, \ 1 \ -2] \cdot x(k) + [1 \ 1, \ 0 \ -1]u(k)$$

$$y(k)=[1 \ 0, \ 0 \ 1]x(k).$$

- (c) The transfer function of a control system is given by $C(s)/R(s)=6(S+2)/s(S+3)(S+4)$.

Draw the state diagram and obtain the state equation.

- (b) Define the Z-transform and discuss its limitations. Find the inverse Z-transform of explain method $F(z) = (z+1) z / (z^2 - z + 1) (z-1)$ by power series.

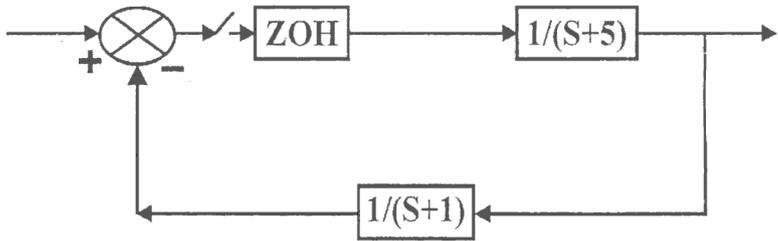
2 Attempt any **two** parts : **10×2=20**

- (a) Find the state models for the following difference equation; also obtain different canonical form for the each system :

$$y(k+3)+5y(k+2)+7y(k+1)+3y(k)=u(k+1)+2u(k).$$



- (b) A closed-loop system is described in figure-1. Determine the output in discrete form when unit step is applied to the input.



- (c) Using jury stability test, determine whether following are stable or not :

$$\Delta(z) = 9z^6 + 8z^5 + 6z^4 + 8z^3 + 6z^2 + 5z + 1$$

$$\Delta(z) = 3z^6 + 3z^5 + 6z^4 + 7z^3 + 2z^2 + z + 1$$

3 Attempt any **two** parts :

10×2=20

- (a) If $\frac{dX_1}{dt} = aX_1 + bX_2$, $\frac{dX_2}{dt} = cX_1 + dX_2$: Determine the sufficient conditions on a, b, c, and d so that the asymptotically stable condition can be achieved.
- (b) What is singular point ? What is Lyapunov stability criterion ? Determine whether the following system is stable or not :

$$\frac{d^2x}{dt^2} + \frac{dx}{dt} + (\frac{dx}{dt})^3 + x = 0$$

- (c) Explain the non linearity issues for following : Nonlinear Spring, Saturation, Nonlinear fluid compressibility and flow rate.



- (a) A first-order system is described by the differential equation :

$$\dot{x}(t)=u(t), \quad x(0)=x_0,$$

Find the optimal law using the Hamilton-Jacobi equation that minimizes the performance index

$$J=\int_0^{t_f}(x^2+u^2)dt, \text{ where } t_f \text{ is specified.}$$

- (b) Explain the Stochastic optimal state estimation for dynamic system.
- (c) For the fixed end points derive the fundamental necessary conditions of variation calculus.

5 Attempt any **two** parts :

10×2=20

- (a) Establish the relationship between PI and Fuzzy control and PID and Fuzzy control.
- (b) Compare the Fuzzy systems, Neural networks, and Conventional control Theory.
- (c) Discuss the steps of Design parameters of general fuzzy controllers and explain with suitable example the self tuning regulators.

