Exam.Code:1017
Sub. Code: 7782

1129

M.E. Electrical Engineering (Power System)
First Semester
EE-8104: Digital Control Systems

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt any five questions. Assume and specify and missing data.

x-x-x

I State Sampling Theorem. Relate the frequency spectrum for a continuous time signal Xa(t) and its sampled sequence X(k)=Xa(kT) and discuss the aliasing problem which can arise due to wrong choice of sampling rate. (10)

II (a) Find the pulse transfer function of the system shown in Fig 1. Obtain the difference equation model and hence obtain impulse response of the system. Also find the step response. (5)

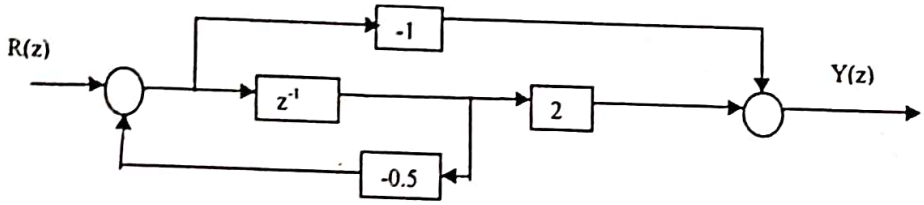

Fig. 1

(b) Find the inverse z-transform of (5)

$$F(z) = \frac{1}{z^2(z-1)^2(z+1)}$$

III (a) Determine the unit step response of a sampled data system shown in Fig 2 (5)

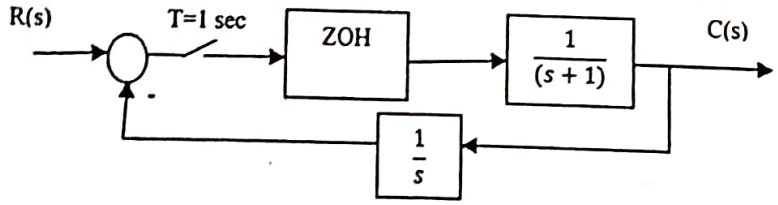

Fig 2

P.T.O.

(b) The discrete state equation is given by $x(k+1) = Fx(k) + Gu(k)$; The state model of a plant is given by (5)

$$\dot{x} = \begin{bmatrix} -2 & 2 \\ 1 & -3 \end{bmatrix} x + \begin{bmatrix} -1 \\ 5 \end{bmatrix} r(t)$$

$$y(t) = [2 \quad -4]x + 6r(t)$$

Obtain the discrete-time model of the system given the sampling period T=0.02 sec.

IV (a) Explain the rules for construction of root locus for digital control system. (5)

(b) Diagonalizable the matrix $F = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & -6 & -4 \end{bmatrix}$ by eigen vector method. (5)

V (a) Pulse transfer function of a system is given by (5)

$$\frac{y(z)}{u(z)} = \frac{3z}{(z+1)^2(2z+1)}$$

Obtain the state model realizations in (i) Jordan form, (ii) cascade realization.

(b) Consider a plant defined by the following state variable model:- (5)

$$F = \begin{bmatrix} 0.5 & 1 & 0 \\ -1 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}; G = \begin{bmatrix} 1 & 4 \\ 0 & 0 \\ -3 & 2 \end{bmatrix}; C = [1 \ 0 \ 0];$$

Determine whether the system is completely (i) state controllable, (ii) output controllable or (iii)observable.

VI How does the concept of stability of non-linear system differ from that of linear one? Using the concept of Lyapunov's energy function, explain various conditions of stability theorem. (10)

VII Explain in details, Digital Position Control Scheme and its control algorithm. (10)

VIII Explain the methods of determining absolute stability of the system. (10)

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