Code No: 09A70207 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, May/June - 2013
Digital Control Systems
(Common to EEE, EIE)

Time: 3 Hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
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1.a) With help of schematic diagram explain the principal operation of digital to analog conversion.
b) Explain the conditions to be satisfied for reconstruction of sampled signal into continuous signal.
c) Explain zero order hold device. [15]

2.a) Find the Z-transform of the following:
i) $f(t) = t^2$ and (ii) $f(t) = e^{-\alpha t} \sin \omega t$
b) What are the popular methods are used to find the inverse z-transform? Explain briefly each of them. [7+8]

3.a) Explain the procedure for obtaining the pulse transfer function of a closed loop transfer function.
b) Find Y(z) /R(z) for the following sample-data closed – loop systems shown in Fig. P3.

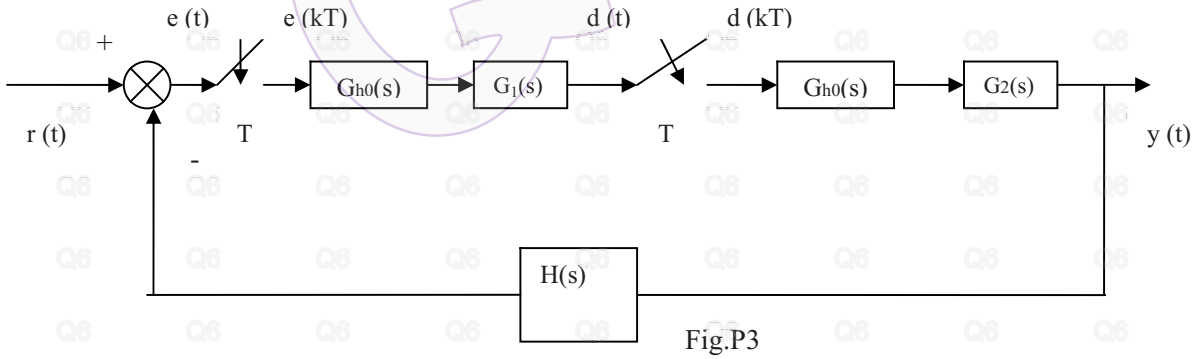

Fig.P3

4. Find the state space representation of the following system.:
$y(k + 2) - 3y(k + 1) + 2y(k) = 4^k$ and $y(0) = 0$; $y(1) = 1$.
Find the complete solution of the above system. [15]

5.a) Explain the concept of controllability and observability of discrete time control system.
b) Examine whether the discrete data system

$$X(k+1) = \begin{bmatrix} 0 & 1 \\ -2 & -2 \end{bmatrix} X(k) + \begin{bmatrix} 1 \\ -1 \end{bmatrix} u(k) \text{ and } \quad y(k) = [1 \quad 0]\, X(k)$$

is (i) State controllable (ii) Output controllable and (iii) Observable'. [7+8]

6.a) Consider the digital system shown in Fig. P6a.

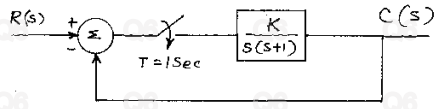

Fig. P6a.

Using Jury's stability test, find the range of values of K for which the system is stable.

b) Explain the method for determination of stability of discrete time systems using bilinear transformation. [7+8]

7.a) Consider the system shown in Fig. P7a and design PI controller, D(z) to meet the following specifications: (i) Velocity error constant K_v= 8 sec^{-1} and Phase margin = 40^0 .

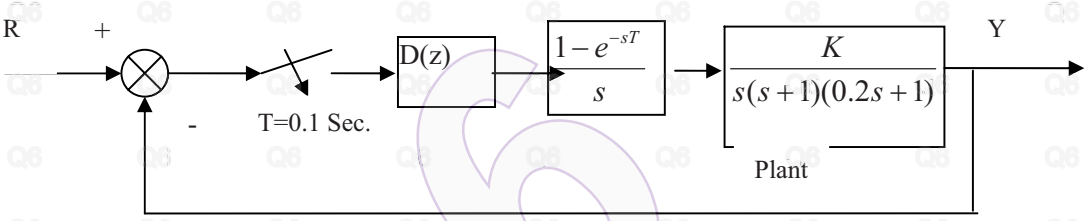

Fig. P7a

b) Explain the design procedure of lead compensator. [7+8]

8.a) Explain the design procedure of state feedback controller using pole placement.

b) Consider the system

$$X(k+1) = \begin{bmatrix} 0 & -0.16 \\ 1 & -1 \end{bmatrix} X(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k) \quad \text{and} \quad Y(k) = [0 \quad 1]\, X(k)$$

Design a full-order observer. The desired eigenvalues of the observer matrix are z=0.5±j0.5. [7+8]

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