Code: R7411008

R7

IV B.Tech I Semester (R07) Supplementary Examinations, May 2012
DIGITAL CONTROL SYSTEMS
(Common to EIE and EConE)

Time: 3 hours **Max Marks: 80**

Answer any FIVE questions
All questions carry equal marks
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1. With neat diagrams explain various types of analog to digital converters and its operation in detail.

2. (a) Find z-transform of the following functions.

   (i) f(s) = $\frac{2(s+1)}{s9s+5)}$ (ii) f(s) = $\frac{10}{s(s^2+s+2)}$

   (b) Find inverse z-transform of the following functions

   (i) f(z) = $\frac{2z}{z^2-1.2z+0.5}$ (ii) f(z) = $\frac{1}{z(z-0.2)}$

3. (a) Obtain the pulse transfer function of the zero-orer hold circuit.

   (b) The block diagram of a multirate discrete data control system is shown in fig(i). Find the closed loop transfer function c(z)/R(z) of the system. The sampling period is 1 sec, N is an unspecified integer ≥ 1. D(s) = $\frac{1}{s+1}$, G(s) = K/S.

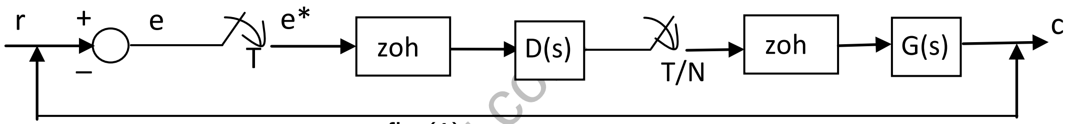

fig (1)

4. (a) Derive the relation between state equations and transfer functions.

   (b) Obtain state transition matrix for the state equations;

   $\begin{bmatrix}\dot{x}_1(t)\\ \dot{x}_2(t)\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_1(t)\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}$ u(t), c(t) = $x_1(t)$

5. (a) Explain in detail how can you find out controllability and observiability for a given system.

   (b) Obtain the controllability of a system given by

   $\dot{x} = \begin{bmatrix}0 & 1\\ -1 & -2\end{bmatrix}$x + $\begin{bmatrix}0\\ 1\end{bmatrix}$u, y = [1 1]x

6. Determine the stability of the following characteristic equations using Jury's stability test.

   (a) $z^3 + z^2 + 3z + 0.2 = 0$

   (b) $z^4 – 1.2\,z^3 + 0.22\,z^2 + 0.066\,z - 0.008 = 0$

   (c) $z^3 - 1.4\,z^2 + 0.53\,z - 0.04 = 0$

7. Design the digital PID controller by using three rectangular integration schemes.

8. Consider the digital control system:

   x [(K+1)^T] = $\begin{bmatrix}0 & 1\\ -1 & -2\end{bmatrix}$ x(KT) + $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ u (KT).

   The pair (A, B) is controllable. Determine state feedback matrix 'G', such that u (KT) = - G.x(KT) places the closed loop eigen values at $z_1 = 0.1$ and $z_2 = 0.2$.

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