Subject Code: C9511

M.Tech - I Semester [R09] Regular/Supplementary Examinations, April - 2012

DIGITAL CONTROL SYSTEMS

(Control Systems)

Time: 3 Hours **Max Marks: 60**

Answer any FIVE questions. All questions carry EQUAL marks.

1. a State the advantages and disadvantages of digital data systems?
   b. With a suitable circuit, explain the operation of sampler and hold devices. Also derive the transfer function of zero-order hold. [4M+8M]

2. a. Obtain the z ? Transform of the following x(k)
   -(.) / 0k(2^123) 4 2^5 + 6, k/0,1,2, ... Assume that x(k)/0 for k<0.

   b. Obtain the inverse z-transform of the following

   i. $9(:) / \frac{:(;<=)}{(;23)^{>}}$ and

   ii. $9(:) / \frac{:^{?>}}{(32;^{?@})^{A}}$ [4M+4M+4M]

6. The weighting sequence of a linear discrete-data system is

$$C(.) / \begin{cases} 0.1E(0.F)^1 \; 4 \; 0.1E(0.4)^1 & . \; G \; 0 \\ 0 & . < 0 \end{cases}$$

   (i). Find the transfer function G(Z) of the system.
   (ii) Let the input be r(k) / $u_s(k)$, the unit step sequence. Find the output c(k) in closed form. Find the final value of C(k) as . N O. [EM+7M]

4. Construct the bode diagram of the open loop transfer function
   G(Z)/ C(z)/E(Z) with Z/ e^{jwt}, 0≤U ≤ U_V/2 for the system $W_X(Y) / \frac{=(V<3)}{V(V<=)}$, T/0.Es.
   Determine in the gain margin and phase margin of the system. [12M]

E. Find the block diagrams of direct programs for the digital controllers given

   a. $[(\backslash) / \frac{(;2].^{\wedge}\_`a)(;2].abc)}{(;23)(;<].===)(;<].\_)}$

   b. $[(\backslash) / \frac{3.\_<].\_;^{?@}<;^{?>}}{32;^{?@}}$

   c. $[(\backslash) / \frac{].=2].a;^{?@}<].=;^{?>}}{32]._;^{?@}2].`;^{?>}}$ [4M+4M+4M]

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6. a. Give the properties of state transition matrix.

   b. Find the state transition equations of the following systems by means of the state diagram method.

$$-(. + 1) \,/\, \mathrm{d}\text{-}(.) + \mathrm{ef}(.)$$

The initial states are given as -(0)

$$\mathrm{d} \,/\, \begin{matrix} 0 & 1 \\ 0.\mathrm{E} & 0.6 \end{matrix}\mathrm{h},\ \mathrm{e} \,/\, \begin{matrix} 0 \\ 1 \end{matrix}\mathrm{h} \qquad \text{[4M+8M]}$$

7. Given the discrete data control system

$$-(. + 1) \,/\, \mathrm{d}\text{-}(.) + \mathrm{ef}(.)$$

$$\mathrm{i}(.) \,/\, [\text{-}(.)$$

Where

$$\mathrm{d} \,/\, \begin{matrix} 0 & 1 \\ 42 & 46 \end{matrix}\mathrm{h},\ \mathrm{e} \,/\, \begin{matrix} 0 \\ 1 \end{matrix}\mathrm{h},\ [\,/\,[1 \quad 41]$$

The control is realized through state feedback,

$$\mathrm{f}(.) \,/\, 4\mathrm{W}(.) \,/\, 4[\mathrm{C}_3 \quad \mathrm{C}_=]\text{-}(.)$$

Where g_1 and g_2 are real constants. Determine the values of g_1 and g_2 that must be avoided for the system to be completely observable. [12M]

8. a. Discuss about dead beat control?

   b. Consider the system given by

$$\mathrm{j}\begin{matrix} -_3(. + 1) \\ -_=(. + 1) \end{matrix}\mathrm{k} \,/\, \begin{matrix} 0 & 1 \\ 40.1\mathrm{F} & 41 \end{matrix}\mathrm{h}\,\mathrm{j}\begin{matrix} -_3(.) \\ -_=(.) \end{matrix}\mathrm{k} + \begin{matrix} 0 \\ 1 \end{matrix}\mathrm{h}\,\mathrm{f}(.)$$

Determine the state feedback gain matrix 'k' such that when the control signal is given by $\mathrm{f}(.) \,/\, 4.\text{-}(.)$ the closed system exhibits the dead beat response. [4M+8M]