Code: R7420203

R7

B.Tech IV Year II Semester (R07) Supplementary Examinations March/April 2013

DIGITAL CONTROL SYSTEMS

(Electrical and Electronics Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE questions
All questions carry equal marks
*****

1 (a) What are the advantages of discrete data control systems over continuous data control systems?

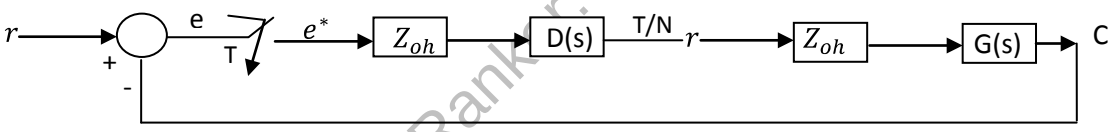
(b) With neat diagrams explain in detail various analog to digital converters.

2 (a) Find z - transform of $f(k) = (0.1)^k\, u_s(k) + 0.5k\,(0.1)^{k-1}\, u_s(k-1)$.

(b) Find inverse z - transform of $F(z) = \frac{z(z+1)}{(z-1)z^2-z+1)}$.

3 (a) Explain the concept of mapping between s-plane and z-plane.

(b) Find the closed loop transfer function $C(z)/R(z)$ of the following multi rate discrete - data control systems. The sampling period is 1 S. 'N' is an unspecified integer ≥ 1. Transfer functions are: D(s) = $\frac{1}{S+1}$, $G(s) = K/S$



4 (a) Derive the relationship between state equations and transfer function.

(b) Find state transition matrix of $A = \begin{bmatrix} 3 & 0 & 0 \\ 2 & 4 & 1 \\ 2 & 1 & 4 \end{bmatrix}$.

5 (a) Explain the concept of duality between controllability and observability.

(b) Find whether the following system is controllable or not.

$$X\,[CK+1)T] = \begin{bmatrix} -1 & 1 & 0 \\ 0 & -4 & 2 \\ 0 & 0 & -10 \end{bmatrix} X\,(KT) + \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} u\,(KT)$$

And $Y(KT) = [\,1 \;\; 0 \;\; 1\,]\, X\,(KT)$.

Contd. in Page 2

Code: R7420203

R7

6 (a) Explain how bilinear transformation can be used for stability analysis of a given system.

(b) Obtain stability of the following characteristic equations by finding the value of 'K' using Jury's stability test:

(i) $z^4 + 0.2z^3 - 0.25z^2 - 0.05\,z + k = 0.$

$(ii) z^3 + 5z^2 - z + 5k = 0.$

7 Explain in detail the digital PID controller design using three rectangular integration schemes.

8 Explain in detail the design procedure of full order state observer.

*****