Roll No. .....

23293

M. Tech. 3rd Semester (Electrical Engg.) (Specialization : Electrical Power System) (Elective-III) Examination – December, 2014

DIGITAL CONTROL SYSTEMS

Paper : MTEPS-301(i)

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt any ***five*** questions out of given ***eight***.

1. (a) Differentiate between digitization, discretization and quantization. 6

(b) What is transfer functions of zero order hold and first order hold ? 7

(c) How signal can be reconstructed ? State and explain sampling theorem. 7

2. (a) Given $z[x(k)] = x(z)$, find z-transform of : 10

(i) $y(k) = \sum_{j=0} x(j)$

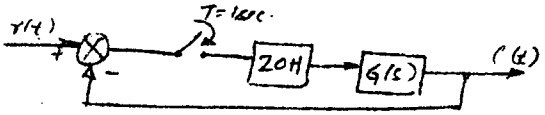
(ii) $y(k) = e^{-ak} x(k)$

(b) Find inverse z-transform of : 10

(i) $\frac{2z}{(2z-1)^2}$

(ii) $\frac{z^{-1}}{(1-az^{-1})^2}$

3. (a) For the sampled data system of fig. given, find the response to the unit step input. Given $G(S) = \frac{1}{S+1}$ 10



(b) Determine the z-transfer function of two Cascaded systems each described by the difference equation : 10

$$c(k) = 0.5\, c(k-1) + r(k)$$

4. (a) Explain the mapping between s-plane and z-plane. 6

(b) Consider a non-linear system governed by equations : 10

$$\dot{x_1} = -x_1 + 2x_1^2 x_2$$
$$\dot{x_2} = -x_2$$

Find the stability using Liapunov functions.

(c) State Jury stability test. 4

5. (a) What are specifications of the system regarding its transient response ? 8

(b) Enumerate the steps involved in the design of a system based on frequency response method. 8

(c) What is the concept of state space method ? 4

6. (a) Consider the system : 10

$$G(S) = G_1(S) \cdot G_2(S) \text{ where } G_1(S) = \frac{b}{s+a}, G_2(S) = \frac{c}{s+d}$$

where a & b are unknown parameters and c & d are known. Construct discrete time direct and indirect self tuning algorithms for partially known system.

(b) What is dead beat response ? Explain. 6

(c) State Ackerman's formula. 4

7. (a) Explain and derive the necessary & sufficient condition for state observation. 10

(b) Draw and explain the architecture of single board controller with custom designed chiMTEPS digital signal processor. 10

8. Write short notes on :

(a) Effects of finite word length and quantization on controllability. 10

(b) Full order state observer. 10