B.E.(with Credits)-Regular-Semester 2012 - Instrumentation Engineering Sem VIII

# IN8041 - Elective-II : Digital Control System

P. Pages : 2 **GUG/W/16/7105**

Time : Three Hours * 4 8 7 7 * Max. Marks : 80

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Notes : 1. Same answer book must be used for each questions.
2. All questions carry marks as indicated.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.

**1.** a) Give the advantages & limitations of the digital control system. **7**

b) The input-output relationship of digital control system is given by the difference eqn. **9**
$J(K+1)+1/2\,y(K)=r(K)\,J(0)=1$
Determine the o/p sequence y(K). When r (K) is a unit step sequence for $K \geq 0$ .

**OR**

**2.** a) Prove the initial value & final value theorem in digital control system. **8**

b) Explain the principles of discretization. **8**

**3.** a) State and explain the sampling theorem. **8**

b) Find the Z-transform of the function. **8**

$$F(z)=\frac{3Z^2+2Z+1}{\left(Z^2-3Z+2\right)}$$

**OR**

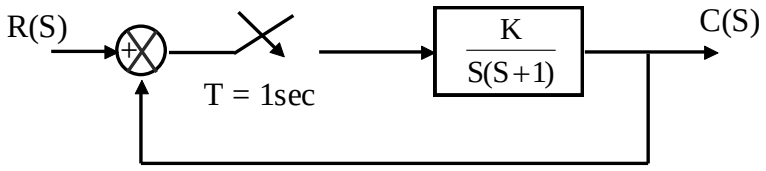
**4.** a) Find the inverse Z-transform of the following. **8**

i) $F(z)=\dfrac{5Z}{Z^2+2Z+2}$

b) Explain the sampling process. **8**

**5.** a) Examine the stability of the following equation using Jury --stability test. **8**
Y(K) -0.4y(K-1)-0.61Y(K-2)+0.87Y(K-3)-0.22y(K-4)=x(K)

b) Consider the digital system shown in Fig. **8**




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

**OR**

**6.** a) Explain the stability criteria by Jury Test. **7**

b) For the following system. **9**

$P(z) = Z^3 - 1.3Z^2 - 0.08Z + 0.24 = 0$

using bilinear Transformation find the stability of system.

**7.** a) Explain the concept of state space method for state space representation of discrete time system. **8**

b) List the types of canonical form for discrete time state space equation & explain them. **8**

**OR**

**8.** a) Derive the necessary conditions for the digital control system. **8**

$x(k+1) = Gx(k)+Hu(k)$

$y(k) = cx(k)+Du(k)$

to be controllable & observable.

b) Explain Lyapunov stability analysis. **8**

**9.** a) A digital process is described by the state equation. **8**

$$x(k+1) = \begin{bmatrix} 0 & 1 \\ -1 & 1 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k)$$

$$y(k) = [2 \quad 0] \; x(k)$$

design the first order observer so as to have a dead beat response.

b) With neat block diagram explain the full order observer. **8**

**OR**

**10** a) Explain the design procedure for lag compensator. **8**

b) Explain the design procedure for lead compensator in discrete time system. **8**

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