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**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**  
(AUTONOMOUS)**M.Tech I Year I Semester (R16) Regular Examinations January 2017****DIGITAL CONTROL SYSTEMS**

(Control Systems)

(For Students admitted in 2016 only)

Time: **3 hours**Max. Marks: **60**(Answer all Five Units **5 X 12 =60** Marks)**UNIT-I**

- Q.1** a. Explain the different types of sampling operations?. 6M  
b. Explain the operation and advantages of zero order hold circuit? 6M

**OR**

- Q.2** a. Explain the successive-approximation A/D converter? 6M  
b. Derive and explain the equation for variance of Quantization noise in terms of Quantization level. 6M

**UNIT-II**

- Q.3** a. Find the z-transform of the following function  $x(k)$  6M  
$$x(k) = \sum a^{k-1} \quad k = 2, 3, \dots$$
  
b. Find the inverse z-transform of the following functions: 6M  
i)  $X(z) = \frac{z+2}{(z-2)z^2}$  and ii)  $X(z) = \frac{2z^3+z}{(z-1)(z-1)^2}$

**OR**

- Q.4** a. Sketch the wave form  $x(t)$  for the given  $X(z) = \frac{1}{10} \frac{z^{-1}(1-z^{-10})}{(1-z^{-1})^2}$  6M  
b. Solve the following difference equation using z-transform method 6M  
Where  
 $x(0) = 0, x(1) = 1.$   
 $X(k+2) = x(k+1) + x(k)$

**UNIT-III**

- Q.5** Sketch the root locus for unity feedback sampled data system having the open loop transfer function:  
$$G(s) = \frac{(1-e^{-Ts})}{s} \frac{K}{s(s+1)}$$
  
Find the value of K with critical gain stability for  $T=1$  and  $T=2$ ? 12M

**OR**

- Q.6** a. a) Explain the stability of a DCS for different locations of closed loop poles 6M  
b. b) Explain the advantages of bode plot based design of control systems. 6M

**UNIT-IV**

**Q.7** Explain the Discretization of Continuous-Time state space equations and obtain the pulse transfer function.

i)  $G(s) = \frac{1}{s(s+2)}$

T = 1 sec.

12M

**OR**

**Q.8** Explain the design procedure of digital PID controller

12M

**UNIT-V**

**Q.9** a. Explain the conditions for complete controllability and complete observability.

6M

b. Examine the controllability and observability of the system

$$X(k+1) = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} X(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U(k) \text{ and } Y(k) = [1 \ 0]X(k) \text{ is}$$

6M

**OR**

**Q.10** Explain liapunov stability analysis and find the stability of the system

12M

$$x_1(k+1) = x_1(k) - 1.2 x_2(k)$$

$$x_2(k+1) = 0.5 x_1(k)$$

**\*\*\* END \*\*\***