Q.P. Code: 16EE7502 **R16**

Reg. No. | | | | | | | | | | |

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**
**(AUTONOMOUS)**
**M.Tech I Year I Semester Regular & Supplementary Examinations February 2018**
**DIGITAL CONTROL SYSTEMS**
**(Control Systems)**

Time: **3** hours Max. Marks:**60**

(Answer all Five Units **5 X 12 =60** Marks)

**UNIT-I**

1 a. Explain the block diagram of digital control system? 6M

b Explain the effect of quantization error in digital control systems? 6M

**OR**

2 a. Compare digital control system and analog control systems? 6M

b. Explain the operation of sample and hold circuit in digital control systems. 6M

**UNIT-II**

3 a. Find the z-transform of the following function x(k)

$x(k) = \sum ka^{k-1}$ k= 1,2,3,……

6M

b. Find the initial value and final value of the following functions

i) $X(z) = \frac{1}{10}\frac{z^{-1}(1-z^{-10})}{(1-z^{-1})^2}$ and ii) $X(z) = \frac{2z^3+z}{(z-1)(z-1)^2}$ 6M

**OR**

4 a. Obtain the z-transform for the following (i) f (t)= $e^{-at}$cos wt. (ii) unit-ramp function. 6M

b. Solve the following difference equation using z-transform method Where x (0) = 0, x (1) = 2. X(k+2)-x(k+1)+.25 x(k)=2u(k) 6M

**UNIT-III**

5 a Explain the advantages of design of Digital control systems based on Frequency response method. 6M

b Determine the stability for the system having characteristic equation

$P(z) = z^4 - 1.2z^3 + 0.07z^2 + 0.3z - .08 = 0$ 6M

**OR**

6 a. Explain the mapping of s plane to z plane with one example. 6M

b. 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=4? 6M

## UNIT-IV

7 Explain state space representation of Discrete time systems &Determine discrete state variable representations controllable ,observable and diagonal canonical form for the transfer function.

$$X(z) = \frac{z+1}{z^2 + 1.3\,z + .4}$$ 12M

**OR**

8 Explain the design of PID Controllers with its advantages over P & PI controllers. 12M

## UNIT-V

9 a. Explain Liapunov stability analysis. 6M

b. Determine the stability of the equilibrium state of the following system

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

$x_2(k+1) = -0.5\,x_1(k) - x_2(k)$ 6M

**OR**

10 Explain the design of Controller using pole placement method. 12M

***** END *****

**$x_1(k+1) = x_1(k) - 1.2\,x_2(k)$**

**$x_2(k+1) = 0.5\,x_1(k)$**

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**$x_2(k+1) = 0.5\,x_1(k)$**