Roll No. | | | | | | | | | | | | | Total No. of Pages : 02

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M.Tech. (EE) (2013 Onwards) (Sem.–1)

DIGITAL CONTROL SYSTEM

Subject Code : MTEE-104

M.Code : 70728

Time : 3 Hrs. Max. Marks : 100

INSTRUCTION TO CANDIDATES :

1. **Attempt any FIVE questions out of EIGHT questions.**
2. **Each question carries TWENTY marks.**

1. Discuss the following :

   a) Principles of signal conversion 7

   b) Basic discrete time signals 6

   c) Practical aspects of choice of sampling rate 7

2. a) A discrete time system is described by the transfer function 10

$$\frac{Y(z)}{R(s)} = \frac{1}{z^2 - 0.75z + 0.125}$$

   Find the response $y(k)$ to the input (i) $r(k) = \delta(k)$ (ii) $r(k) = \mu(k)$

   b) Using Jury's method find the stability of the system whose characteristic polynomial is given by $\Delta(z) = 3z^5 + 10z^4 + 5z^3 + 6z^2 + 7z + 8$ 10

3. Explain the digital position control system. Also discuss Torque speed characteristics of Stepper motor. Support your answer with suitable diagrams, whenever required. 20

4. Discuss in detail the z plane specifications of control system design. 20

5. By considering suitable examples explain the different design steps of digital Lead compensator and digital Lag compensator using root locus plot. 20

6. Obtain the Canonical state variable models from the following transfer function 20

$$G(s) = \frac{S+3}{s^3 + 9s^2 + 24s + 20}$$

7. a) What is controllability and observability? State and prove the necessary and sufficient conditions for the system to be completely Controllable and Observable. 10

b) Find the controllability and observability of the following system : 10

$$\dot{x}(t)=\begin{bmatrix}-2 & 1\\ 1 & -2\end{bmatrix}x(t)+\begin{bmatrix}1\\ 1\end{bmatrix}u(t)$$

$$y(t) = [0 \;\; 1]\, x(t)$$

8. Discuss the following in detail :

a) Z domain description of systems with dead time 10

b) Digital Temperature control system 10

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.