Code No: **R1642021** **R16** **Set No. 1**

IV B.Tech II Semester Regular/Supplementary Examinations, July - 2021

DIGITAL CONTROL SYSTEMS

(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
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PART–A *(14 Marks)*

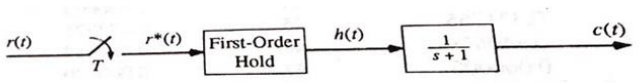
1. a) What are the demerits of digital systems? [2]
   b) Compare the relationship between the Laplace transform and the Z-transform. [3]
   c) Define the Controllability and observability. [2]
   d) What are the transient response specifications? [2]
   e) What is the need of lag and lead compensators? [2]
   f) What are the sufficient conditions for design of state feedback controller through pole placement? [3]

PART–B *(4x14 = 56 Marks)*

2. a) Define various finite time delays of input and output sample/ hold signals with neat diagram. [7]
   b) Obtain the necessary expressions of Frequency domain characteristics of zero order hold and draw its bode plots. [7]

3. a) State the theorems of z–transform. [7]
   b) Find the output at the sampling instants c(kT) of the system shown in the figure

      (i) The input is a unit step function and the sampling period is 0.1s. Find the final value of c(kT) a $k\rightarrow\infty$.
      (ii) The input is a unit ramp function and the sampling period is 0.1 s



[7]

4. a) Obtain the state equations of discrete data systems with sample and hold devices. [7]
   b) A discrete-time system has state equation given by [7]

   $x(k+1)=\begin{vmatrix} 0 & 1 \\ -10 & -7 \end{vmatrix} x(k)$

   use Cayley-Hamilton approach to find out its state transition matrix.

5. a) Explain the relationship between the S-plane and the Z-plane. [7]
   b) State and explain the Jury's stability test. [7]

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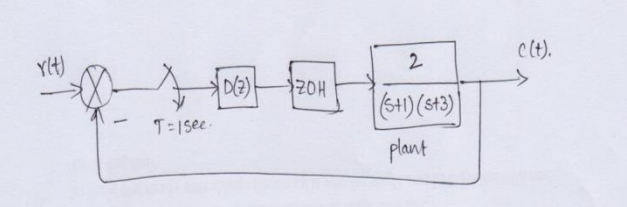
6. Design a compensator D(z) using root locus method for the following system to meet the given specifications.
   a) ζ=0.5
   b) ω_n = 1.5
   c) K_p = 7.5



[14]

7. Consider a linear system described by the transfer function
   T(s) = 10/[S(S+1)(S=2)]
   Design a feedback controller with a state feedback so that the closed loop poles are placed at -3, -1±j1. [14]

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