Code No: **R42044** **R10** **Set No. 1**

IV B.Tech II Semester Supplementary Examinations, April - 2018

DIGITAL CONTROL SYSTEMS

(Common to Electronics and Communication Engineering and Electronics and Instrumentation Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) With a suitable circuit, explain the operation of sampler and hold devices. Also derive the transfer function of zero-order hold. [8]
b) What do you mean by D/A conversion? Explain an R-2R ladder 3 bit DAC. [7]

2 a) State and prove initial and final value theorems of z-transforms. [7]
b) Obtain the inverse z-transform of the following

$(i)\ X(z) = \dfrac{z^{-3}}{(1-z^{-1})(1-0.2z^{-1})}$ $(ii)\ X(z) = \dfrac{z^{-1}(1-z^{-2})}{(1+z^{-2})^2}$ [8]

3 a) Discuss the mapping between s-plane and z-plane. [5]
b) Find $Y(z)/R(z)$ for the following sample-data closed loop systems shown in figure 1

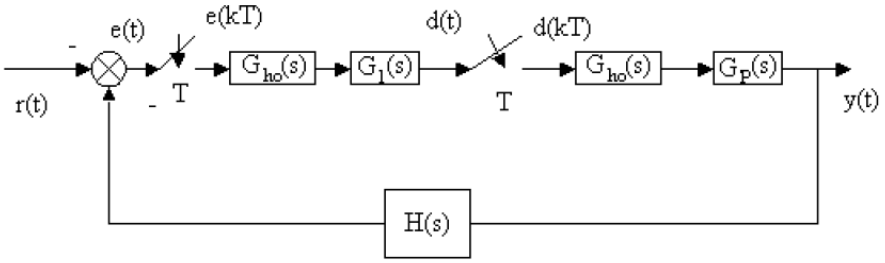

Figure.1 [10]

4 Consider the discrete control system represented by the following transfer function $G(z) = \frac{1+0.8z^{-1}}{1-z^{-1}+0.5z^{-2}}$ Obtain the state representation of the system in the observable canonical form. Also find its state transition matrix. [15]

5 a) Explain the observability conditions for pulse transfer function. [5]
b) Investigate the controllability and observability of the following system

$$\begin{pmatrix} x_1(k+1) \\ x_2(k+1) \end{pmatrix} = \begin{pmatrix} 1 & -2 \\ 1 & -1 \end{pmatrix} \begin{pmatrix} x_1(k) \\ x_2(k) \end{pmatrix} + \begin{pmatrix} 1 & -1 \\ 0 & 0 \end{pmatrix} u(k);$$

$$\begin{pmatrix} y_1(k) \\ y_2(k) \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x_1(k) \\ x_2(k) \end{pmatrix}$$

[10]

6 Determine the stability of the following characteristic equations by using suitable tests.
(a) $5z^2-2z + 2 = 0$ (b) $z^3-0.2z^2-0.25z + 0.05 = 0$
(c) $z^4-1.7z^3+1.04z^2-0.268z + 0.024 = 0$. [15]

7 a) Explain in brief the digital PID controllers. [7]
b) Explain the design procedure of digital controller through bilinear transformation. [8]

8 Write short note on the following:
(a) Reduced order observer
(b) Necessary conditions for design of state feedback controller through pole placement. [15]