Code No: R05411008 **R05** **Set No. 2**

IV B.Tech I Semester Examinations,November 2010
DIGITAL CONTROL SYSTEMS
Common to Electronics And Control Engineering, Electronics And Instrumentation Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) A state feed back control system has following system equations
X(k+1) = GX(k) + HU(k)
Y(k) = CX(k)
U(k) = -KX(k)
Where K is state feed back gain matrix.
Draw the necessary block diagram for the control system and derive the observer error equation.
(b) Briefly explain the design of digital control systems that must follow changing reference inputs, applying observed-state feed back method. Draw necessary block diagram. [8+8]

2. Obtain the closed loop pulse transfer function of the systems shown in Figure 1 and Figure 1. [16]

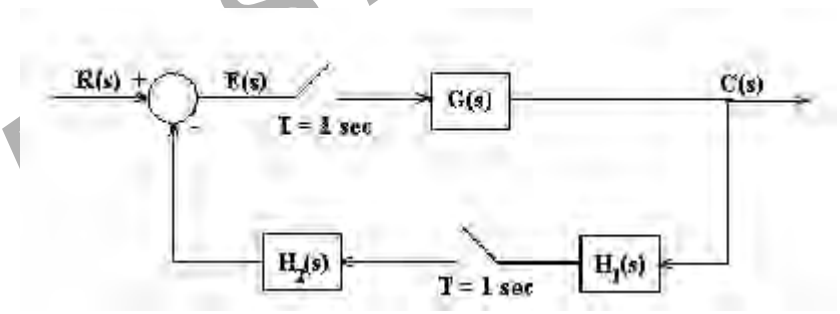

Figure 1:

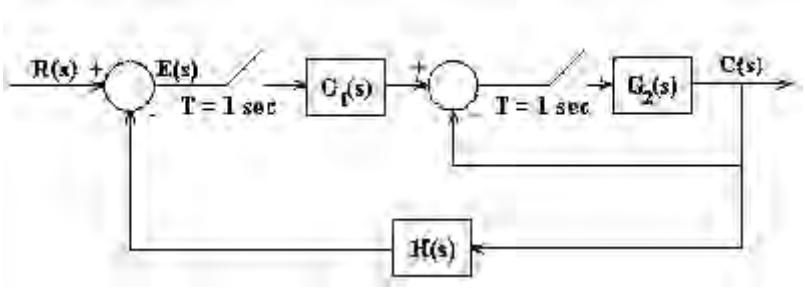

Figure 2:

3. Develop a mathematical model of sample and hold circuit. Show that an ideal sampler is an impulse modulator. [16]

4. Determine the stability of the following characteristic equations by using suitable tests.

   (a) $z^3+z^2+3z + 0.2 = 0$

   (b) z^4 - $1.2z^3+0.22z^2+0.0668z$ -0.008 = 0. [8+8]

5. (a) Explain the mapping between S-plane, Z-plane and ω-plane with suitable diagrams.

   (b) Explain the design procedure of digital controller in ω -plane using frequency response method. [8+8]

6. Obtain the Z - transform of the following:

   (a) G^k where G is an n x n matrix.

   (b) k^2.

   (c) ka^{k-1} by two methods. [16]

7. The block diagram of a sampled data system is shown in below figure 3; obtain a discrete time state model for the system. [16]

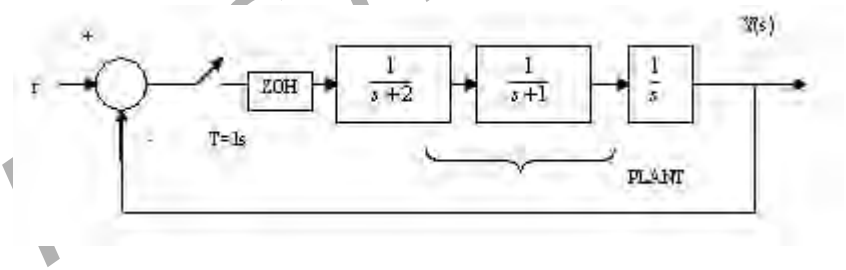

Figure 3:

8. Convert the following state model into Jordan canonical form and there from comment on controllability and observability.

$$X(k+1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -4 & -3 \end{bmatrix} X(k) + \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ -1 & 1 \end{bmatrix} U(k) \quad . \qquad [16]$$

$$Y(k) = \begin{bmatrix} 0 & 1 & -1 \\ 1 & 2 & 1 \end{bmatrix} X(k)$$

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Code No: R05411008 **R05** **Set No. 4**

IV B.Tech I Semester Examinations,November 2010
DIGITAL CONTROL SYSTEMS
Common to Electronics And Control Engineering, Electronics And Instrumentation Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. The block diagram of a sampled data system is shown in below figure 1; obtain a discrete time state model for the system. [16]

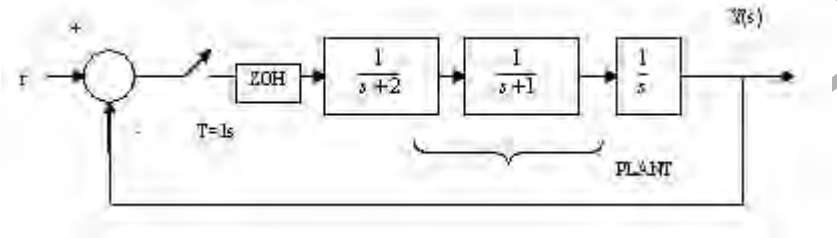

Figure 1:

2. Obtain the closed loop pulse transfer function of the systems shown in Figure 2 and Figure 3. [16]

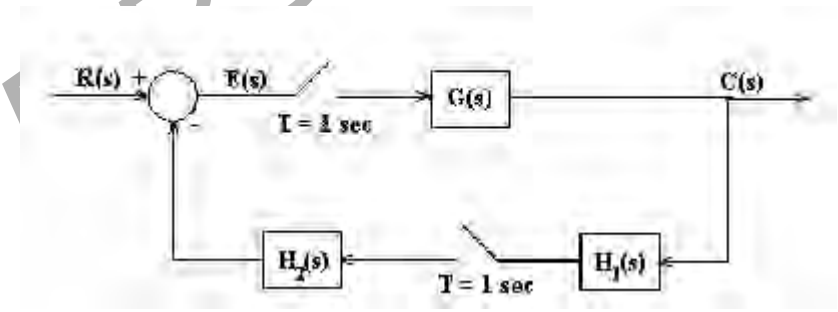

Figure 2:

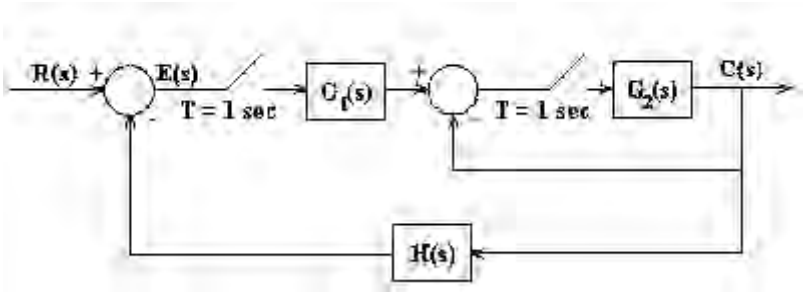

Figure 3:

3. Convert the following state model into Jordan canonical form and there from comment on controllability and observability.

$$X(k+1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -4 & -3 \end{bmatrix} X(k) + \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ -1 & 1 \end{bmatrix} U(k)$$

$$Y(k) = \begin{bmatrix} 0 & 1 & -1 \\ 1 & 2 & 1 \end{bmatrix} X(k)$$

[16]

4. Develop a mathematical model of sample and hold circuit. Show that an ideal sampler is an impulse modulator. [16]

5. Determine the stability of the following characteristic equations by using suitable tests.

   (a) $z^3+z^2+3z + 0.2 = 0$

   (b) $z^4 - 1.2z^3+0.22z^2+0.0668z -0.008 = 0$. [8+8]

6. (a) A state feed back control system has following system equations
   X(k+1) = GX(k) + HU(k)
   Y(k) = CX(k)
   U(k) = -KX(k)
   Where K is state feed back gain matrix.
   Draw the necessary block diagram for the control system and derive the observer error equation.

   (b) Briefly explain the design of digital control systems that must follow changing reference inputs, applying observed-state feed back method. Draw necessary block diagram. [8+8]

7. Obtain the Z - transform of the following:

   (a) G^k where G is an n x n matrix.

   (b) k^2.

   (c) ka^{k-1} by two methods. [16]

8. (a) Explain the mapping between S-plane, Z-plane and ω-plane with suitable diagrams.

   (b) Explain the design procedure of digital controller in ω -plane using frequency response method. [8+8]

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Code No: R05411008 **R05** **Set No. 1**

IV B.Tech I Semester Examinations,November 2010
DIGITAL CONTROL SYSTEMS
Common to Electronics And Control Engineering, Electronics And Instrumentation Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. The block diagram of a sampled data system is shown in below figure 1; obtain a discrete time state model for the system. [16]

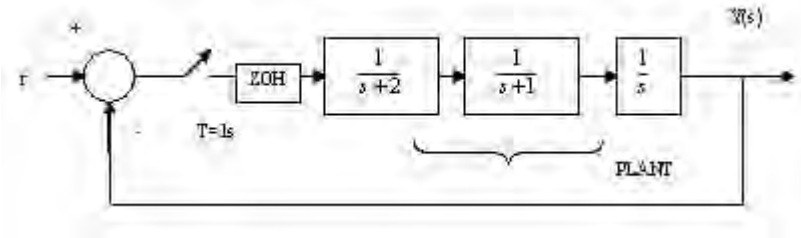

Figure 1:

2. Determine the stability of the following characteristic equations by using suitable tests.
   (a) $z^3+z^2+3z + 0.2 = 0$
   (b) $z^4 - 1.2z^3+0.22z^2+0.0668z -0.008 = 0.$ [8+8]

3. Obtain the closed loop pulse transfer function of the systems shown in Figure 2 and Figure 3. [16]

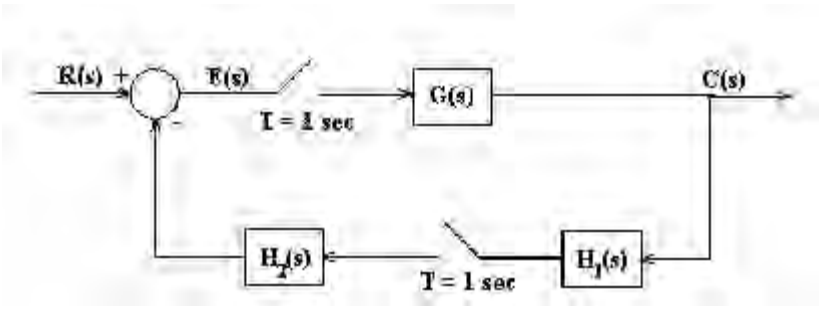

Figure 2:

4. Develop a mathematical model of sample and hold circuit. Show that an ideal sampler is an impulse modulator. [16]

5. (a) A state feed back control system has following system equations
   X(k+1) = GX(k) + HU(k)

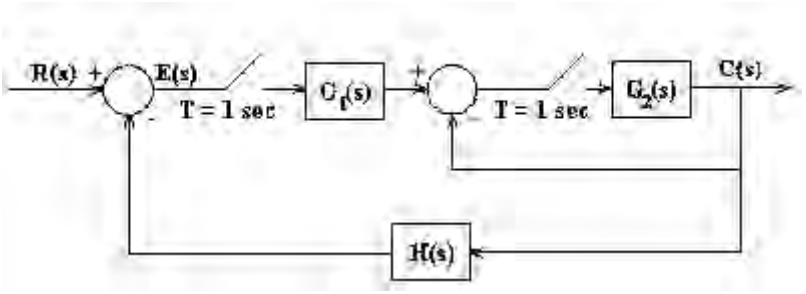

Figure 3:

Y(k) = CX(k)
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(b) Briefly explain the design of digital control systems that must follow changing reference inputs, applying observed-state feed back method. Draw necessary block diagram. [8+8]

6. (a) Explain the mapping between S-plane, Z-plane and ω-plane with suitable diagrams.

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7. Convert the following state model into Jordan canonical form and there from comment on controllability and observability.

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8. Obtain the Z - transform of the following:

   (a) G^k where G is an n x n matrix.

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Code No: R05411008 **R05** **Set No. 3**

IV B.Tech I Semester Examinations,November 2010
DIGITAL CONTROL SYSTEMS
Common to Electronics And Control Engineering, Electronics And Instrumentation Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. Convert the following state model into Jordan canonical form and there from comment on controllability and observability.

$$X(k+1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -4 & -3 \end{bmatrix} X(k) + \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ -1 & 1 \end{bmatrix} U(k)$$

$$Y(k) = \begin{bmatrix} 0 & 1 & -1 \\ 1 & 2 & 1 \end{bmatrix} X(k)$$ [16]

2. Determine the stability of the following characteristic equations by using suitable tests.
   (a) $z^3+z^2+3z + 0.2 = 0$
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   (a) G^k where G is an n x n matrix.
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   Draw the necessary block diagram for the control system and derive the observer error equation.
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5. The block diagram of a sampled data system is shown in below figure 1; obtain a discrete time state model for the system. [16]

6. Obtain the closed loop pulse transfer function of the systems shown in Figure 2 and Figure 3. [16]

Code No: R05411008 **R05** **Set No. 3**

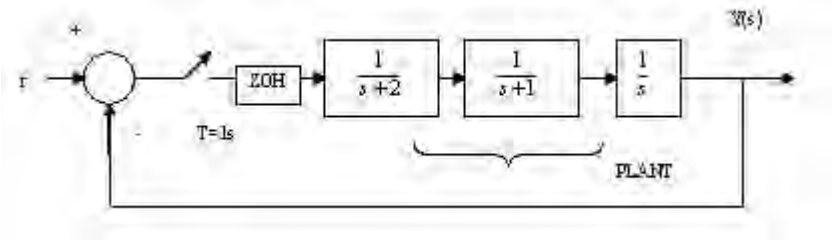

Figure 1:

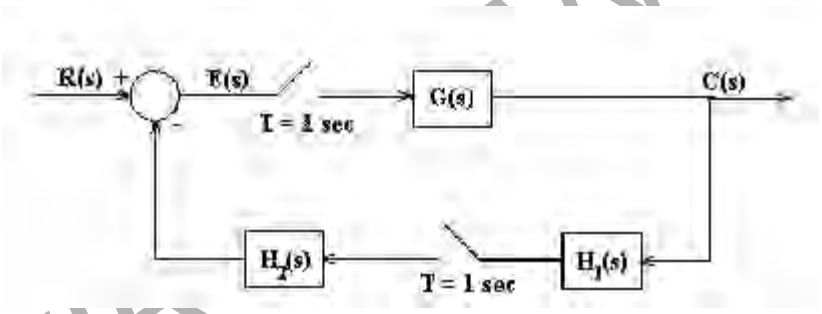

Figure 2:

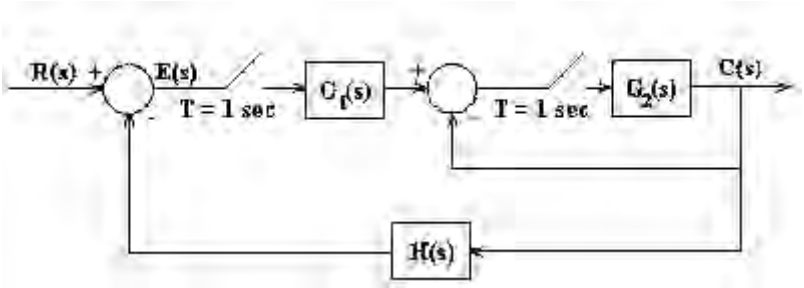

Figure 3:

Code No: R05411008 **R05** **Set No. 3**

7. (a) Explain the mapping between S-plane, Z-plane and ω-plane with suitable diagrams.
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8. Develop a mathematical model of sample and hold circuit. Show that an ideal sampler is an impulse modulator. [16]

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