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BIEEE-002

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

00413 **Term-End Examination**

December, 2018

BIEEE-002 : DIGITAL CONTROL SYSTEM

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***seven*** *questions. All questions carry equal marks. Use of scientific calculator is allowed.*

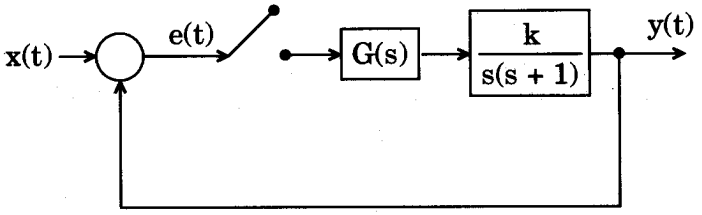
1. With suitable circuit and block diagram, explain the operation of sample and hold devices. Also draw its time-domain characteristics. Clearly mention sample and hold operation. *10*

2. Obtain the inverse Z-transform of x(z) using direct division method and partial fraction method. *10*

$$x(z) = \frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$$

3. State and prove five properties or theorems of Z-transform. Also give suitable examples. *10*

4. For the system given below, find out the closed loop transfer function and its unit step response when T = 2 sec : *10*



5. Consider the system :

$$\begin{bmatrix} x_1(k+1) \\ x_2(k+1) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} (-1)^k$$

Find y(k) for $k \geq 1$, if

$x_1(0) = x_2(0) = 1$ and $y(k) = x_1(k)$. *10*

6. Discuss in detail the loss of controllability and observability due to sampling process. Give suitable example also. *10*

7. Consider the system :

$$x(k+1) = F\,x(k) + G\,u(k)$$

$$y(k) = C\,x(k)$$

with $F = \begin{bmatrix} 0 & 1 & 0 \\ 0 & -1 & 1 \\ 0 & -1 & 10 \end{bmatrix}$; $G = \begin{bmatrix} 0 \\ 0 \\ 10 \end{bmatrix}$; $C = [1\ \ 1\ \ 1]$.

Design a state feedback controller which will place the closed loop poles at $-10, -1 \pm j\sqrt{3}$. *10*

8. Write short notes on any ***two*** of the following : *2×5=10*

(a) Lyapunov Stability

(b) Advantages of Digital Compensator

(c) Routh Stability Criteria

9. Describe optimal digital control in short. Explain Euler-Lagrange equation of discrete system. *10*