

01081

**B.Tech. ELECTRICAL ENGINEERING
(BTELVI)**

Term-End Examination

December, 2012

BIEEE-002 : DIGITAL CONTROL SYSTEM

Time : 3 Hours

Maximum Marks : 70

*Note : (1) Attempt any seven questions.
(2) All question carry equal marks.*

1. Find the Z-transform for : 10
 - (a) $u_s(t)$ unit step function
 - (b) e^{-at}
 - (c) $tu_s(t)$
 - (d) $\sin wt$

2. Obtain a mathematical model of sample and Hold 10
Operation. Also, derive Zero Order Hold
equation.

3. Explain the specifications of frequency response 10
of digital control system with suitable diagram.

4. For a control system 10
$$x^\circ(t) = Ax(t) + bu(t)$$
$$y(t) = (x(t))$$

draw the state diagram and obtain the transfer function where :

$$A = \begin{bmatrix} 0 & -1 & 0 \\ 0 & -1 & 1 \\ 0 & -1 & -10 \end{bmatrix}, \quad b = \begin{bmatrix} 0 \\ 0 \\ 10 \end{bmatrix}, \quad c = [1 \quad 0 \quad 0].$$

5. Explain how to solve the state equation $\dot{x} = Ax$. **10**
Also get the Response where

$$A = \begin{bmatrix} 0 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 0 & 3 \end{bmatrix} \quad x(0) = \begin{bmatrix} 0 \\ 0 \\ 10 \end{bmatrix}$$

6. What is jury stability test ? Check the stability of **10**
function.

(a) $F(z) = z^3 + 3.3z^2 + 4z + 0.8.$

(b) $2z^4 + 7z^3 + 10z^2 + 4z + 1$

7. Explain the necessary conditions of Liapunov **10**
stability method. Check stability for given system.

$$x_1(K+1) = -0.5x_1(K)$$

$$x_2(K+1) = -0.5x_2(K_1)$$

8. Derive the expression of discrete Euler-Lagrange **10**
equation and transversality condition equation.

9. Find optimal control 10

$u^*(k)$; $K=0, 1, 2, \dots, 10$ such that the

performance Index $J = \frac{1}{2} \sum_{K=0}^{10} (x^2(K) + 24^2(K))$ is

minimized, subject to the equality constraint.
 $x(K+1) = x(K) + 24(K)$ initial state is $x(0) = 1$,
 $x(11) = 0$ final state.

10. Obtain the Expression of Riccati equation. 10
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