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BIEEE-009

01228

B.Tech. ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

June, 2013

BIEEE-009 : DIGITAL CONTROL SYSTEM DESIGN

Time : 3 hours *Maximum Marks : 70*

Note : *(i) Attempt **any seven** questions.*

*(ii) Each question carry **equal** marks.*

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1. Obtain the mathematical model and frequency domain characteristics of Zero Order Hold (ZOH). **10**

2. Explain :

(a) Routh's stability criterion on the γ - plane **10**

(b) Bilinear transformation

3. What are the specifications of frequency response and time response features of a digital control system ? **10**

4. Consider a control system **10**

$\dot{x}$ (t) = Ax(t) + Bu(t)

y (t) = Cx(t) Draw the state diagram and obtain the transfer function. Where

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

5. Explain : **10**
   (a) Jury's stability criterion
   (b) PID controllers

6. Check the stability by Jury's Test : **10**
   (a) $Z^3 + 3.3Z^2 + 4Z + 0.8 = 0$
   (b) $2Z^4 + 7Z^3 + 10Z^2 + 4Z + 1 = 0$

7. (a) Defin the concept of complete controllability and observability. **10**
   (b) Explain pole placement design of controllers using state feedback for SISO system.

8. A state equation of a digital control system : **10**
   $x(K+1) = Ax(K) + Bu(K)$
   Obtain the state transition = matrix ϕ (K) where

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}$$

9. Draw and obtain Jordan canonical form of given transfer function. **10**

$$G(S) = \frac{(S+4)}{(S+2)^2 (S+5)}$$

10. Define Cayley Hamilton theorem. Evaluate state transition matrix ϕ (t) for a given system $\dot{x} = Ax$ **10**

when $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}$