BIEEE-002

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

00584

Term-End Examination

June, 2014

BIEEE-002 : DIGITAL CONTROL SYSTEM

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. Each question carries equal marks.*

1. (a) Explain about the types of sampling operations. *4*

   (b) Write down the process involved in conversion of Analog signal to Digital signal. *6*

2. Define the properties of Z-transform related to Complex Translation theorem. *10*

3. Using the inversion integral method, obtain the inverse Z-transform of *10*

$$X(z) = \frac{10}{(z-1)(z-2)}$$

4. Obtain the closed loop-pulse transfer function of the system shown in Figure 1 below : *10*

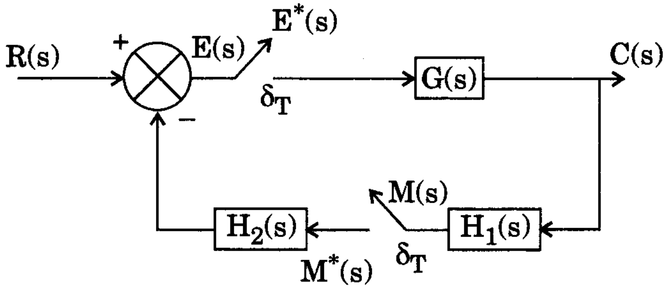

Figure 1

5. Consider the following characteristics equation :

$$P(z) = z^3 - 1{\cdot}3z^2 - 0{\cdot}08z + 0{\cdot}24 = 0$$

Determine whether or not any of the roots of the characteristic equation lie outside the unit circle in the z-plane using Routh-stability criterion. *10*

6. Discuss the procedure for designing load compensators for digital control system by root locus method. *10*

7. Consider the following system :

$$\frac{Y(z)}{U(z)} = \frac{z+1}{z^2 + 1{\cdot}3z + 0{\cdot}4}$$

Show the state-space representation in the following form : *10*

(a) Diagonal canonical form

(b) Observable canonical form

8. Examine the stability of the following characteristic equation :

$$P(z) = z^4 - 1{\cdot}2z^3 + 0{\cdot}07z^2 + 0{\cdot}3z - 0{\cdot}08 = 0$$

by using Jury-stability criterion. *10*

9. Consider the discrete-time control system defined by *10*

$$X(K+1) = G\,X(K) + H\,U(K)$$

where

$$G = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}, \; H = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \; X(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}.$$

Determine the optimal control sequence U(K) that will minimize the following performance index :

$$J = \frac{1}{2} X^*(8)\, S \times (8) + \frac{1}{2} \sum_{K=0}^{7} [X^*(K)\, Q\, X(K) + U^*(K)\, R\, U(K)]$$

where

$$Q = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \; R = 1, \; S = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

10. Discuss about the "Steady-State Riccati Equation". *10*