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BIEEE-002

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

Term-End Examination

00413 **June, 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. Give the block-diagram representation of the state-model of a discrete-time multivariable LTI system. Also find the solution of the state equation of a discrete-time LTI system by using z-transform approach. *10*

2. Consider the system described by the equations

$$x_1(k+1) = 2x_1(k) + 0{\cdot}5\, x_2(k) - 5$$

$$x_2(k+1) = 0{\cdot}8\, x_2(k) + 2$$

Investigate the stability of the equilibrium state using Lyapunov equation. *10*

3. Obtain the transfer function description for the following system : *10*

$$\begin{bmatrix} x_1(k+1) \\ x_2(k+1) \end{bmatrix} = \begin{bmatrix} 2 & -5 \\ \frac{1}{2} & -1 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(k)$$

$$y(k) = 2x_1(k)$$

4. Discuss the Jury's stability criterion. Also investigate the stability of the discrete-time system described by the characteristic polynomial *10*

$$P(z) = 3z^4 + 6z^3 + (1 + 4z) + 10z^2$$

5. Solve for y(k) when

$$y(k) = r(k) - r(k-1) - y(k-1);\ k \geq 0$$

where,

$$r(k) = \begin{cases} 1 ; & k \text{ even} \\ 0 ; & k \text{ odd} \end{cases}$$

and $y(-1) = r(-1) = 0$ *10*

6. Find y(z) for the sampled-data closed-loop system of Figure 1. *10*

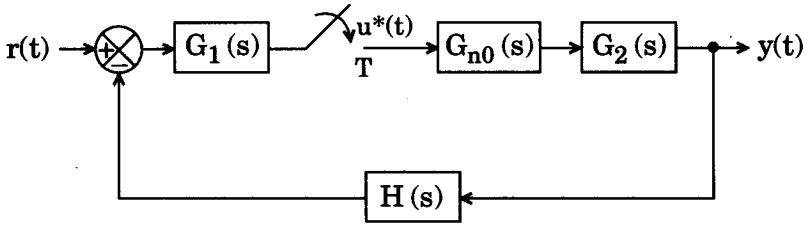

Figure 1

7. A continuous-time plant described by the equation

$$\dot{y} = -y + u + w$$

is to be controlled by a digital computer. y is the output, u is the input and w is the disturbance signal. Sampling interval T = 1 sec. Obtain a discrete-time state-variable model of the plant. *10*

8. How does the sampling period influence the controllability and observability of the sampled system ? *10*

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

(a) Stability Improvement by State-Feedback

(b) Optimal Digital Control

(c) Bilinear Transformation