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BIEEE-009

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

Term-End Examination

00254

June, 2017

BIEEE-009 : DIGITAL CONTROL SYSTEM DESIGN

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any* ***seven*** *questions. All questions carry equal marks. Symbols used have their usual meanings.*

1. (a) Determine the Z-transform of a unit ramp function. *5*

(b) Find the transfer function of a first-order hold. Sketch the output of a first-order hold. *5*

2. (a) What is the effect of sampling on the spectrum ? *5*

(b) Determine the pulse transfer function for the system with open loop transfer function $G(s) = \frac{s+2}{s+1}$. The sampling time is $T = 0{\cdot}5$ sec. *5*

3. For the sampled data system shown in Figure 1, obtain the final value of C(kT) for a unit step input with sampling period T = 1 sec. Write the expression of C(kT). *10*

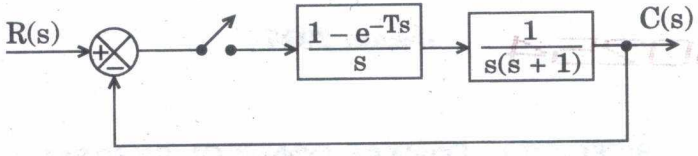

Figure 1

4. (a) Explain Jury's criterion of stability analysis. *5*

(b) Find the stability of the system, given the characteristic polynomial

$$F(z) = 3z^4 + 7z^3 + 10z^2 + 4z + 1.$$ *5*

5. (a) Write the merits of state-space representation. *5*

(b) Obtain a state-space representation for the difference equation

$$c(k + 2) + 0{\cdot}7c(k + 1) + 0{\cdot}1c(k) = 2f(k + 1) + f(k).$$ *5*

6. Determine the characteristics D(z) of a digital controller such that the response of the system to a unit step function will be $C(t) = 1 - e^{-0{\cdot}5t}$. The transfer function for the plant is $\frac{1}{1 + 5s}$ and the sampling period T = 1 sec. *10*

7. (a) State the properties of the state transition matrix. 5

(b) Given the matrix $F = \begin{bmatrix} 0 & 1 \\ -15 & -1 \end{bmatrix}$, determine $\phi(k) = F^k$ using the Z-transform method. 5

8. (a) Define the following terms : 5

(i) Stabilizability

(ii) Reachability

(b) Consider an n^{th} order SISO system

$\dot{x} = Ax + bu; \quad y = cx.$

Assume the feedback of the form $u = -kx + r$, where r is the reference input signal. Show that the zeroes of the system are invariant under state feedback. 5

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

(a) Multirate Discrete Data Systems

(b) Cascade Compensation using Bilinear Transformation

(c) Root Locus Plot

(d) Deadbeat Controller
