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BIEEE-009

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

Term-End Examination

00153

June, 2018

BIEEE-009 : DIGITAL CONTROL SYSTEM DESIGN

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. Each question carries equal marks. Use of scientific calculator is permitted.*

1. (a) Draw the block diagram of a basic digital control system. Explain the function of each block. 7

(b) Explain zero-order hold (ZOH) and obtain the impulse response for the power series expansion given by 7

$$f_k(t) = f(kT) + f^{(1)}kT(t - kT) + \frac{f^{(2)}(kT)}{2!}(t - kT)^2 + \ldots$$

where $f_k(t) = f(t)$ for $kT \le t \le (k + 1)T$

and $f^{(n)}(kT) = \left.\frac{d^n f(t)}{dt^n}\right|_{t=kT}$ for $n = 1, 2, \ldots$

2. The discrete-time system of Figure 1 is described by the transfer function

$$G(z) = \frac{Y(z)}{R(z)} = \frac{0{\cdot}05\,z}{z - 0{\cdot}95}$$

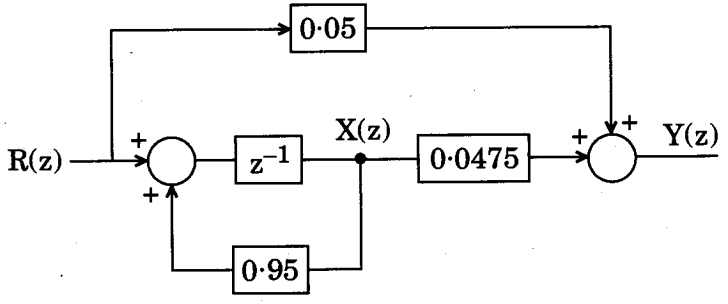

Figure 1

Find the response y(k) to the input r(k) for (i) r(k) = δ(k) discrete time impulse, and (ii) r(k) = μ(k) unit step. *7+7=14*

3. Using the Routh stability criterion determine the stability of the system whose characteristic equation is given by *14*

$$a(s) = 2s^5 + 3s^4 + 2s^3 + s^2 + 2s + 2$$

4. (a) Using bilinear transformation, discuss the cascade compensation by continuous data controllers. *7*

(b) What is two degrees of freedom compensation ? *7*

5. (a) How does a PID controller work ? What is the criterion for determining the initial condition in PID controller design ? 7

(b) Convert $A = \begin{bmatrix} 4 & 0 & 1 \\ 2 & 3 & 2 \\ 1 & 0 & 4 \end{bmatrix}$ into Jordan canonical form, having eigenvalues $\lambda = 5$ and $\lambda = 3$. 7

6. For a discrete data system, define the following terms : *5+5+4*

(a) Controllability

(b) Observability

(c) Reachability

7. Write short notes on any ***two*** of the following : *2×7=14*

(a) Nyquist Stability Criterion

(b) Feedback Continuous Data Controller

(c) Sample and Hold (S/H) Devices
