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BIEEE-009

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

Term-End Examination

00011

June, 2015

BIEEE-009 : DIGITAL CONTROL SYSTEM DESIGN

Time : 3 hours *Maximum Marks : 70*

Note :

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

(ii) Each question carries equal marks.

(iii) Use of scientific calculator is permitted.

(iv) Missing data, if any, may be suitably assumed and mentioned.

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1. State Sampling theorem. Discuss the various factors which limit the choice of sampling rate. *10*

2. (a) Explain how s-plane characteristic roots are mapped on the z-plane. *5*

(b) What is multi-rate discrete data system ? *5*

3. (a) The characteristic equation of a linear digital system is

$$z^3 - 0{\cdot}1\, z^2 + 0{\cdot}2\, Kz - 0{\cdot}1\, K = 0$$

Determine the values of "K" for which the system is stable using Jury's stability test method. *5*

(b) What is the effect of addition of zeros on the root locus ? Explain with the help of suitable example. 5

4. (a) A unity feedback system has the open-loop transfer function

$$G(s) = \frac{5}{s(s+1)\ (s+2)}.$$

Using the Routh stability criterion, show that the closed loop system is stable. 5

(b) Compare the stability properties of the system shown in Figure 1 with (i) T = 0·5 and (ii) T = 1. Assume K > 0. 5

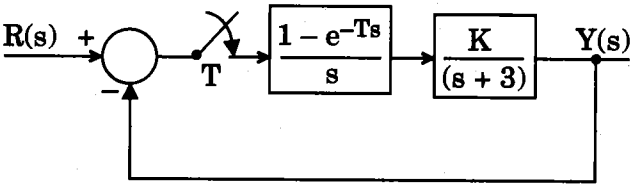

Figure 1

5. Implement digital controller using bilinear transformation. What are the properties of interacting PID controller ? 10

6. How is cascade compensation provided by continuous data controllers using bilinear transformation ? 10

7. Consider the digital controller defined by

$$D(z) = \frac{U(z)}{E(z)} = \frac{4(z-1)(z^2 + 1{\cdot}2z + 1)}{(z + 0{\cdot}1)(z^2 - 0{\cdot}3z + 0{\cdot}8)}.$$

Realize this digital controller in the cascade scheme and in parallel scheme. Use one first-order section and one second-order section. *10*

8. Convert the following transfer function into Jordan canonical form with a state diagram : *10*

$$G(s) = \frac{s + 3}{(s + 2)^2 (s + 5)}$$

9. (a) What are the necessary and sufficient conditions for the digital control system to be completely controllable and observable ? *5*

(b) Explain pole placement design of controllers using state feedback for Single Input Single Output (SISO) system. *5*

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

(a) Cayley-Hamilton Theorem

(b) Two Degrees of Freedom Compensation

(c) Feedback Continuous Data Controller
