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BIEEE-009

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

Term-End Examination

00465 **December, 2014**

BIEEE-009 : DIGITAL CONTROL SYSTEM DESIGN

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted. Missing data, if any may be suitably assumed and mentioned.*

1. Draw and explain the configuration of the basic digital control system. What are the advantages and disadvantages of digital control systems ? *10*

2. Derive the mathematical model for Zero-Order Hold (ZOH) and First-Order Hold (FOH) operation. *10*

3. Briefly explain the Jury stability criteria with necessary conditions for stability. *10*

4. (a) What is the effect of addition of poles on the root locus ? Explain with the help of suitable examples. *5*

(b) Explain the procedure for construction of Bode diagram for discrete time systems. *5*

5. (a) Using r-transformation followed by the Routh stability criterion, find the number of poles of the following transfer function that lie inside the unit circle on the z-plane.

$$G(z) = \frac{3z^4 + 2z^3 - z^2 + 4z + 5}{z^4 + 0{\cdot}5z^3 - 0{\cdot}2z^2 + z + 0{\cdot}4}$$ *5*

(b) State and explain the Nyquist stability criterion with example. *5*

6. How is transfer function converted into canonical state variable mode using Phase-variable method ? *10*

7. (a) Using the Cayley-Hamilton technique, find e^{At} for

$$A = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix}$$ *5*

(b) Explain the concept of controllability and observability of discrete time control system. *5*

8. Evaluate the state variable model of the given transfer function G(s) with the help of Jordan canonical method :

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

Also draw the state diagram of the model. *10*

9. (a) Consider the system shown in Figure 1. Find the range of values of "K" for which the system is stable using Jury's table : *5*

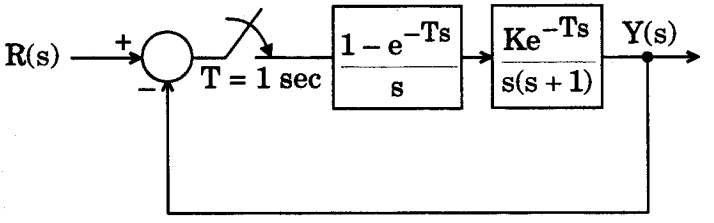

Figure 1

(b) What are the properties required to characterise the dead-beat response design ? *5*

10. Draw and explain the block diagram of PID controller. Differentiate non-interacting and interacting PID controllers in brief. *10*