LIB
27/5/13 FN

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 21482

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Seventh Semester

Instrumentation and Control Engineering

IC 2401/IC 71 – DIGITAL CONTROL SYSTEM

(Common to IC 71 Digital Control System for Electronics and Instrumentation Engineering)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the advantages of digital control system?

2. Draw the block schematic of a typical digital control system.

3. State Shanon's sampling theorem.

4. Name any two frequency domain characteristics.

5. Obtain the z transform of e^{-at}

6. State the necessary condition for Jury's stability test.

7. State the Jordan canonical form.

8. Define controllability and observability.

9. Compare position and velocity form of PID controller.

10. What is a state regulator?

PART B — (5 × 16 = 80 marks)

11. (a) Sketch the block diagram for general sampled data system. Explain the function and various steps involved with a flow chart.

Or

(b) (i) Explain the need and merits of digital control system. (8)

(ii) With diagram, Explain a typical flow control loop with digital control. (8)

12. (a) (i) Explain the data reconstruction process. (10)

(ii) How is the types of stability determined from the roots of the characteristic equation? (6)

Or

(b) Discuss the factors that limit the choice of sampling interval and also state the rules for selection of sampling interval.

13. (a) (i) Explain the Jury stability test. (8)

(ii) Determine the stability of the system defined by the characteristic equation $z^3 + 3.3z^2 + 4z + 0.8 = 0$. (8)

Or

(b) (i) Sketch a typical closed loop sampled data control system. (6)

(ii) Obtain the modified z transform of $G_p(s) = \dfrac{e^{-0.55}}{2s+1}$. (10)

14. (a) State and prove Caley-Hamilton theorem.

Or

(b) Draw the state diagram for the discrete-data system modeled by the following dynamic equations

$$x(K+1) = Ax(K) + Bu(K)$$

$$C(K) = Dx(K)$$

Find the transfer function $C(z)/U(z)$ and also determine the characteristic equation of the system if $A = \begin{bmatrix} -1 & 1 \\ -0.5 & 0.2 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ and $D = [1 \quad 0]$.

15. (a) (i) Write the equations of digital position and velocity forms of *P*, *PI* and *PID* controllers. (10)

(ii) Write a note on reduced state observers. (6)

Or

(b) Design a deadbeat controller for the following process $G_p(s) = \frac{1}{s(s+5)}$ with sampling interval $T = 1$ sec.
