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Question Paper Code : 60688

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Seventh/Eighth Semester

Instrumentation and Control Engineering

IC 2401/IC 71/10133 IC 701 — DIGITAL CONTROL SYSTEM

(Common to Electronics and Instrumentation Engineering)

(Regulations 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the general architecture of digital control system,
2. What are sampled data systems?
3. State Shanon's sampling theorem.
4. What is the transfer function of zero order hold?
5. Obtain the z transform of e^{-at}.
6. State the necessary condition for Jury's stability test.
7. What is state transition matrix?
8. What is the significance of pulse transfer function?
9. What is state regulator design?
10. Mention the characteristics of deadbeat response.

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) Differentiate between single-rate sampling and multirate sampling. Give example for such systems. (6)

(ii) Describe the Zero order Hold operation. (10)

Or

(b) Explain the characteristics of ideal sampler in Sampled data control systems.

13. (a) (i) Write a note on the computational rules for Z transform. (6)

(ii) For the sampled data control system shown in figure 13(a) find the expression c (kT). (10)

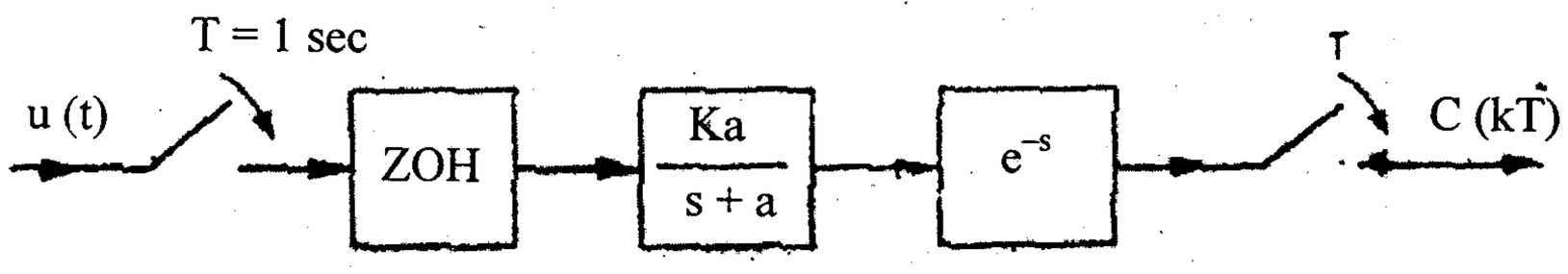

Figure 13(a)

Or

(b) (i) Explain the method of Jury stability criterion. (8)

(ii) Test the stability of the polynomial

$$Z^5 + 2.6z^4 - 0.56z^3 - 2.05z^2 + 0.0775z + 0.35 = 0\,.$$ (8)

14. (a) (i) Convert the transfer function $\dfrac{1.65(z+0.1)}{z^3 + 0.7z^2 + 0.11z + 0.005}$ into state space representation. (8)

(ii) Find the state transition equation of the systems with initial states at $x(0)$ has $A = \begin{bmatrix} 0 & 1 \\ 0.5 & 0.3 \end{bmatrix}$; $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$. (8)

Or

(b) (i) Illustrate Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix}$. (8)

(ii) Find the state controllability of a discrete data control system described by state equation. (8)

$$x(k+1) = Ax(k) + Bu(k);\ A = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0.5 & 0 \\ 0 & 0 & 2 \end{bmatrix} B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}.$$

15. (a) Derive the Position and velocity forms of a digital PID controller with neat illustration. (16)

Or

(b) . Illustrate and explain the process of dead beat control by state feedback. (16)
