

C 41262

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Name.....

Reg. No.....



**SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE
EXAMINATION, MAY 2013**

AI 09 604—ADVANCED CONTROL THEORY

(2009 Admission onwards)

Time : Three Hours

Maximum : 70 Marks

Part A

Answer all questions.

1. Define Ackermann's formula.
2. Draw the structure of a full Order Observer.
3. Define State transition matrix. List out its properties.
4. Write the transfer function of a PI-controller.
5. Draw the graphical representation of stable, asymptotically stable, and unstable system in the sense of Liapunov.

(5 × 2 = 10 marks)

Part B

Answer any four questions.

6. What is Pole placement by state feedback and state Observer.
7. Find the stability of the following system using Jury's test :

$$F(z) = 5z^2 - 2z + 2 = 0.$$

8. Construct a state model for a system characterized by the difference equations

$$y(k+2) + 5y(k+1) + 6y(k) = u(k)$$

$$y(0) = y(1) = 0 ; T = 1 \text{ sec.}$$

9. What is P-controller and what are its characteristics ?
10. Show that the following quadratic form is positive definite :—

$$V(x) = 10x_1^2 + 4x_2^2 + x_3^2 + 2x_1 x_2 - 2x_2 x_3 - 4x_1 x_3.$$

11. Explain Liapunov stability analysis of LTI Systems.

(4 × 5 = 20 marks)

Turn over

Part C

Answer all questions.

12. (A) Investigate the controllability and absorbability of the following system :—

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -1 & 1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u.$$

$$y = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$

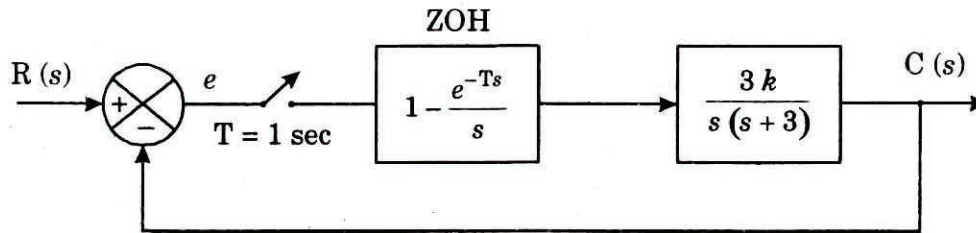
Or

- (B) Consider the system with Transfer function $G(s) = \frac{10}{s(s+1)(s+2)}$. Design a state feedback controller so that the closed loop poles are placed at $-2, -1 \pm j1$.

13. (A) Obtain the state model of the following system $G(s) = \frac{(s+3)}{(s+5)(s+2)^2}$.

Or

- (B) Find the range of gains, K to make the system stable



14. (A) Explain the effects of proportional, Integral, derivative and composite control modes on the response of a controlled process.

Or

- (B) Write short notes on :

- (i) Ziegler Nichol's tuning.
- (ii) Cohen and Coon tuning.

15. (A) Determine the stability of the equilibrium state of the following system using Liapunov method.

$$\dot{x}_1 = -x_1 - 2x_2$$

$$\dot{x}_2 = x_1 - 4x_2$$

the Liapunov functions.

Or

- (B) Explain robust Internal model control system in detail.

(4 × 10 = 40 marks)