

C 26775

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Name.....

Reg. No.....

**SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
MAY 2012**

**AI 09 604—ADVANCED CONTROL THEORY
(2009 Admissions)**



Maximum : 70 Marks

Time : Three Hours

Part A

Answer all questions.

1. Draw the block diagram representation of the state equation.
2. Define a MIMO system.
3. List out different types of state space representations used.
4. Write the expressions of a PID controller transfer function.
5. Define 'definiteness'. What are different types of 'definiteness' ?

(5 × 2 = 10 marks)

Part B

Answer any four questions.

6. Briefly describe the configuration of an observer.
7. The input-output relation of a sampled data system is described by the equation

$$y(k+2) + 5y(k+1) + 6y(k) = x(k+1) - x(k). \text{ Determine its pulse transfer function.}$$

8. Explain state transition matrix of discrete time system.
9. What is PI controller and what are its effect on system performance ?
10. Determine whether the following quadratic form is negative definite

$$V(x) = -x_1^2 - 3x_2^2 - 11x_3^2 + 2x_1x_2 - 4x_2x_3 - 2x_1x_3.$$

11. Briefly explain Direct method of Liapunov stability analysis.

(4 × 5 = 20 marks)

Turn over

Part C

Answer all questions.

12. (A) Determine whether the following system is completely controllable and observable

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ -0.8 \end{bmatrix} u, y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Or

- (B) Design a state feed back controller for the system
- $\dot{X} = \begin{bmatrix} 1 & -1 \\ 1 & -2 \end{bmatrix} X + \begin{bmatrix} 1 \\ 2 \end{bmatrix} u$
- to place the poles at
- $-1, -2$
- .

13. (A) Obtain the solutions of homogeneous and non-homogeneous state equations.

Or

- (B) Consider a discrete time unity feedback control system (sampling period
- $T = 1$
- sec.) whose open loop pulse transfer function is given by

$$G(z) = \frac{K(0.3679z + 0.2642)}{(Z - 0.3679)(z - 1)}$$

Determine the range of gains 'K' for stability by use of Jury's stability test.

14. (A) What are different types of tuning techniques. Explain in detail.

Or

- (B) Explain P, PI, PID controllers and obtain their circuitry realizations.

15. (A) (i) Briefly explain different types of definiteness with an example.

- (ii) Consider the following system described by

$$\dot{x}_1 = x_2$$

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

Determine the stability of the system by Liapunov method.

Or

- (B) Write short notes on :

- (i) Robust internal model control system.
- (ii) Robust PID controlled systems.

(4 × 10 = 40 marks)