

C 14729

(Pages 3)

Name.....

Reg. No.....

**SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE
EXAMINATION, DECEMBER 2010**

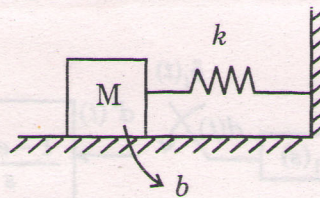
AI 04 605—ADVANCED CONTROL THEORY

Time : Three Hours

Maximum : 100 Marks

Answer all questions.

1. (a) Explain the Basic concept of phase plane method.
- (b) Define Linear and non-linear control system.
- (c) Explain any two properties of z-transform in detail.
- (d) Determine the z-transform of the following discrete unit step sequence $f(k) = u(k)$.
- (e) Discuss about the alterian for good controllers.
- (f) Write short notes about auto tuning features.
- (g) A simple Mask, spring, friction system is given below :



Show that the system is stable.

- (h) Discuss about the Robust PCD controlled system design procedure. (8 × 5 = 40 marks)
2. (a) Consider the system described by the state model.

$$\dot{X} = AX$$

$$Y = CX$$

$$\text{where } A = \begin{bmatrix} -1 & 1 \\ 1 & -2 \end{bmatrix} \quad C = [1 \ 0].$$

Design a full order state observer. The desired eigenvalues for the observer matrix are $\mu_1 = -5; \mu_2 = -5$.

(15 marks)

Or

Turn over

(b) Consider a linear system described by the equation :

$$\dot{X} = \begin{bmatrix} 1 & 2 & 0 \\ 3 & -1 & 1 \\ 0 & 2 & 0 \end{bmatrix} X + \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix} u$$

$$= AX + BU$$

$$Y = [0 \quad 0 \quad 1] X$$

$$= CX$$

Check whether the system is observable.

(15 marks)

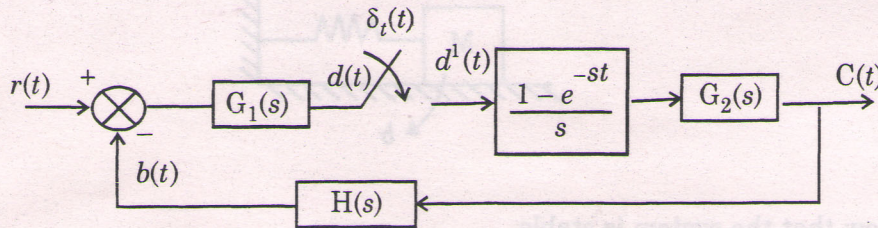
3. (a) Check for the stability of the following characteristic equation by Jury stability test :—

$$z^3 - 0.2z^2 - 0.25z + 0.05 = 0.$$

(15 marks)

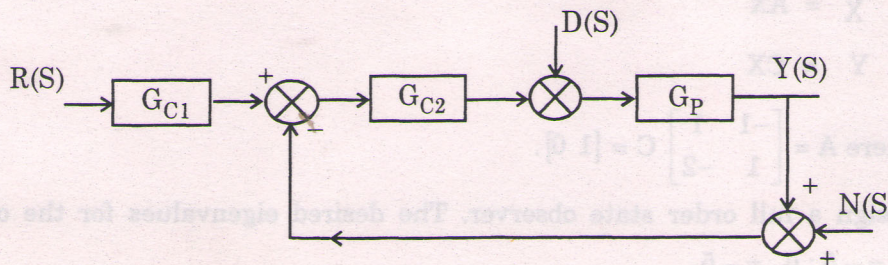
Or

(b) Find output C(Z) in Z-domain for the closed loop sampled data control system shown below :



(15 marks)

4. (a) Show that the control system shown below is two degree of freedom system.



(15 marks)

Or

(b) Explain the Cohen and Coon rules for tuning PID controller.

(15 marks)

5. (a) Consider the second order system described by :

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

clearly, the equilibrium state is the origin. Determine the stability of the state.

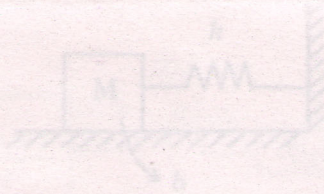
(15 marks)

Or

(b) Explain the direct method for constructing Liapunor function for Linear system.

(15 marks)

[4 × 15 = 60 marks]



Show that the system is stable.

(10) Discuss about the Robust PCD controlled system design procedure.

(3 × 5 = 15 marks)

2. (a) Consider the system described by the state model.

$$\dot{X} = AX$$

$$Y = CX$$

$$\text{where } A = \begin{bmatrix} -1 & 1 \\ 1 & -2 \end{bmatrix} \quad C = [1 \ 0]$$

Design a full order state observer. The desired eigenvalues for the observer matrix are

$$p_1 = -5; p_2 = -5.$$

(15 marks)

Or

Turn over