Code No: RR410205

Set No.1

IV B.Tech. I Semester Regular Examinations, November -2005
ADVANCED CONTROL SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Suppose if the system equations are known in Jordan form. How do you test the properties of controllability? Explain using a state model. [16]

2. State, prove and explain Lyapunovs stability theorm. Also explain what are the sufficient conditions of stability. [16]

3. (a) Explain the different methods used to find the state feedback gain matrix and compare them?

   (b) Consider a linear system described by the transfer function

   $\frac{Y(s)}{u(s)} = \frac{10}{s(s+2)(s+1)}$

   Design a feed back controller with a state feedback so that the eigen values of the closed loop system are at $-2, -1 \pm$ j1. [6+10]

4. (a) Explain Minimum - Time problem?

   (b) Explain State Regulator problem in brief? [8+8]

5. Illustrate with an example the problem with terminal time t_1 fixed and x (t_1) free. [16]

6. (a) State and prove optimal control problem based on dynamic programming in discrete time system

   (b) Explain the principles of causality and invariant imbedding. [16]

7. (a) Explain the popular inherent nonlinear elements and their functionalities.

   (b) Derive the Describe function for an on-off nonlinearity. [6+10]

8. Draw a phase-plane portrait of the system defined by [16]

   $\dot{x}_1 = x_1 + x_2$

   $\dot{x}_2 = 2x_1 + x_2$

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Code No: RR410205 **Set No.2**

IV B.Tech. I Semester Regular Examinations, November -2005
ADVANCED CONTROL SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. Suppose if the system equations are known in Jordan form how do you test the properties of observability? Explain using a state model. [16]

2. State stability in the sense of Lyapunov. Explain in terms of an example. [16]

3. (a) Explain the method of determining of transformation matrix for controllability.
   (b) Prove that if the n-dimensional linear time-invariant single-input system is controllable, then it can be transformed, by an equivalence transformation, into the controllable companion form. [8+8]

4. (a) Discuss the nature of information about the plant supplied to the controller?
   (b) Write short notes on Design of optimum controllers? [10+6]

5. Illustrate with an example the problem with terminal time $t_1$freeandx(t_1)fixed [16]

6. Derive the recurrence relation required to be solved in the dynamic programming problem of a multiple decision process in direct time. [16]

7. (a) Explain the popular intentional nonlinear elements and their functionalities.
   (b) Derive the Describe function for Saturation nonlinearity. [6+10]

8. Draw a phase-plane portrait of the following system: [16]
   $\ddot{x} + \dot{x} + |x| = 0$

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Code No: RR410205 **Set No.3**

IV B.Tech. I Semester Regular Examinations, November -2005
ADVANCED CONTROL SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Suppose you are given a n-dimensional linear time-invariant system. How do you transform into a observability canonical form? State and prove the theorem used. [16]

2. What are the different types of stability? Define and explain each of them with examples. [16]

3. (a) How will you find the transformation matrix for observability.

   (b) The state model of a system is given by

   $$\begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} u \; ; \; y = [1 \quad 0 \quad 0] \; X$$

   Convert the state model to observable phase variable form. [6+10]

4. Write short notes on minimum time control law and prove the same. [16]

5. Illustrate with an example the problem with terminal time $t_1$and$x(t_1)$free. [16]

6. (a) Give the algorithm of Dynamic programming problem by representing through a flow chart.

   (b) What is Multistage decision process in Discrete-Time? [16]

7. (a) Explain the effect of inherent nonlinearities on static accuracy.

   (b) Derive the Describe function for an on-off nonlinearity with hysteresis.[6+10]

8. Draw a phase-plane portrait of the following system: [16]

   $$\ddot{\theta} + \dot{\theta} + \sin\theta = 0$$

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Code No: RR410205 **Set No.4**

IV B.Tech. I Semester Regular Examinations, November -2005
ADVANCED CONTROL SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. State and prove canonical decomposition theorem. [16]

2. State any two properties of B1 B0 and explain them. [16]

3. (a) Explain the linear system with full-order state observer with neat block diagram.
   (b) Design a full-order state observer for the given state model.
   $Given\ A = \begin{bmatrix} 1 & -1 \\ -2 & 1 \end{bmatrix};\ C = [1,\ 0]$
   and given values are $\mu_1 = -5, \mu_2 = -5$ [16]

4. (a) What are the steps followed for finding solution to optimal control problem?
   (b) What are the factors to be considered for designing of optimum controller. [10+6]

5. Illustrate with an example the problem with terminal time $t_1$andx(t_1)freebutrelated. [16]

6. (a) Formulate the continuos time process as a multi state decision process
   (b) What is the principle causality. [16]

7. (a) Explain the subharmonic oscillations and self-excited oscillations.
   (b) Derive the Describe function for Dead-Zone nonlinearity. [8+8]

8. (a) Explain the isocline method for construction of phase -plane portrait.
   (b) Determine the locations and types of singular points of the nonlinear system described by [8+8]
   $$\dot{x}_1 = 0.3 - 0.1x_1 + x_2 - 0.188x_1^2 - 0.75x_2^3$$
   $$\dot{x}_2 = -0.25x_1 - 0.1x_2 + 0.047x_2^3 + 0.188x_1\,x_2^2$$

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