Code No: RA410201 **RA**

**IV B.Tech I Semester Regular Examinations, November/December 2005**
**ADVANCED CONTROL SYSTEMS**
**(Electrical and Electronics Engineering)**

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

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. State the basic theorem for determining the concept of controllability of time varying system utilizing state transition matrix. Explain the same with proof. [16]

2. (a) What do you mean by asymptotic stability? Explain.
   (b) State and explain the Lyapunovs stability theorem. [16]

3. (a) Consider the system with
   $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ $B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 1 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
   Obtain equivalent system in controllable companion form.
   (b) Obtain equivalent observable companion form for the system given in (a) [16]

4. (a) Discuss the nature of information about the plant supplied to the controller.
   (b) Write short notes on Design of optimum controllers? [16]

5. (a) Explain the minimum principle of Pontyagin and how it effects the conditions for optimality.
   (b) Find the curve of minimum length joining the origin and line y(t) = 2 - t [16]

6. Find the control vector which minimizes
   $J = \frac{1}{4}x^2(t_1) + \frac{1}{4}\int_0^{t_1} 4^2(t)dt$, $t_1$ specified for the system described by $\dot{x} = x + 4$ Use Hamilton-Jacobi equations to find the optimum control vector. Comment on your result when $t_1 \to \infty$.

7. (a) Explain the subharmonic oscillations and self-excited oscillations.
   (b) Derive the describe function for zone nonlinearity. [16]

8. (a) Explain the delta method for construction of trajectories of second order dynamical systems.
   (b) Consider the system escribed by the following equation: $\ddot{x} + \dot{x} + x^3 = 0$. Given the initial conditionsx(0)=1, $\dot{x}(0)$=0, construct the trajectory starting at the initial point. [16]

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