Roll No ....

MEIC-202
M.E./M.Tech., II Semester
Examination, June 2013
Optimal and Adaptive Control

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.
ii) All questions carry equal marks.

1. Explain pontryagin maximum principle A system is described by the equation

$$\dot{x}_1(t) = x_2(t)$$

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$$\dot{x}_2(t) = x_2(t) + u(t)$$

The performance index to be minimized is

$$J = \frac{1}{2}\int_0^{t_1}(x^2 + u^2)dt$$

The control inequality conditions are given by $|u(t)| \leq U$ for $tt(t_0, t_1)$. Determine the optimal control law using pontryagin's minimum principle.   14

2. Find the equation of the curve which minimizes the functional

$$J = \int_{t_0}^{t_1}\left(\frac{1}{2}\dot{x}^2 + x\dot{x} + \dot{x} + x\right)dt$$

You can consider unspecified boundary conditions.   14

3. Develop Hamiltonian model for solving the optimal control problem. What are its advantage and disadvantage.   14

4. A linear differential equation is described by

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}x + \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}u$$

Where $X^T = \begin{bmatrix} x_1 & x_2 \end{bmatrix}$ and $U^T = \begin{bmatrix} u_1 & u_2 \end{bmatrix}$ Find the control vector u such that $J = \frac{1}{2}\int_0^4\|u\|^2 dt$ is minimum given $X^T(0) = \begin{bmatrix} 1 & 1 \end{bmatrix}$ and $x_1(4) = 0$.   RGPVONLINE.COM   14

5. What is meant by singular solution while optimizing a functional? Explain with suitable examples.   14

6. Explain model reference adaptive control using a chemical process plant model.   14

7. Differentiate between: 14
   a) Plant model and reference model
   b) Hearing model approach and adaptive autopilot.

8. Write short notes on any two: 14
   a) Solution of Matrix Riccati equation.
   b) Sensitivity of optimal systems
   c) Input signal adaptive system.

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