R09

Code No: D7501

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH II - SEMESTER EXAMINATIONS, APRIL/MAY 2012
OPTIMAL CONTROL THEORY
(CONTROL SYSTEMS)

Time: 3hours **Max. Marks: 60**

Answer any five questions
All questions carry equal marks
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1.a) Explain in detail about optimal control system.
b) Explain the principle of optimality in decision making process.

2.a) Explain the characteristics of dynamic programming solution.
b) Explain the procedures for solving control problems using dynamic programming.

3.a) Explain discrete linear regulator problem with an example.
b) Derive the transversality condition of the calculus of variations.

4.a) Explain the necessary conditions for optimal control in linear regulator problems.
b) Given the optimal feedback system for $\dot{x} = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$ with the performance index $\int_0^\infty (6\chi_1^2 + u^2)\, dt$. Find optimal value using Pontryagin's principle.

5.a) Explain in detail about the steepest descent algorithm with an example.
b) Explain the nature of state estimation problem with an example.

6.a) With a suitable block diagram explain the non statistical estimation with full estimator and explain the procedure.
b) Design an estimator for $\dot{x}(t) = \begin{bmatrix} 1 & -2 \\ -2 & 0 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(t)$ $y(t) = [0\ 1]\, x(t)$ such that the estimator dynamics has two Eigen values of -5.

7.a) Given $\dot{x} = x + u$, $x(0) = x^0$ and $x(2) = x^2$. Find U that minimizes $J = \int_0^2 (x^3 + u^3)\, dt$.
b) Draw the flow chart for variation of extremal algorithm.

8. Write short notes on
a) Regulator problem in feedback form.
b) Explicit solution of the optimal estimation problem.

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