國 立 臺 北 科 技 大 學

九十六學年第一學期電機系博士班資格考試

最 佳 控 制 試 題

填 學 生 證 號 碼

注意事項：

1. 本試題共【6】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。

1. (20 %) What kind of optimization problems are solved by using the Lagrange multiplier method? What is the merit of this method?

2. (15 %) What is the Pontryagin's Minimum Principle?

3. (10 %) What is the principle of optimality in dynamic programming?

4. (15 %) A major difficulty when solving the algebraic Riccati equation is it is a nonlinear equation. In general, how to solve the ARE? Explain it!

5. (20 %) Consider a system:

$$\ddot{\theta}(t) = u(t).$$

with $\theta(0) = 1$, $\theta(2) = 0$, $\dot{\theta}(0) = 1$, $\dot{\theta}(2) = 0$. Derive the control input such that the performance index $J(x) = \frac{1}{2}\int_0^2 \ddot{\theta}^2(t)dt$ will be minimized.

6. (20 %) Consider a system:

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

with the performance index: $J = \frac{1}{2}\int_0^\infty (x^T \begin{bmatrix} q_1 & 0 \\ 0 & q_2 \end{bmatrix} x + u^2)dt$.

Derive the control input $u(t)$.