國　立　宜　蘭　大　學

１０３學年度研究所碩士班考試入學

自動控制試題

（電機工程學系碩士班）

准考證號碼：

《作答注意事項》

1.請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。

2.考試時間：100 分鐘。

3.本試卷共有 五 題，共計 100 分。

4.請將答案寫在答案卷上。

5.考試中禁止使用大哥大或其他通信設備。

6.考試後，請將試題卷及答案卷一併繳交。

7.本考科可使用非程式型（不具備儲存程式功能）之電子計算機。

1. Find the region for parameter a such that the system with a characteristic equation

$$s^5 + 4s^4 + 8s^3 + 8s^2 + as + 4 = 0$$

is stable. (15%)

2. For a unit feedback system with the open-loop transfer function G(s),

$$G(s) = \frac{1 + 2s}{2s^2 + 3s + 1}$$

(1) Find the steady-state error if the input is $r(t) = 3u(t)$ ($u(t)$ is a unit step function) (15%)

(2) Design a controller to eliminate the steady-state error. (15%)

3. For the system with the following state equation,

$$\dot{X} = AX + Bu$$

If $u = 0$ and $A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 3 & 0 \\ 0 & 1 & 2 \end{bmatrix}$, is the system stable? Explain the reason. (10%)

4. For a nonlinear system with the input u,

$$2\ddot{y} = -3y^2\dot{y} - ay + u$$

(1) Linearize the system with $y = 1$, and $\dot{y} = 0$ (10%)

(2) Find the characteristic equation for the linearized system. (10%)

(3) Find the region for parameter a such that the linearized system is stable. (10%)

5. Find the inverse z-transform for $X(z) = \frac{z}{z^2+0.3z+0.2}$ (15%)