國 立 宜 蘭 大 學

１０２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 5 題問答題，一題 20 分，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. Give the control system in Fig. 1, find the value of **K** so that there is **5%** error in the steady sate.
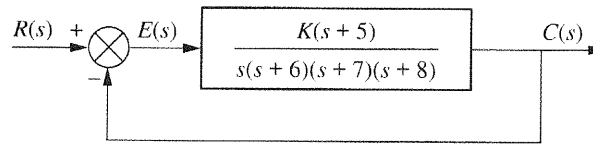

Fig.1 A unity feedback control system.

2. Given a unity feedback system that has the forward transfer function $G(s) = \dfrac{K(s+2)}{s^2 - 4s + 13}$

   Do the following:
   a. Sketch the root locus.
   b. Find the imaginary-axis crossing.
   c. Find the gain, K, at the jw-axis crossing.
   d. Find the break point.
   e. Find the angle of departure from the complex poles.

3. Give the system represented in state space as follows.

$$\dot{x}(t) = \begin{bmatrix} 0 & 2 \\ -3 & -5 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} e^{-t}$$

$$y = \begin{bmatrix} 1 & 3 \end{bmatrix} x, \quad x(0) = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

Solve for $y(t)$.

4. Given a second-order system with two poles (-3 + j7, -3 + -j7), find ζ(damping ration), w_n(natural frequency), Tp(peak time), %OS (percent overshot) and T_s(setting time).

5. Determine whether the system is controllable or not.

$$\dot{x} = Ax + Bu = \begin{bmatrix} -1 & 1 & 2 \\ 0 & -1 & 5 \\ 0 & 3 & -4 \end{bmatrix} x + \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix} u$$