

國立臺北科技大學 111 學年度碩士班招生考試

系所組別：1112 機械工程系機電整合碩士班甲組

第二節 自動控制 試題 (選考)

第 1 頁 共 1 頁

注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

4. When $C(s) = K$, $P(s) = 1/(s^4 + 12s^3 + 64s^2 + 128s)$, $D(s) = N(s) = 0$, answer the following questions:
 - (a) Determine the root locus on the real axis. (4%)
 - (b) Determine the angles and centroid of asymptotes. (4%)
 - (c) Determine the breakaway point. (4%)
 - (d) Determine the points of the root locus crossing the imaginary axis, and the corresponding value of K . (4%)
 - (e) Determine the departure angle of its root locus at the complex poles. (4%)
5. When $P(s) = (s + 1)/[(s - 1)(s - 2)]$, please find the controller design $C(s)$ that places the closed-loop system pole to $-1, -2, -3$. (20%)

Consider the closed-loop system in Figure 1.

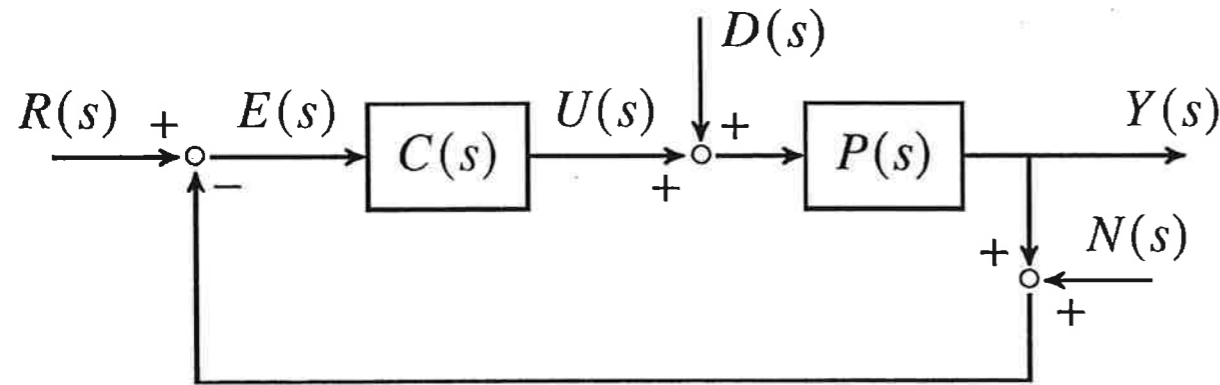


Figure 1. Closed-loop system.

Please answer the following questions:

1. In this block structure:
 - (a) Verify the transfer function $T_1(s) = Y(s)/R(s)$ and $T_2(s) = E(s)/D(s)$ in terms of $P(s)$ and $C(s)$. (10%)
 - (b) What are the definitions of gain margin and phase margin? (10%)
2. When $P(s) = (6s + 8)/(s^2 - s - 2)$, $C(s) = 1$:
 - (a) What are the poles and zeros of $P(s)$? (10%)
 - (b) Find the gain margin, phase margin, and crossover frequencies of the closed-loop system $T_1(s) = Y(s)/R(s)$. (10%)
3. If $P(s) = (6s + 8)/(s^2 - s - 2)$, $C(s) = 1$, $R(s) = 1/s$, $D(s) = N(s) = 0$:
 - (a) Please calculate the output response $y(t)$, where $y(t)$ is the result of inverse Laplace transform of $Y(s)$. (10%)
 - (b) Calculate $\lim_{t \rightarrow \infty} e(t)$, where $e(t)$ is the result of inverse Laplace transform of $E(s)$.