

國立中正大學

112 學年度碩士班招生考試

試題

[第 3 節]

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| 科目名稱 | 自動控制 |
| 系所組別 | 機械工程學系光機電整合工程 |

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

國立中正大學 112 學年度碩士班招生考試試題

科目名稱：自動控制

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系所組別：機械工程學系光機電整合工程

1. (25%) Consider the dynamics G with the input-output relationship governed by

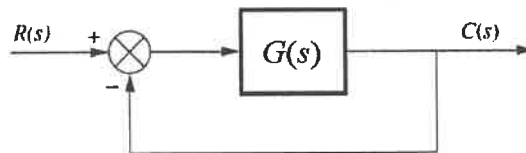
$$y(t) + \int_0^t y(\tau) d\tau = u(t), \text{ for } \forall t \geq 0,$$

where u is the input and y is the output.

- (a) (5%) Prove that the transfer function of the dynamics G is $G(s) = \frac{s}{s+1}$.
- (b) (5%) What is the unit-pulse response of G ?
- (c) (5%) Infer the unit-step response of G from the unit-pulse response in (b).
- (d) (5%) What is the frequency response of G ?
- (e) (5%) Is G a low-pass filter? Why or why not?
2. (25%) Consider the dynamics G with the transfer function being

$$G(s) = \frac{21s^2 + 21s + 20}{(s+20)(s^2 + s + 1)}.$$

- (a) (5%) Is G bounded-input-bounded-output stable?
- (b) (5%) What is the steady-state error of the unit-step response?
- (c) (5%) Estimate the rising time of the unit-step response.
- (d) (5%) Estimate the overshoot of the unit-step response.
- (e) (5%) Estimate the settling time of the unit-step response.
3. (20%) Please apply magnitude and angle condition to check if the following test points are going to be passed by the root-locus and find its K .



$$G(s) = \frac{K(s+4)(s+5)(s+6)}{(s+7)(s+8)(s+9)}$$

$s = -7.5$

(a)

$s = -10$

(b)

$s = -4.5$

(c)

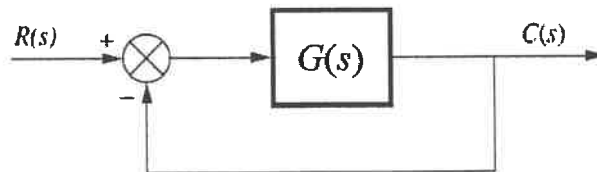
$s = -5 - 3j$

(d)

$s = -6 + 2j$

(e)

4. (20%) Please plot the root locus with its asymptotes and intersection point.



$$G(s) = \frac{K}{(s - P_1)(s - P_2)(s - P_3)(s - P_4)}$$

where $P_1 = -5 + i; P_2 = -5 - i; P_3 = -3 + i; P_4 = -3 - i$

5. (10%) Please use asymptotic approximations to plot the Bode plot (ω within $[10^{-2}, 10^2]$) for $G(s) = s$ and $G(s) = 1/s$.