

# 國立中央大學九十一年度碩士班研究生入學試題卷

所別: 電機工程學系 丙組 科目: 控制系統 共    / 頁 第    / 頁

1. Consider a system:

$$\begin{cases} \dot{x} = \begin{bmatrix} 0 & 1 \\ -8 & -6 \end{bmatrix} x + \begin{bmatrix} 0 \\ 8 \end{bmatrix} u \\ y = [2 \quad 1] x \end{cases}$$

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Suppose that  $x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$  and  $u = 2t \text{ u(t)}$ , where  $u(t) = \text{unit step function}$ .  
Find  $y(t)$ .

2. Consider a unit feedback system with the open-loop transfer function:

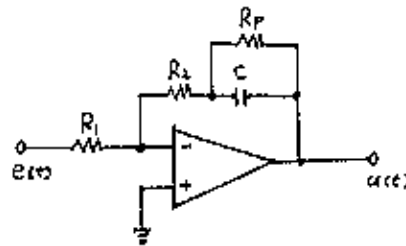
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$$\frac{s+2}{s(s+1)(s^2+2s+2)}$$

Find the gain margin.

3. Explain what kind of controller the following circuit is.

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Suppose  $R_1 = R_2 = R_f = 1 \text{ M}\Omega$ ,  
 $C = 1 \mu\text{F}$ .

4. A closed-loop system has the state equations

$$\begin{aligned} \dot{x}(t) &= \begin{bmatrix} -1 & 0 & 0 \\ 0 & 2 & 0 \\ -1 & -2 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t) \\ y(t) &= [1 \quad 0 \quad 0] x(t) \end{aligned}$$

- (a) Calculate the system characteristic equation. (5%)  
(b) Use the results in (a) to determine system stability. (10%)

5. Given the compensator transfer function

$$G_c(s) = \frac{0.5s + 0.005}{s + 0.02}$$

- (a) Find the dc gain of the compensator. (7%)  
(b) Find the high-frequency gain of the compensator. (7%)  
(c) Is the compensator phase-lead or phase-lag. Why? (7%)

6. In the system of Figure 1, write state equations for the system such that  $x_1(t)$  is the state for the upper block and  $x_2(t)$  is the state for the lower block.

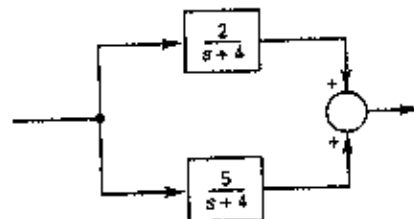


Figure 1

- (a) Determine if this system is controllable. (7%)  
(b) Determine if this system is observable. (7%)

參考用