

國立高雄應用科技大學  
100 學年度碩士班招生考試  
機械與精密工程研究所（乙組）

准考證號碼  （考生必須填寫）

自動控制

試題 共 3 頁，第 1 頁

- 注意：a. 本試題共 5 題，每題 20 分，共 100 分。  
b. 作答時不必抄題。  
c. 考生作答前請詳閱答案卷之考生注意事項。

1. The second order system with overall transfer function  $\frac{Y(s)}{U(s)} = \frac{4}{s^2 + 2s + 4}$  is applied a unit step input  $u(t) = 1$ . Assume that all the initial conditions are zero.
- (1) Find the damping ratio, natural frequency, and damped natural frequency of the system. (5%)
  - (2) Find the transient response of the system. (5%)
  - (3) Find the peak time and maximum overshoot of the system. (5%)
  - (4) Find the steady state output of the system and settling time within 5% of the final value. (5%)

2. For the control system shown in Figure 1, the transfer functions are given as

$$G_1(s) = \frac{1}{s+2}, \quad G_2(s) = \frac{1}{s+1}, \quad \text{and } H(s) = 1.$$

- (1) Find the overall transfer function relating  $R(s)$  and  $Y(s)$ . (5%)
- (2) Find the overall transfer function relating  $R(s)$  and  $E(s)$ . (5%)
- (3) Find the transient response of the system with an impulse input  $r(t) = \delta(t)$ . (5%)
- (4) Find the transient response of the system with a sinusoidal input  $r(t) = \sin t$ . (5%)

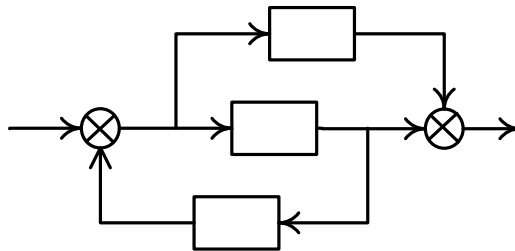


Figure 1

3. The control system shown in Figure 2 has a forward-path transfer function

$$G(s) = \frac{K(s+3)}{(s+2)(s-2)} \quad \text{and negative unit feedback loop.}$$

- (1) Find the value of the gain  $K$  for stability. (5%)
- (2) Find the break-in and breakaway points. (5%)
- (3) Sketch the root-locus diagram of the system. (10%)

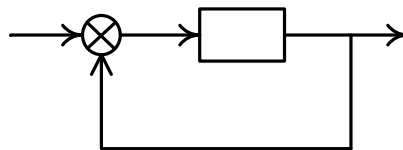


Figure 2

$R(s)$  +  $E(s)$

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4. The overall transfer function of the system is  $G(s) = \frac{s}{(s+2)(s^2+2s+4)}$ .

(1) Find the equations for magnitude and phase. (5%)

(2) Construct bode diagrams for  $s$ ,  $\frac{1}{s+2}$ , and  $\frac{1}{s^2+2s+4}$  individually using

Figure 3. (15%)

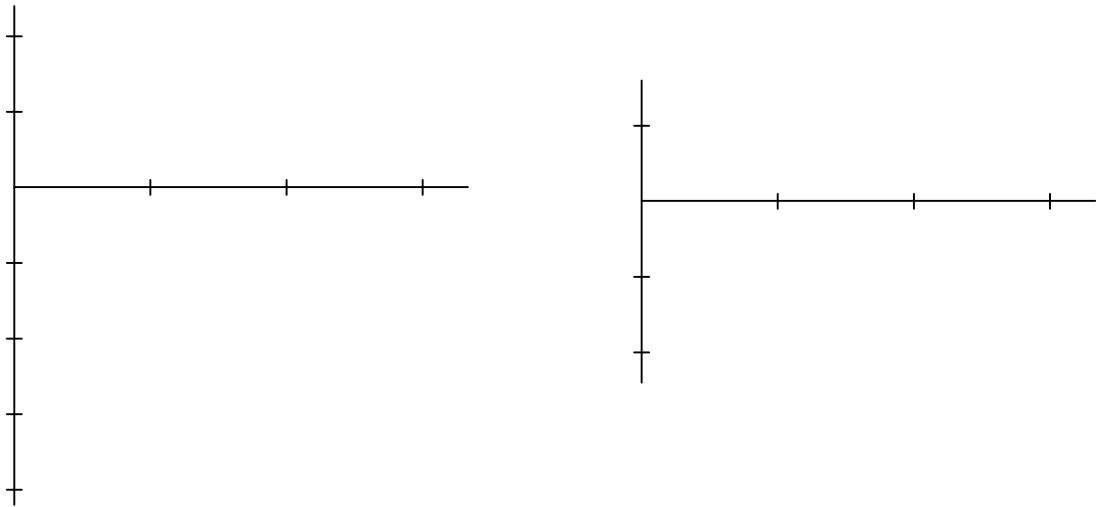


Figure 3

5. The control system with overall transfer function  $\frac{Y(s)}{U(s)} = \frac{s+3}{s^2+3s+2}$  is applied an impulse input  $u(t) = \delta(t)$ . Assume that all the initial conditions are zero.

(1) Find the state space equation  $\dot{X} = AX + BU$  and output equation  $Y = CX$ . (5%)

(2) Find the characteristic equation and matrix  $(sI - A)^{-1}$ . (5%)

(3) Find state variable  $x(t)$  and output  $y(t)$ . (10%)

