國立臺灣師範大學 101 學年度碩士班招生考試試題

科目：控制系統　　　　　　　　　　　　　適用系所：應用電子科技學系

注意：1.本試題共乙頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

1. (共 20 分) Consider following system shown in Fig. 1, where

$$G_P(s) = \frac{1}{(s+1)(s+2)}.$$

(a) Sketch the Nyquist diagram for the system. (10 分)

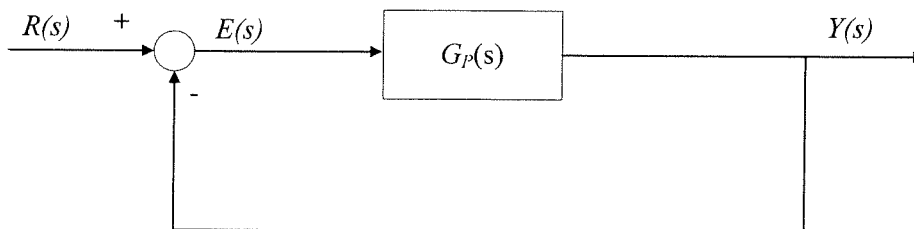(b) Use the Nyquist criterion to determine if the system is stable? (10 分)

Fig. 1

2. (共 20 分)

For the system shown in Fig. 1, where

$$G_P(s) = \frac{10}{s^2(1+s)(1+10s)},$$

find the steady-state error with an input of $r(t) = 4 + 6t + 3t^2$, $t \geq 0$.

3. (共 20 分)

Consider the system given by $\dot{\mathbf{x}}(t) = \begin{bmatrix} 2 & 0 \\ -1 & 1 \end{bmatrix}\mathbf{x}(t) + \begin{bmatrix} 1 \\ -1 \end{bmatrix}u(t), \quad y(t) = [1 \quad 1]\mathbf{x}(t)$.

(a) Determine if the system is controllable ? (10 分)

(b) Determine if the system is observable ? (10 分)

4. (共 20 分)

Consider the following system shown in Fig. 2 below.

(a) Find the equivalent single block that represents the transfer function ,

$$T(s) = \frac{C(s)}{R(s)} = ? \,(10 \text{ 分})$$

(b) Determine the damping ratio, percentage overshoot, settling time, rise time, and damped frequency of oscillation subject to a step input. (10 分)
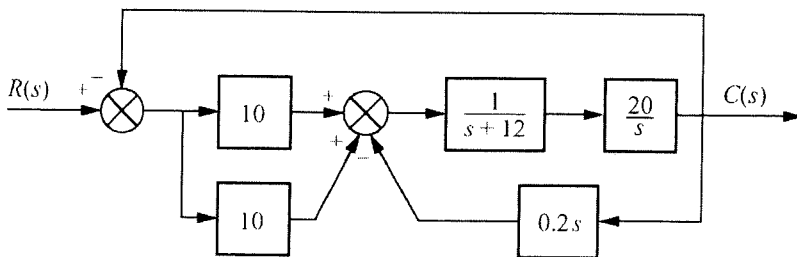
Fig. 2

5. (共 20 分)

A system is represented by the state and output equations:

$$\dot{\mathbf{x}} = \begin{bmatrix} 0 & 2 & 3 \\ 0 & 6 & 5 \\ 1 & 4 & 2 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} u, \quad y = [1 \quad 2 \quad 0]\mathbf{x}$$

(a) Find the characteristic equation. (10 分)

(b) Find the poles of the system. (10 分)