

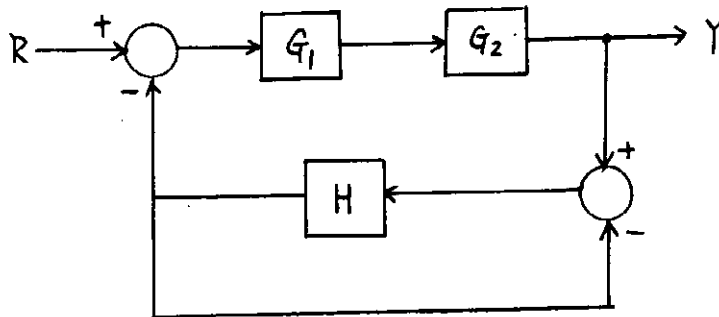
## 八十五學年度國立台灣工業技術學院研究所碩士班招生考試

所別：電子工程技術研究所

組別：系統組

科目：控制系統

1. Consider a system with the block diagram shown below.



(a) Find its transfer function  $G = \frac{Y}{R}$ . (10%)

(b) Let  $H = 1$ ,  $G_1 = \frac{1}{s}$ , and  $G_2 = \frac{4}{s+3}$ . Please find the output  $y(t)$  and the dc gain of the system, when the input is a unit-step function. (10%)

2. For a unity feedback system with the loop transfer function

$$L(s) = \frac{K}{(s+1)(s+2)(s+3)}, \quad K > 0.$$

(a) Determine the range of  $K$  for the system to be stable. (10%)

(b) Find the system poles on the  $j\omega$  axis when the system is about to go into instability. (10%)

(c) Provided that the system has a second-order pole, determine its location. (10%)

(d) If a pole is located at  $(-4, j0)$ , determine the closed-loop transfer function of the system.

What's the damping ratio  $\zeta$  for the dominating pair of poles? (10%)

(e) Let  $K = 30$ . Please find the system's gain margin  $GM$  in decibels. (10%)

(f) Let  $K = 7 >$ . If the system is unstable, please determine the location of a real zero, such that after its addition to  $L(s)$ , the system can remain stable. (10%)



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3. For a system with the dynamic equations :

$$3x_1 + 2\dot{x}_1 + \dot{x}_2 = -u$$

$$x_2 + \dot{x}_1 = u$$

where  $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$  is the state vector and  $u$  is the system input.

The system output  $y = x_1$ .

(a) Determine the controllability and observability of the system. (10%)

(b) Find the transfer function  $G(s) = \frac{Y(s)}{U(s)}$ . (10%)

