系所組別： 航空太空工程學系丙組

考試科目： 自動控制

考試日期：0222，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Consider the system transfer function given below,

$$\frac{Y(s)}{R(s)} = \frac{2s+8}{s^2+4s+8}.$$

   a. Find the response y(t) if R(s) is a unit step input. (15%)
   b. Derive peak time and percent overshoot of y(t) obtained in a. (10%)

2. Consider a unity feedback control system with forward controller $G_c(s)$ and plant $G_p(s)$, where

$$G_c(s) = \frac{K(s+z)}{s} \quad \text{and} \quad G_p(s) = \frac{1}{(s+2)^2(s+4)}.$$

   a. For $K>0$ and $z>0$, specify the area where the system is stable on K-z plane with z being horizontal axis. (15%)
   b. If $z=3$, find the system poles and the associated K when the system is marginally stable. (10%)

(背面仍有題目,請繼續作答)

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3.

Consider the system shown in Fig.3-1.

(a). Determine the magnitude and phase of G(s*), $s^* = -2 + j2\sqrt{3}$. (5%)

(b). Apply the **phase condition of root locus** to determine the coefficients of the controller (p and K), as shown in Fig. 3-2, such that s* becomes the resulting closed-loop pole. (10%)
(Answer obtained using the comparing coefficient approach will not score)

(c). Sketch the root locus with p obtained in (b) for K > 0. (10%)

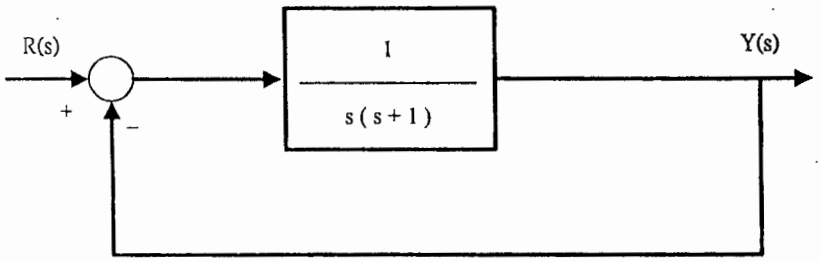

Fig.3-1

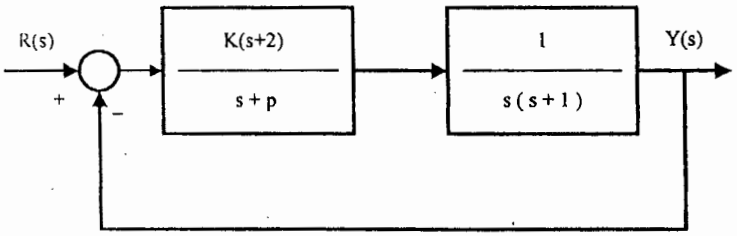

Fig. 3-2

4.

(a). Determine the system transfer function G(s) for a minimum phase system with its Bode gain plot shown in Fig 4-1. (7%)

(b). Plot the Nyquist plot of system G(s) and the Nyquist $\mathcal{D}$ contour. (10%)

(c). Consider system G(s) obtained in 4(a). Determine steady state errors of the unity feedback system, as shown in Fig.4-2, corresponding to a unit-step and unit-ramp reference input, respectively. (8%)

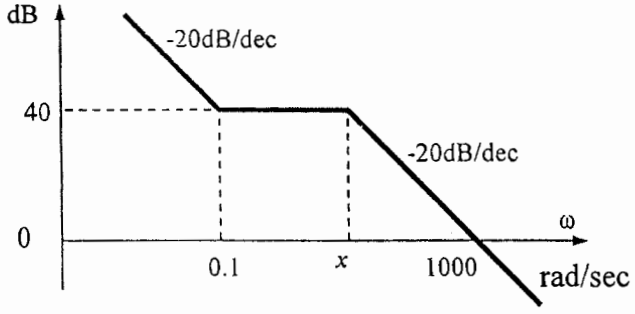

Fig. 4-1

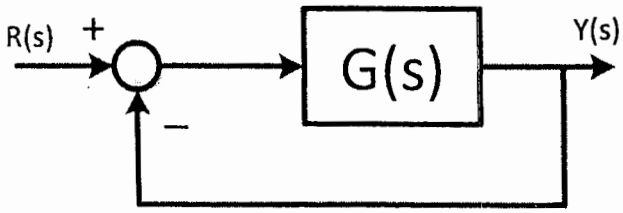

Fig. 4-2