93學年度國立成功大學研究所招生考試 系統及船舶機電工程學系 丁組 自動控制 試題 共 貳 頁 第 壹 頁

#1) The transfer function of a linear, time-invariant (LTI) system is known in the form:
(20%)

$$G(s)=\frac{Y(s)}{U(s)}=\frac{K(s+5)(s-1)}{s(s+\alpha)(s+2)^2(s+3)(2s+5)}$$

The unit impulse response of the system is of the form:

$$y(t)=\mathcal{L}^{-1}\{Y(s)\}=-\frac{1}{6}+a_1e^{-t}+a_2e^{-2t}+a_3te^{-2t}+a_4e^{-2.5t}+a_5e^{-3t}$$

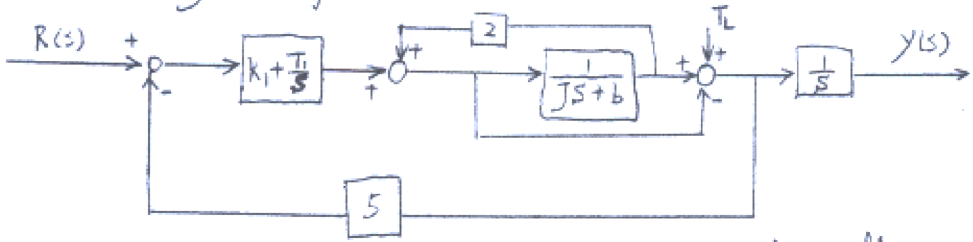
, where a_1, a_2, a_3, a_4, a_5 are constants.

(i) Determine K and α. (10%)

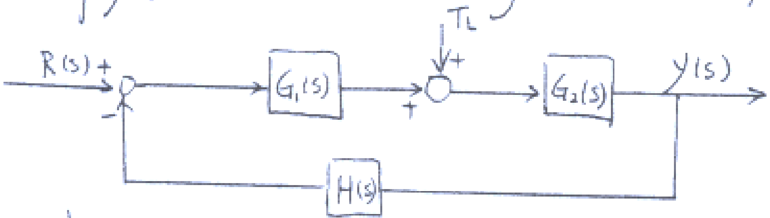
(ii) Give a pole-zero sketch in the s-plane (5%)

(iii) What is the static gain of the system? (5%)

#2) Block diagram of a servomechanism is shown below:
(20%)



(i) Simply the above block diagram to the following:



What is $G_1(s)$, $G_2(s)$ and $H(s)$? (10%)

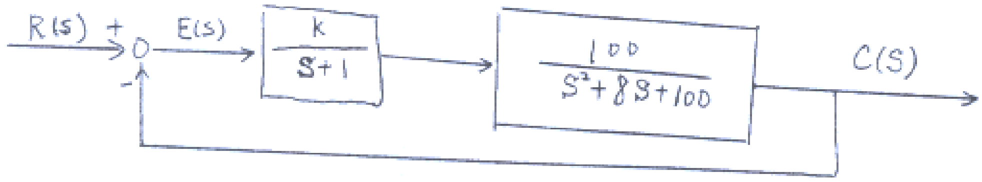
(ii) Derive transfer functions between (a) R(s) and the output Y(s)
(b) T_L and the output Y(s). (5%)

(iii) Determine the system characteristic equation and the order of the system. (5%)

(背面仍有題目,請繼續作答)

#3) Shown below is a simple Control configuration:

(20%)



It is required to select a suitable value of K so that the steady state tracking error for a unit step input is less than 0.1 Is it possible to find such a K value? Justify your answer.

#4) The characteristic equation of a linear Control system is

(20%)

$$S^3 + 2S^2 + 20S + 10K = 0$$

Apply the Routh-Hurwitz criterion to determine the values of K for system stability.

#5) (i) Draw the Root Loci of the second-order system:

(20%)

$$S(S+2) + K(S+4) = 0 \qquad (10\%)$$

(ii) Find the two breakaway (or breakin) points of the root Loci. (10%)