※ 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 two structures shown in *Fig.* 1.

   (a) Please select H_1 and H_2 so that the nominal system outputs satisfy $F_1 = F_2 = F$, and assume $KH_1 > 0$. (10%)

   (b) From the sensitivity definition, please determine the sensitivity of F with respect to K for these two structures, respectively. Which structure is less sensitive?. (15%)
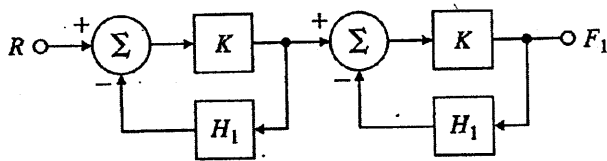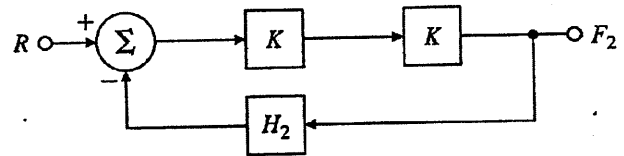

Fig. 1(a)　　　　　　　　　　　　　*Fig.* 1(b)

2. Consider a closed-loop system described in *Fig.* 2, where $C(s) = K$ and $G(s) = \dfrac{(s^2+1)}{(s-1)^3}$. Please apply Nyquist plot design method to find the range of K such that the closed-loop system is stable. (25%)
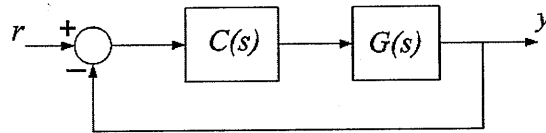

Fig. 2

3. For the motor, load, and torque-speed curve shown in *Fig.* 3, find the state-space representation in phase-variable form for the transfer function $G(s) = \theta_L(s)/E_a(s)$. (25%)
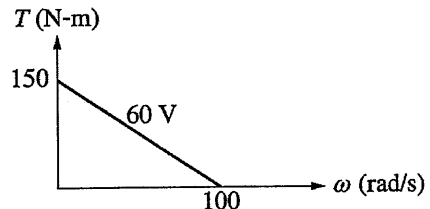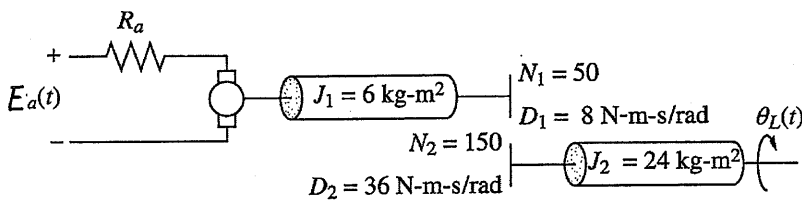

Fig. 3

4. Design the values of K_1 and K_2 in the system of *Fig.* 4 to meet the following specifications: Steady-state error component due to a unit step disturbance is -0.015; steady-state error component due to a unit ramp input is 0.2. (25%)
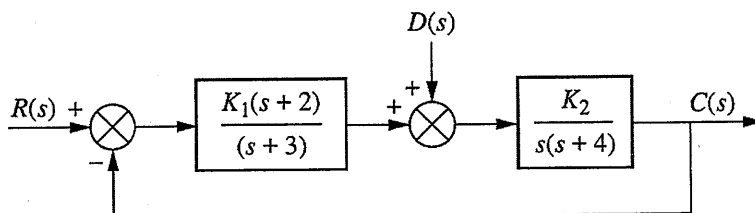

Fig. 4