大同大學 102 學年度研究所碩士班入學考試試題
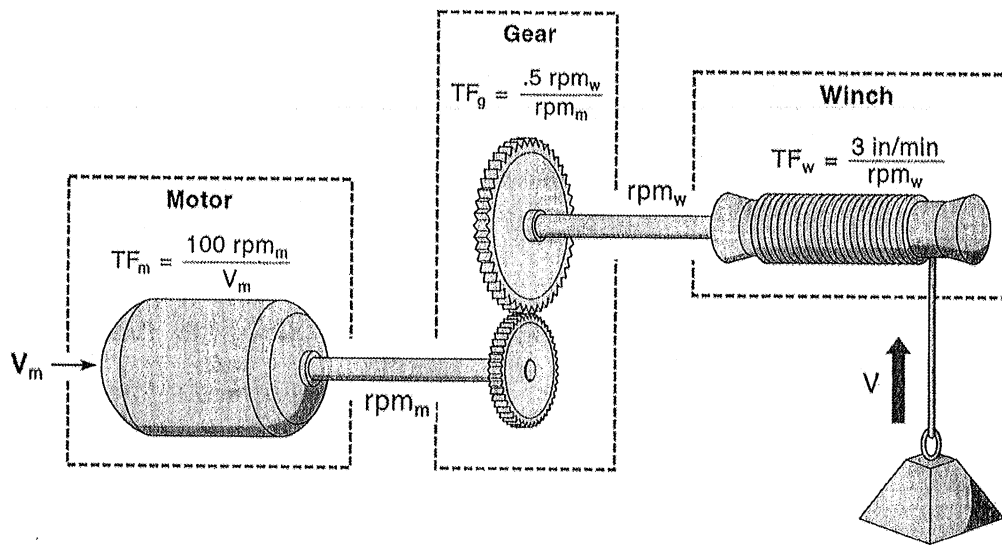
註：本次考試　**不可以**參考自己的書籍及筆記；

1. **(15%)** 試舉出生活中的例子說明：(1) 不穩定系統，(2)穩定系統；(3)準穩定系統。
   (提示：不加控制手段會出錯的系統可以視為不穩定系統的一種)

2. **(15%)** 下圖為使用一個電壓控制的馬達，經過一減速機後驅動重物捲揚器的系統，請畫出其方塊圖(block diagram)。說明何謂轉移函數(transfer function)？並寫出其轉移函數。

3. **(20%)** Plot a typical unit step response of a linear control system. Define and show the maximum overshoot, delay time, rise time, settling time and steady state error on the figure.

4. **(20%)** The loop transfer function of a unit feedback system is
$$G(s) = \frac{K(s+2.5)(s+3.2)}{s^2(s+1)(s+10)(s+30)}$$
Sketch the root locus for $0 < K < \infty$. In addition, determine the range of the gain K for which the system is stable.

5. **(15%)** The loop transfer function of a unit feedback system is
$$G(s) = \frac{K(s+1)}{s(1-s)(1+5s)}$$
Sketch the Nyquist Plot of this system and determine the range of the gain K for which the system is stable using **Nyquist stability criterion.**

6. **(15%)** A unity feedback system has a loop transfer function
$$G(s) = \frac{K}{s(1+0.2s)(1+0.05s)}$$
   (*a*) Find the gain K so that the gain margin of the system is 20dB.
   (*b*) Find the gain K so that the phase margin of the system is 40°.