編號： 249　系所：電機工程學系乙組　　科目：控制系統

本試題是否可以使用計算機： ☑可使用 ， ☐不可使用 （請命題老師勾選）

1. Fig. 1 shows the feedback control system with a compensator $G_c(s) = (\alpha s + 1)/(\beta s + 1)$. Select $\alpha = 0.2$. Determine the values of β and K so that the damping ratio of the dominant roots is great than 0.707 and the settling time (with a 2% criterion) is less than 3.2 seconds. (20%)

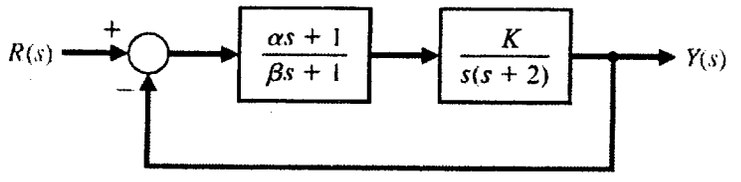

Fig. 1

2. Fig. 2 shows a ship steering control system. (a) Assume that the rudder input $R(s)$ is zero. Find the steady-state effect of a constant wind force $D(s) = 1/s$ for $K = 50$. (b) Determine the rudder input $R(s)$ can then be used to bring the ship deviation back to zero. (15%)

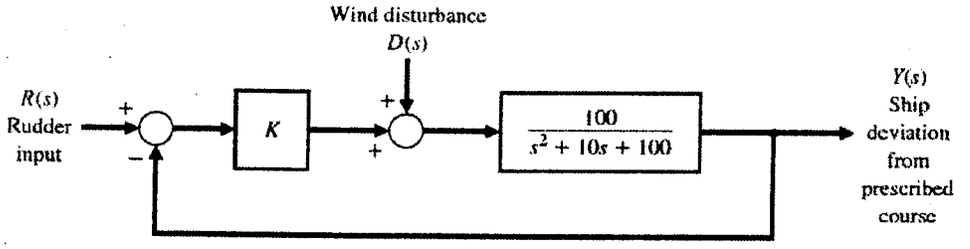

Fig. 2

3. Fig. 3 shows the feedback control system for a magnetic amplifier. The time constant of the magnetic amplifier is equal to 0.5 second, and the gain is $K = 100$. Select the value for the capacitance C so that the transfer function $V_o(s)/V_{in}(s)$ has a damping ratio of 0.8. Calculate the settling time (with a 2% criterion) of the resulting system. (15%)

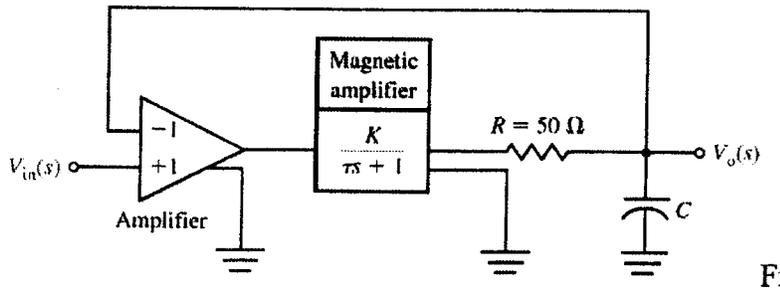

Fig. 3

4. A system is shown in Figure 4, where $D(s) = K(s+2)/(s+p)$ and $G(s) = 1/s(s+1)$. (a) Please use root locus design method to determine K and p such that the root locus will pass through the point $-3 \pm j3$. (b) Please also determine the third root in part (a) form the root locus. (16%, 6%)

（背面仍有題目，請繼續作答）

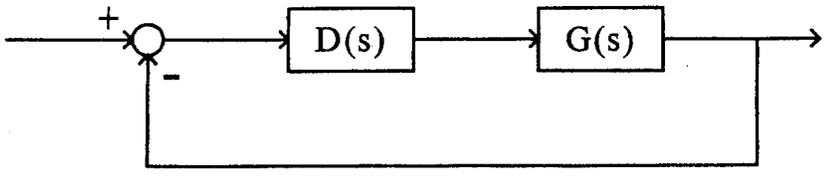

Fig. 4

5. Please show that if $\dot{C}(t) = C_1 C(t) - C(t) C_1$, then $C(t) = e^{C_1 t} C(0) e^{-C_1 t}$. Please also show that the eigenvalues of $C(t)$ are independent of t. (12%, 6%)

6. Is a system with impulse response $g(t, \tau) = e^{-5|t-\tau|}$, for $t \geq \tau$, BIBO stable? (10%)