VE03

國立臺北科技大學 108 學年度碩士班招生考試

系所組別：1302 車輛工程系碩士班

第二節　自動控制　試題（選考）

注意事項：

1. 本試題共四大題，每題 25 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (25%) A system has three masses, and these three masses are fixed tightly together (Fig.1). The parameter values are: $m_1 = m_2 = m_3 = \frac{1}{3},\ k_1 = k_2 = 9,\ c_1 = c_2 = 3$.

(1) Find the governing differential equation of x_1 . (7%)

(2) Find the transfer function of the input $f(t)$ and output x_1 of this system if initial conditions $x_1 = 0,\ \dot{x}_1 = 1$ are given. (6%)

(3) Is this system stable or unstable? Why? (5%)

(4) If $f(t)$ is a unit step input, what is the oscillating frequency of the transient time response of this system? (7%)

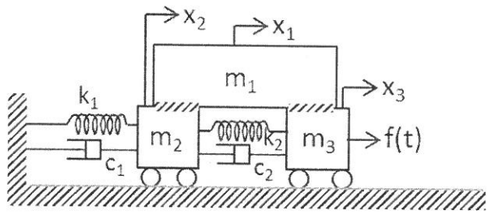

Fig.1

2. (25%) The unit-step time response of a 2nd-order system is in Fig.2.

(1) According to Fig.2, find the approximate values of rise time t_r, overshoot M_p, peak time t_p and settling time t_s. (12%)

(2). If the equations of t_r , t_p , t_s , M_p are given, find the transfer function of this system. (13%) ($M_p = e^{-(\zeta\pi/\sqrt{1-\zeta^2})}$ $t_s = \frac{4}{\zeta\omega_n}$ $t_r = \frac{0.8+2.5\zeta}{\omega_n}$ $t_p = \frac{\pi}{\omega_d}$)

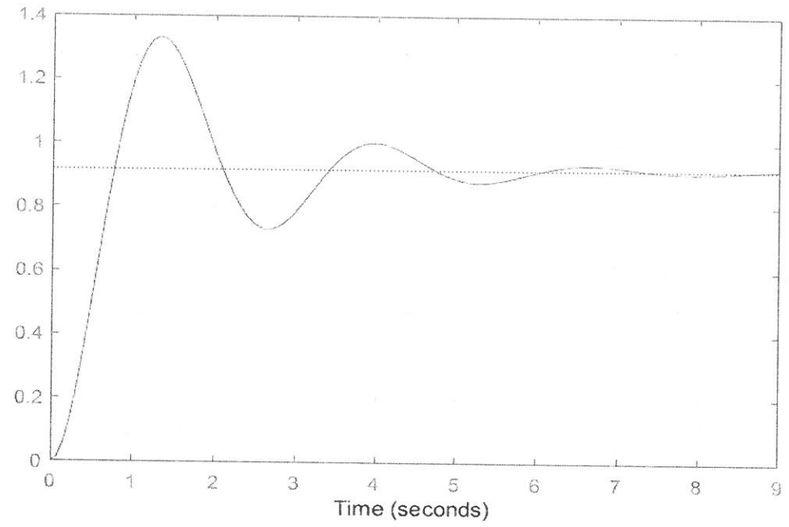

Fig.2

3. (25%) Fig. 3.1 is the block diagram of a system with three subsystems, a disturbance *d*, and a feedback H.

(1) What is the open-loop transfer function of the system from input to output? (4%)

(2) What is the closed-loop transfer function of the system from input to output? (5%)

(3) What is the closed-loop transfer function of the system from disturbance to output? (6%)

(4) If a proportional gain K is added to the block as Fig. 3.2. And the transfer functions are $G_1(s) = \frac{1}{s+1}$, $G_2(s) = \frac{1}{s^2+2s-1}$, $G_3(s) = 0$, $H(s) = 1$. What is range of the value of K to ensure system stability? (10%)

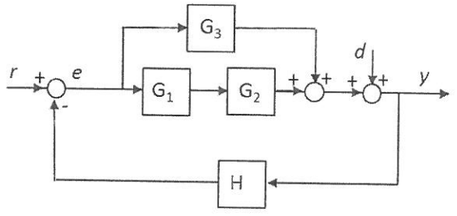

Fig.3.1

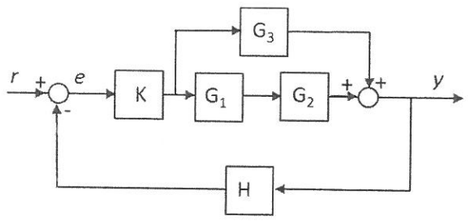

Fig. 3.2

注意：背面尚有試題

4. (25%) The block diagram of a feedback system is as Fig.4.

(1) The system is unstable if this system has at least one closed-loop pole at the right-half-plane of s-plane. Why? (6%)

(2) Draw the approximate root locus for each of the following cases: (12%)

(a) $G(s) = \frac{s+2}{s^2+4s+3}$, (b) $G(s) = \frac{s+3}{s^2+3s+2}$,

(c) $G(s) = \frac{s+2}{s^2+2s+2}$, (d) $G(s) = \frac{1}{s^3+6s^2+11s+6}$

(3) For the cases in (2), which system(s) can have damping ratio < 0.707 for any value of K? (7%)

Fig.4