1. 一回授控制系統之方塊圖如圖 A 所示，當輸入 r(t)=3sin(t)時，所測得之輸出 c(t)= 6sin(t–45°)，請由頻率響應之觀點，計算求系統的參數 ζ 及 ω_n 分別爲何？(15%)

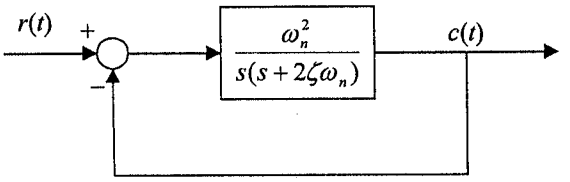

圖 A

2. 一系統的控制方塊圖如圖 B 所示，以圖中所示的 x_1, x_2 及 x_3 作爲狀態變數，試從節點#1 和#2 列寫其狀態空間(A,B,C,D)表示式(註：$s=\frac{d}{dt}$)。(10%)

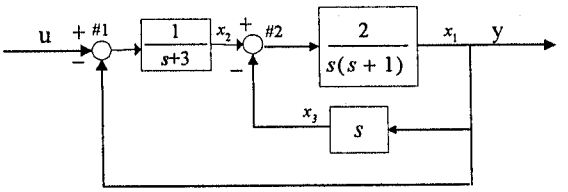

圖 B

3. 令圖 C 電路輸入—輸出電壓之轉移函數爲 $T(s)=\frac{V_o(s)}{V_i(s)}=k\frac{\tau_1 s+1}{\tau_2 s+1}$，求

(1) T(s)參數值 k, τ_1, τ_2 及 T(∞)各爲何? (7%)

(2) 畫出 $|T(j\omega)|$ 之頻率特性曲線近似圖。(5%)

(3) 試問該電路是屬於何種濾波器? 請依頻率與振幅間之關係說明之。(3%)

R_1=10KΩ, R_2=5KΩ, R_3=10KΩ, C=1μF

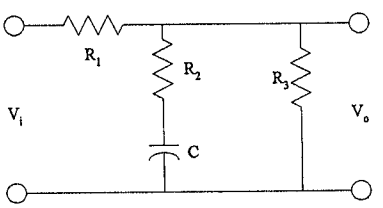

圖 C

4. 已知一閉迴路系統之轉移函數爲 $T(s)=\frac{10}{(s+2)(s-0.5)}$，依控制系統之物理意義是否能繪製頻率響應曲線圖? 如可以，請繪製該系統之振幅/相位頻率特性曲線(極座標圖)。如不可以，則請說明理由。(10%)

(背面仍有題目,請繼續作答)

5. (a) Try to define the rise time, the peak time, the maximum overshoot and and the steady state error in the standard time response , if it is the time response of a second order feedback control system and the input signal is a unit step input, which damping ratio is smaller than 0.5.

(b) If the control input is a unit step input, could you say the output signal is described as the following eqn. ?

$$C(t) = 1 - \frac{e^{-\zeta\omega_n t}}{\sqrt{1-\zeta^2}} \sin\left(\omega_n\sqrt{1-\zeta^2}\,t + \tan^{-1}\frac{\sqrt{1-\zeta^2}}{\zeta}\right)$$

(c) Is the peak time $t_p = 3/\omega_n\sqrt{1-\zeta^2}$?

(d) If the above equation is wrong, please derive the correct form and also derive the form of Mp ?

(e) By the way, if $\omega_n = 100$ and $\zeta = 0.5$, how about the value of Mp ? (20%)

6. (a) For a control system, if you want to design the system time response, which damping ratio is larger than 0.5 and the settling time is smaller than 1 second, could you find the range of the dominant poles in the s-plane?

(b) If you use the ITAE performance index to judge the performance of your control effect of your system, (10%)

(b.1) can you explain the meaning of ITAE ?

(b.2) why do you use the index?

7. Consider the following dynamic vibration absorber as the following figure. Using the root locus method to determine the effect of M_2 and k_{12}. Determine the specific values of the parameters M_2 and k_{12} so that the mass M_1 does not vibrate when $F(t) = a\sin\omega_0 t$, assume that $M_1 = 1$, $k_1 = 1$ and $b = 1$, $k_{12} < 1$ and the term k_{12}^2 may be neglected. (20%)