AT03

國立臺北科技大學 108 學年度碩士班招生考試

系所組別：1502 自動化科技研究所

第二節　自動控制　試題（選考）

第一頁　共一頁

注意事項：

1. 本試題共四題，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. (20%) For the control system as shown in Figure 1, sketch the root locus and determine the maximum value of K (K>0) such that the system closed-loop poles are all real.

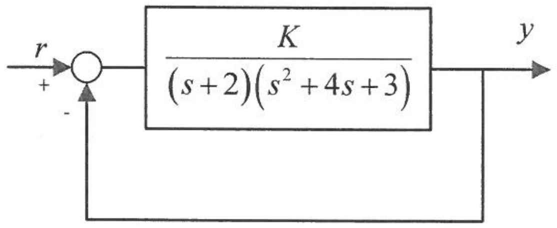

Figure 1

(1) (10%) Sketch the root locus.

(2) (10%) Determine the maximum value of K (K>0) such that the system closed-loop poles are all real.

2. (20%) For the unity feedback system with open-loop transfer function

$$G(s)=\frac{50}{s(s+10)}$$

(1) (10%) Find the step error constant K_p, ramp error constant K_v and parabolic error constant K_a.

(2) (10%) The input $r(t)=2+3t+0.5t^2$, please find the error $e(10)$ at t=10 sec and the steady-state error e_{ss}.

3. (30%) For the control system as shown in Figure 2, its plant model is expressed as

$$\dot{x}=-10x+2u-d$$
$$y=x$$

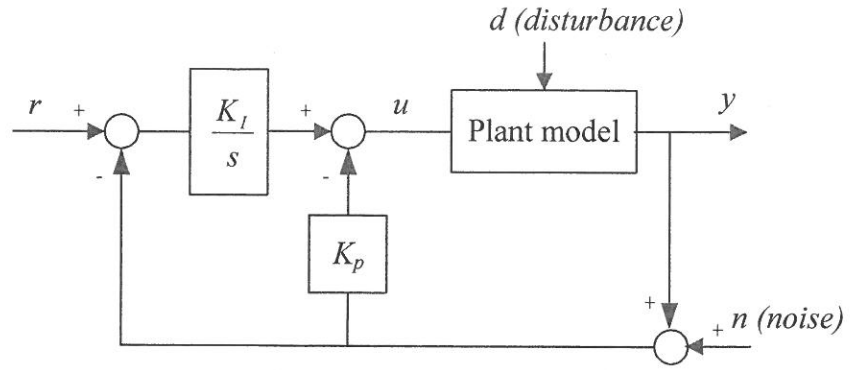

Figure 2

(1) (10%) Find the parameters K_p and K_I of the controller to let the closed loop poles be located at -10 and -8.

(2) (10%) Find the following closed loop transfer functions:

(a) $\left.\frac{y}{r}\right|_{d=0,n=0}$; (b) $\left.\frac{y}{d}\right|_{r=0,n=0}$; (c) $\left.\frac{y}{n}\right|_{r=0,d=0}$

(3) (10%) Find the steady-state value of y due to unit-step input r and unit-step disturbance change of d.

4. (30%) A mass-spring-damper system is shown in Figure 3(a), where m, c, k are the mass, spring constant and damping coefficient, respectively. A force $f(t)$ = 2 *Newton* is applied to this system, the mass displacement of $y(t)$ is plotted in Figure 1(b).

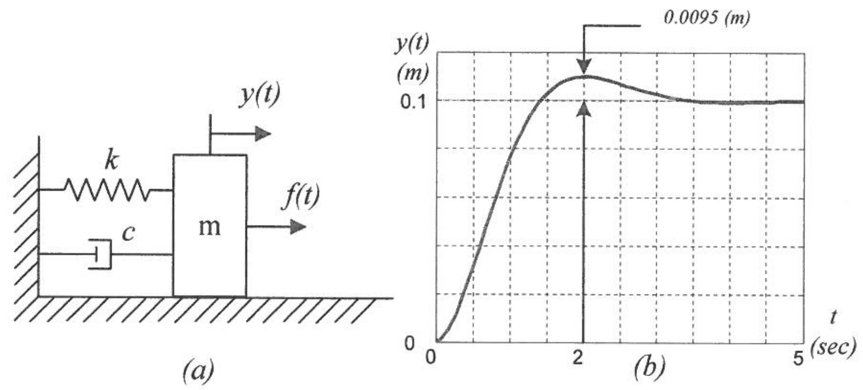

Figure 3

(1) (8%) Derive the dynamic equation of motion of the system and find the transfer function

$$G(s)=\frac{Y(S)}{F(s)}$$

(2) (8%) Determine the natural frequency ω_n and damping ratio ς from this response curve in Figure 1(b).

(3) (6%) Determine the parameters m, c, k .

(4) (8%) If input force $f(t)=2\sin(t)$, find the steady state response $y_{ss}(t)$.