國立臺北科技大學 111 學年度碩士班招生考試

系所組別：1501 自動化科技研究所

第二節　自動控制　試題（選考）

注意事項：

1. 本試題共 5 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. Please complete the block diagram of Fig. 1 by filling in the blocks (1)-(4) using the name of devices shown in Fig. 2. (20% in total; 5% for each)

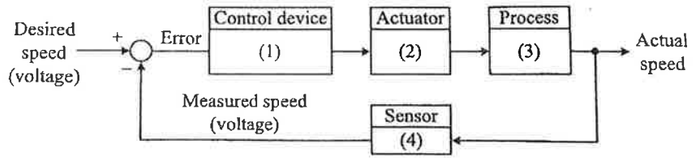

Fig. 1. Block diagram model.

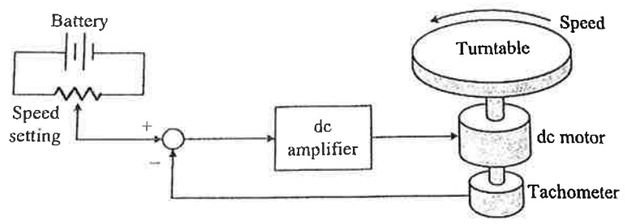

Fig. 2. Closed-loop control of the speed of a turntable.

2. Please complete the following Laplace Transform pairs. (20% in total; 4% for each)

$f(t)$	$F(s)=\mathcal{L}\{f\}(s)$
step function, $u(t)$	(1)
$\sin \omega t$	(2)
t^n	(3)
e^{-at}	(4)
impulse function, $\delta(t)$	(5)

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

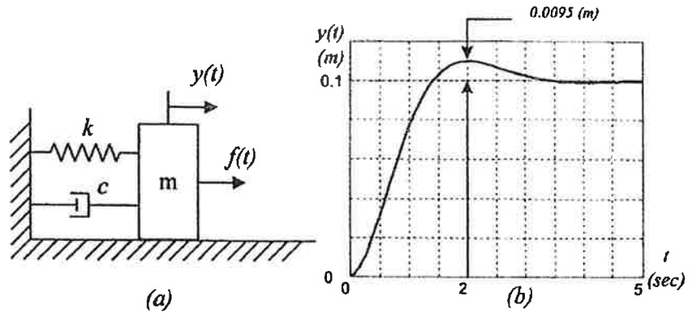

Fig. 3. A mass-spring-damper system to be analyzed.

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

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

(2) Determine the natural frequency ω_n and damping ratio ζ from the response curve shown in Fig. 3(b). (8%)

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

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

4. The transfer function of a unity feedback control system is given as

$G(s)=\frac{(s+5)}{(s+2)(s+4)}$. (15% in total)

(1) Please sketch the Bode plot of the system with the transfer function. (10%)

(2) Is the system stable? Why? (5%)

注意：背面尚有試題

5. A closed-loop system where $R(s)$ is a unit step function is shown in Fig. 4. (15% in total)

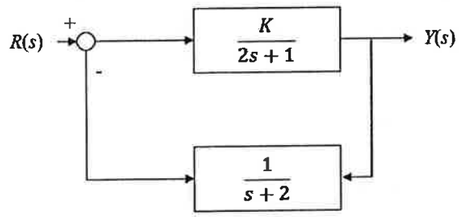

Fig. 4. A closed-loop system.

(1) Find the range of K for which the closed-loop system is stable. (10%)

(2) Find the value of K that gives the minimum steady-state error of the closed-loop system. (5%)