國立臺北科技大學九十八學年度碩士班招生考試

系所組別：2112　2130 電機工程系碩士班甲丙組

第一節　控制系統（選考）試題

注意事項：

1. 本試題共五題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

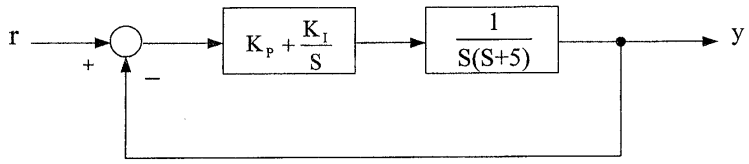
一、 (20 %)　Answer "True" or "False" for the following statements: **（每小題 4 分）**

1. Feedback is sometimes used to improve the sensitivity of a control system.
2. The controllability of a system can be changed via coordinate transformation.
3. The zeros of a system can be moved using state feedback.
4. The bandwidth is enlarged when phase-lag compensation is applied.
5. A system compensated with a PD controller is usually more robust than the system compensated with a PI controller.

二、(20 %) For the system G(s) given below, is it BIBO stable, marginally stable, or unstable? You need to say the reason for your answers. **（每小題 4 分）**

1. $G(s) = 1$;
2. $G(s) = s$;
3. $G(s) = \frac{1}{s}$
4. $G(s) = \frac{1}{(s+1)^2}$
5. $G(s) = \frac{1}{(s^2+1)^2}$

三、 Consider the following system:



1. (12 %) Determine the region in the K_p-versus-K_I parameter plane in which all closed-loop poles are to the left of the line s = -1 in the s-plane.
2. (8 %) Is it possible to set all closed-loop poles to the left of the line s = - c, for **any** c > 0 by choosing suitable K_p and K_I? If not, determine how large the value c can be?

四、 A control process is modeled by the following state equations:

$$\dot{x}_1 = x_1 + x_2$$
$$\dot{x}_2 = 6x_1 + u(t)$$

The control $u(t)$ is obtained from state feedback such that

$$u(t) = -k_1 x_1 - k_2 x_2$$

1. (10 %) Determine the region in the k_1-versus-k_2 parameter plane in which the closed-loop system is asymptotically stable.
2. (10 %) Determine k_1 and k_2 such that the closed-loop poles locate at s=-2+j2 and s=-2-j2.

五、 Consider the following nonlinear system:

$$\dot{x} = -x + y$$
$$\dot{y} = 2x - y - xz$$
$$\dot{z} = xy - 4z$$

1. (6 %) How many equilibrium points are there in the system?
2. (6 %) Find the approximate linear systems at these equilibrium points.
3. (8 %) Find their characteristic equations and determine the stability.