**Please answer the following short questions with arguments to support your answers. Simple YES and NO will not be granted any point.**

1. (10%) Is it true that a system with experimentally-derived Bode plot to be always stable?
2. (10%) Why the integral control can usually reduce the steady-state error of a closed-loop system?
3. (10%) Please provide the definition of the Gain Margin. Why is it related to the stability of a closed-loop system?
4. (10%) Is it true that when a system has poles on the imaginary axis, the system is stable most of the time and unstable only under certain conditions? (This kind of situation is often referred to as Marginally stable or Neutrally stable.) Please give a detailed analysis when a system has poles on the imaginary axis, especially on the referred "certain conditions".
5. (10%) The design specifications of a control system usually consist of the transient response and the steady-state response indexes. Please show as many indexes as you can in both categories and illustrate how those indexes relate to your design.
6. (10%) A Bode plot can be considered as a model of dynamic systems and be used in the control system design. How it is different from a transfer function, the most commonly used model in classical control?
7. (10%) The design goal of a control system is to achieve the result that the output to be as close to the reference input as much as possible. Please show how this design goal can be achieved by the control theories you have learned.

**Design Problem**

8. Given the frequency response of an open-loop plant G(s) as in Figure 1 and the closed-loop system in Figure 2. Please answer the following questions.
   (a) (10%) From Figure 1 and Figure 2, please identify the system type of the system (which is related to the steady-state error under unity-feedback condition)? What are the corresponding error constant and the steady-state error of the closed-loop system?
   (b) (10%) Assume that a steady-state error of 0.1 with a ramp input with slope 10 is required. Please determine the controller gain D(s)=K to satisfy the steady-state error requirement and the corresponding PM of the closed-loop system?
   (c) (10%) Assume that we also need to have the Phase Margin of 45 degrees, please design the appropriate first-order LEAD/LAG compensators to satisfy the above design criteria in (b) and (c).

見背面

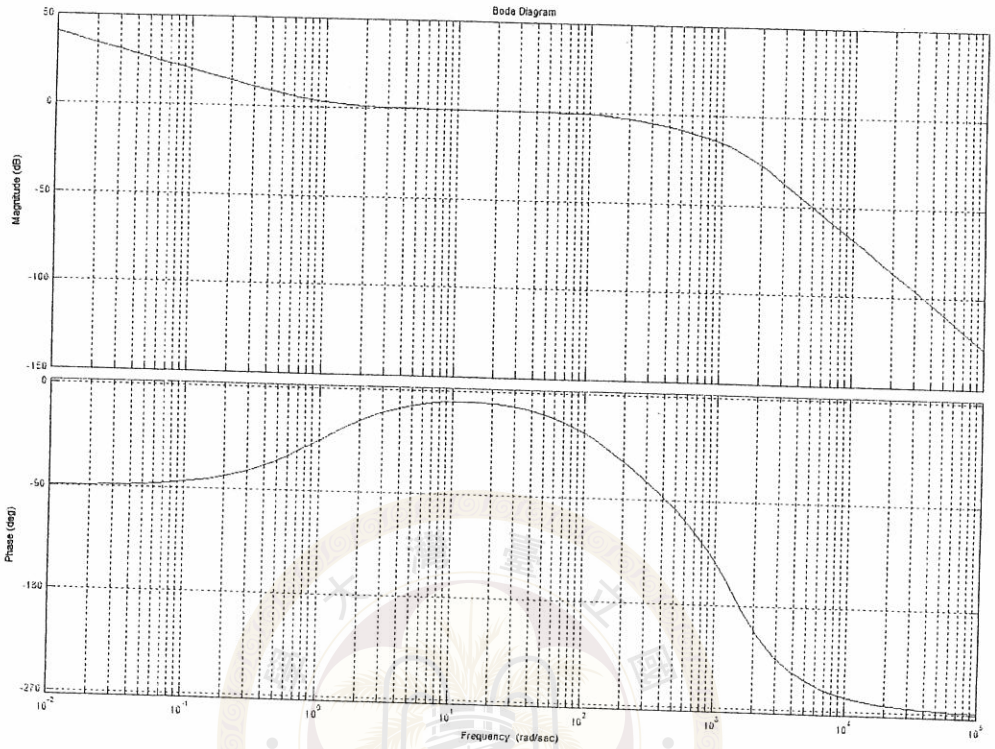


Figure 1

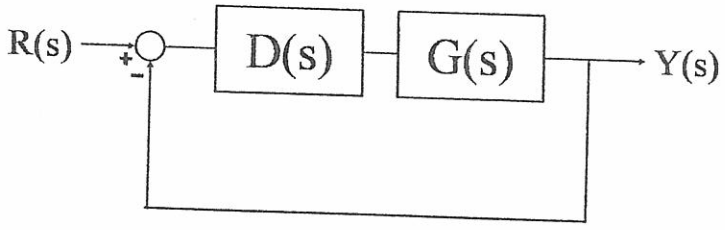


Figure 2

試題隨卷繳回