編號：E 100　系所：機械工程學系戊組　　科目：自動控制

本試題是否可以使用計算機：☑可使用，☐不可使用　（請命題老師勾選）

1. Construct a mathematical model and explain the behavior of measuring human's temperature.
(15%)

2. Use mathematical formulation to describe a method for simulating the sinusoidal response of a second-order linear time-varying system.
(15%)

3. Use mathematical formulation to describe the advantages and disadvantages of using feedback in controlling the speed of a DC-motor system.
(20%)

（背面仍有題目，請繼續作答）

4. (20%) Consider a system (**Fig. P4**) with loop transfer function:

$$G(s)H(s)=\frac{k(s+2)}{(s+10)(s-1)}.$$

(a) What is Nyquist stability criterion?

(b) Use the Nyquist stability to determine the range of k such that the closed-loop system is stable.

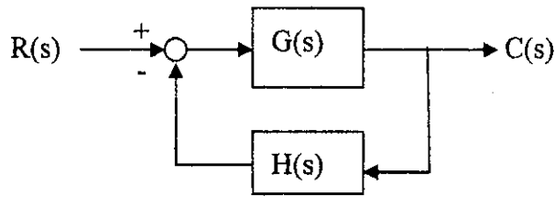

Fig. P4

5. (30%) A block diagram of a simplified model of the human respiratory control system is shown in **Fig. P5**. The objective is to control the effective ventilation of the lungs such that a satisfactory balance of concentrations of carbon dioxide and oxygen is maintained in the blood circulated at the chemoreceptor.

(a) Plot the Bode diagram of the open-loop transfer function G(s) when $G_c(s)=1$. Find the gain margin and phase margin.

(b) Design a PI controller, $G_c(s) = K_p+K_I/s$, so that following specifications are satisfied:

Velocity error constant $K_v=1$ for ramp reference input.

Phase margin is maximized.

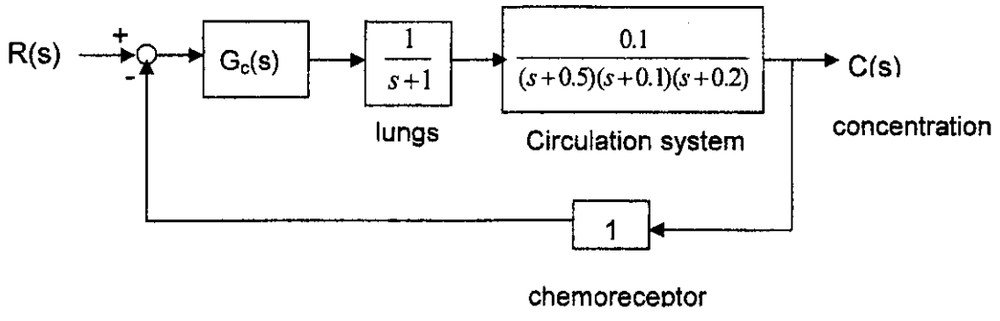

Fig. P5