※ 考生請注意：本試題 ☑可 □不可 使用計算機

1、Find the Laplace transforms of the functions shown in Figure 1. (10%)

(a) Write a complete expression for g(t), and then take the Laplace.

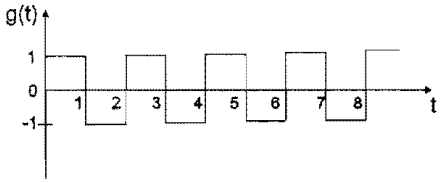

Figure 1.

2、Consider the electromechanical system shown in Figure 2 (15%)

(a) Draw the free-body diagram.

(b) Find the differential equation that describes the operation of the system.

(c) Calculate the transfer function of the system.

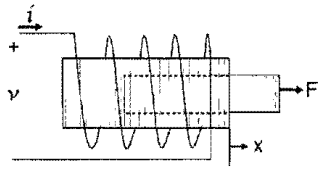

Figure 2

3、The block diagram of a dc-motor control system is shown Figure 3. Determine the range of K for stability using the Nyquist criterion when K_t has the following values: (20%)

(a) K_t=0

(b) K_t=0.1

(c) For the system, Let K=10, Final the range of K_t for stability with the Nyquist criterion.

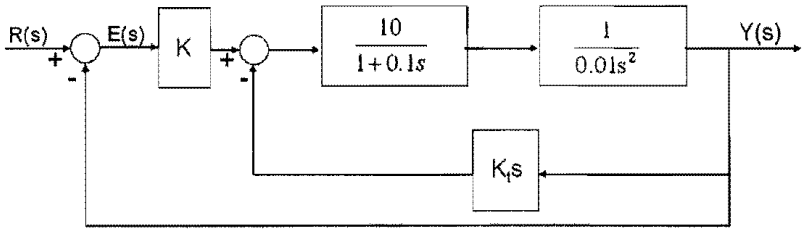

Figure 3

(背面仍有題目,請繼續作答)

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4、For a plant $G_P(s)=\dfrac{\omega_n^2}{s(s+2\xi\omega_n)}$ (15%)

(a) Design a P-D controller $G_c(s)$.

(b) Give an electronic-circuit realization of the P-D controller in (a) find the gains of $G_c(s)$. (Represented it by R and C in your circuit)

5、Figure 4 shows an RLC circuit. (20%)

(a) Find the state equation for the circuit when *v(t)* is an input, *i(t)* is an output, and capacitor voltage and the inductor current are the state variables.

(b) Find the condition that the system is controllable.

(c) Find the condition that the system is observable.

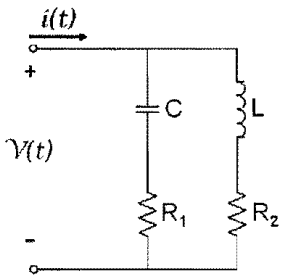

Figure 4

6、A sampled-data control system is shown in Figure 5. The sampling period is 1 sec. (20%)

(a) Find the transfer function $\dfrac{C(z)}{R(z)}$.

(b) Find the step response of the closed-loop system.

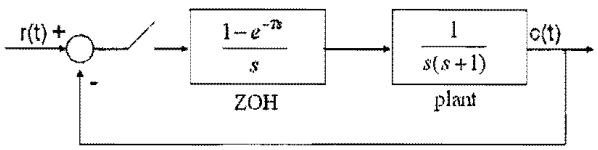

Figure 5