淡江大學九十二學年度碩士班招生考試試題

系別：機械與機電工程學系　　科目：自　動　控　制

准帶項目請打「○」否則打「×」
簡單型計算機
✓

1. *(20%)* The unit impulse response of the system shown in Figure 1 is : $y(t) = e^{-t} - e^{-2t}$, $t >= 0$
   (a) What is the system's transfer function G(s) ?
   (b) When r(t) is a unit step input, what is y(t) ?

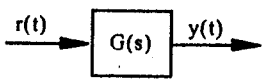

Figure 1

2. (*20%*) Sketch an approximate Bode diagram of the following transfer functions:

$$G2(s) = \frac{10(s^2 + 10)}{s(s^2 + 100)}$$

3. (*20%*) Consider the conveyor system shown in Figure 2. The controlled system can be modeled as the block diagram shown in Figure 3, where **m** is the equivalent mass of the driver system, **M** is the mass of the object carried by the conveyor, **b** is the equivalent viscous friction coefficient, **y** is the object's position. There is no slip between **M** and the conveyor belt. A proportional type controller is used for $G_c(s)$, and its gain is **K**. If the system parameters are: **m** = 1 Kg, **b** = 2 N/m/sec, and **K** = 2, answer the following questions:
   (a) Sketch the root loci of the system when **M** varies from 0 to ∞ ?
   (b) If it is required that the damping ratio of the controlled system be kept larger than 0.5, then what is the largest **M** the conveyor can carry ?

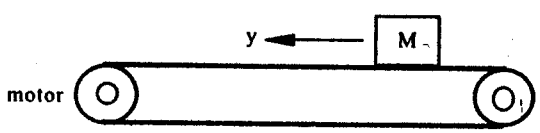

Figure 2

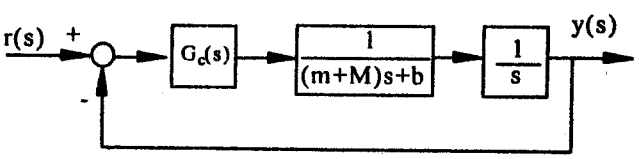

Figure 3

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4. *(20%)* The block diagram of a close-loop system is shown in Figure 4. The frequency response of its open loop transfer function, G(s), is measured and shown in Figure 5,
   (a) What is the steady state value of e(t) when the input r(t) = 1+ t ?
   (b) If it is desired to reduce the steady state error by adding a proportional gain K to G(s), the open loop transfer function becomes KG(s), what is the maximum K for the system to remain stable ?

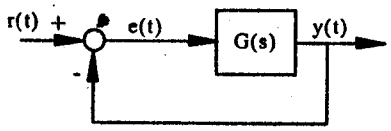

Figure 4

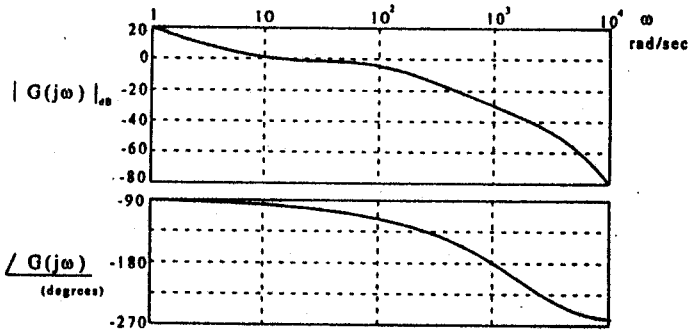

Figure 5

5. (*20%*) The block diagram of a control system is shown in Figure 6, the feedback gains k1 , k2 , k3 are real constants. Find k1 , k2 , k3 such that the poles of the system are at -1 ± j and –10 ?

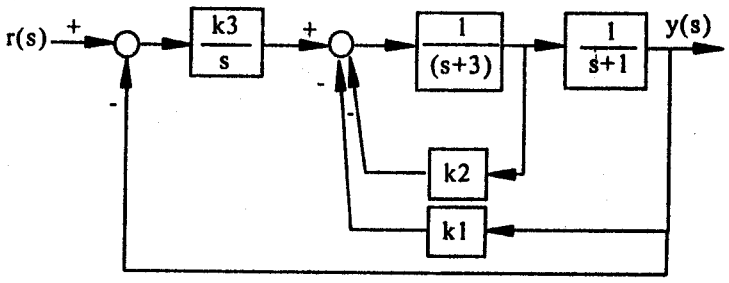

Figure 6