

國立台灣科技大學九十六學年度碩士班招生試題

系所組別： 高分子工程系碩士班丙組

科目： 控制系統

共五大題，總分 100 分；請於答案卷內依序作答。

一、 選擇題：共 4 題，8 分／題，總計 32 分。每題皆為四選一之

選擇題，空白者零分計算，選錯一題則倒扣 2 分，倒扣至零分止。

請將選擇題答案註明正確題號書寫於答案紙內，如於試題作答不

予計分。

1. A linear time-invariant system initially at rest, when subjected to a unit-step input, gives a response $y(t) = te^{-t}$, $t > 0$. The transfer function of the system is

- (A) $\frac{1}{(s+1)^2}$ (C) $\frac{1}{s(s+1)^2}$
 (B) $\frac{s}{(s+1)^2}$ (D) $\frac{1}{s(s+1)}$

2. Closed-loop transfer function of a unity-feedback system is given by $Y(s)/R(s) = 1/(\tau s + 1)$. Steady-state error to unit-ramp input is

- (A) ∞ (B) τ (C) 1 (D) $1/\tau$

3. A unity feedback system has open-loop transfer function

$$G(s) = K/[s(s+1)(s+2)]; K > 0$$

The value of K that results in oscillatory response to step input, is

- (A) 2 (B) 6 (C) 20 (D) 60

4. The first two rows of Routh tabulation of a third-order system are

$$\begin{array}{c|cc} s^3 & 2 & 2 \\ s^2 & 4 & 4 \end{array}$$

- (A) The characteristic equation has one root in right half s-plane
 (B) The characteristic equation has two roots on the $j\omega$ -axis at $s = \pm j$
 (C) The characteristic equation has two roots on the $j\omega$ -axis at $s = \pm 2j$
 (D) None of the answers in (A), (B) and (C) is correct

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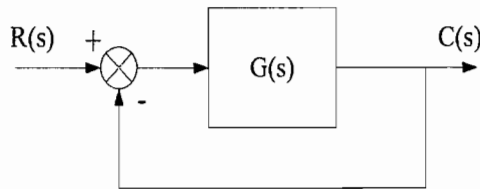
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二、 Given the unity feedback system with (18%)

$$G(s) = \frac{4}{s(s^6 - 2s^5 + 2s^4 - 4s^3 - s^2 + 2s - 2)}$$

find out how many closed-loop poles lie in the right half-plane, the left half-plane, and on the $j\omega$ -axis.



三、 A controlled process is modeled by the following state equations:

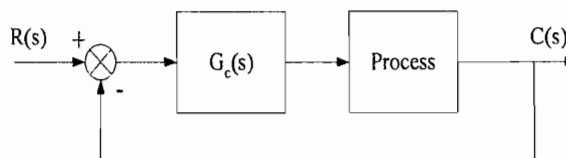
$$\dot{x}_1(t) = -x_1(t) + 5x_2(t)$$

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

where $u(t)$ is the input. The output equation is $c(t) = x_1(t)$.

(a) The control is obtained through state feedback. Design state-feedback control so that the closed-loop system has a damping ratio of 0.707 and a natural undamped frequency of 10 rad/s. (10%)

(b) The following figure shows the block diagram of the closed-loop system. Design a PD controller $G_c(s)$ so that the closed-loop poles are at $s = -4$ and $s = -8$. (10%)



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四、 Obtain the root locus for positive values of K , for a system whose

characteristic equation is $q(s) = s^3 + 4s^2 + 6s + 4 + K(s^3 + 5s^2 + 4s - 10) = 0$

(15%)

五、 A two-mass model of a system is shown in the figure.

(15%)

Find the transfer function $\frac{y(s)}{F(s)}$.

