國立臺南大學 103 學年度 **電機工程學系碩士班** 招生考試 控制系統 試題卷

共 6 題，每題配分標明於題目後，合計 100 分

1. The following differential equations represent linear time-invariant systems, where $r(t)$ denotes the input, and $y(t)$ is the output. Find the transfer function $Y(s)/R(s)$ for each of the systems. (20%)

(a) $$\frac{d^3y(t)}{dt^3}+2\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+6y(t)=3\frac{dr(t)}{dt}+r(t)$$

(b) $$2\frac{d^2y(t)}{dt^2}+\frac{dy(t)}{dt}+5y(t)=r(t)+2r(t-1)$$

2. As shown in Fig. 1, find the transfer function $V_{out}(s)/V_{in}(s)$ in the Laplace domain. (10%)

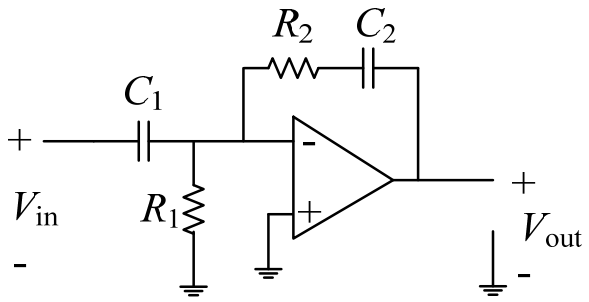

Fig. 1

3. A control system with a PD controller is shown in Fig. 2. Find the values of K_P and K_D so that the ramp-error constant K_v is 1000 and the damping ration is 0.5. (20%)

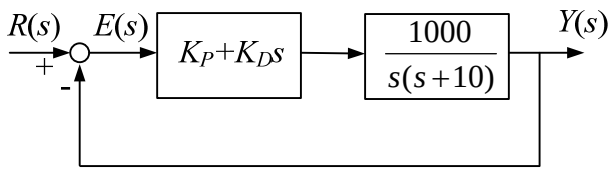

Fig. 2

4. Using the Routh-Hurwith criterion, determine the number of roots (of the following equation) those are in the right-half s-plane. (10%)

$$S^6 + 2S^5 + 8S^4 + 15S^3 + 20S^2 + 16S + 16 = 0$$

5. As shown in Fig. 3, $G(s) = \dfrac{12(s+4)}{s(s+1)(s+3)}$ and $R(s) = \dfrac{1}{s^2}$.

   Please find the steady state error of the system. (20%)

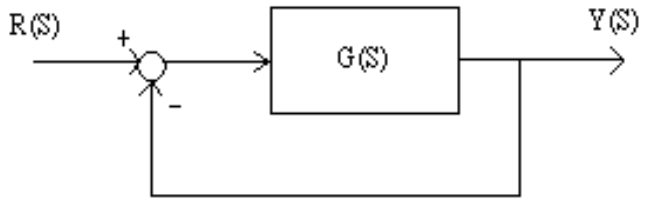

Fig. 3

6. Given a system described by the following dynamic equation:

$$\frac{dx(t)}{dt} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} x(t).$$

   Find the transfer function between Y(s) and U(s). (20%)