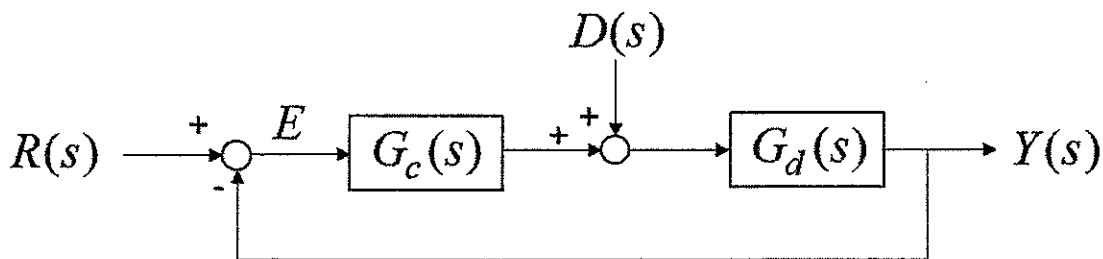


※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1.
 - (i) Suppose a system $y=S(x)$ is linear, where y is output and x is input. Please describe the conditions of a linear system satisfies. (15%)
 - (ii) Is $y=ax+b$ a linear system? (5%), Why? (5%)

2. A system is with a block diagram as below



- (i) Please find the relationship between $Y(s)$ and $R(s)$ (5%)
- (ii) Please find the relationship between $Y(s)$ and $D(s)$ (5%)
- (iii) Define the system tracking error $E(s) = R(s) - Y(s)$. Please find the relationship between $E(s)$ and the combination of $(D(s)$ and $R(s))$ (5%)
- (iv) How to reduce the error $E(s)$ due to $D(s)$ in steady state? (10%)

3. Please sketch the Bode plots for $G(s)$. (15%)

According to the definition of bandwidth, please find the bandwidth of $G(s)$ and briefly describe what kind of the filter of $G(s)$ is? (10%)

$$G(s) = \frac{0.5s}{1 + 0.1s}$$

4. A dynamical system is formulated by the following governing equation.

$$\ddot{x} + a_1\dot{x} + a_2x = b_0\dot{u} + b_1u$$

- (i) Find the state space formulation of this system. (10%)
- (ii) If the system parameters can be selected, please find them to satisfy the zero steady state error with respect to a unit step input. (15%)