國立中央大學八十六學年度碩士班研究生入學試題卷

所別：電機工程研究所　丙組　科目：控制系統　共 2 頁 第 1 頁

1. Find $\frac{Y(s)}{P(s)}$

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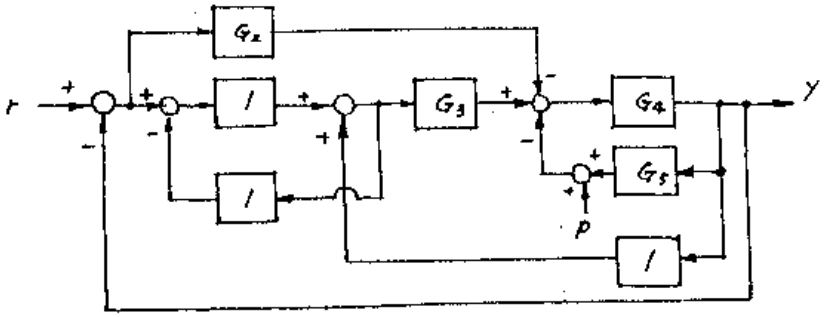

2. Find the stability ranges of α of the following system.

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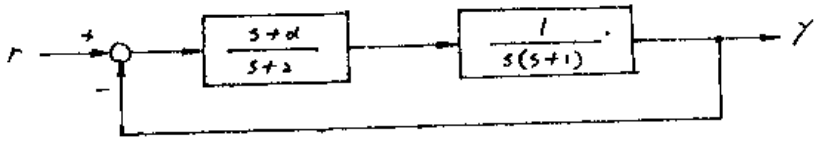

3. Find the observable-form realization of $G(s)$.

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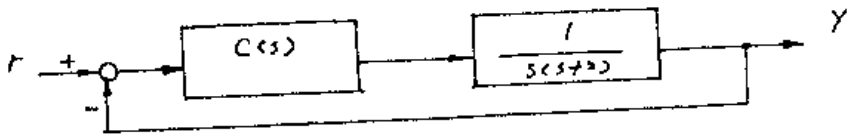
$$G(s) = \frac{s^4 + 2s^3 - s^2 + 4s + 12}{2s^4 + 10s^3 + 20s^2 + 20s + 8}$$

4. Design the compensator $C(s)$ of degree 1 so that the closed-loop system has poles at -2 and $-2 \pm 2j$.

(Assume $C(s)$ is proper).



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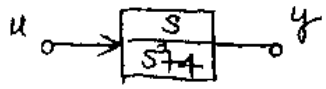
5. Consider the system in the following figure

a) write a set of equations that describes this system in the stand conanical control form as $\dot{\underline{x}} = \underline{F}\underline{x} + \underline{G}u$ and $y = \underline{H}\underline{x}$. (10%)

b) Design a control law of the form



$u = -[k_1 \; k_2]\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$

that will place the closed-loop poles at $s = -2 \pm 2j$ (10%)

6. Consider the nonlinear autonomous system.

$$\frac{d}{dt}\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} x_2(x_3 - x_1) \\ x_1^2 - 1 \\ -x_1 x_3 \end{bmatrix}$$

a) Find the equilibrium point(s) (10%)

b) Find the linearized system about each equilibrium point (10%)

7. Consider the system

$$\underline{F} = \begin{bmatrix} -2 & 1 \\ 1 & 0 \end{bmatrix}, \quad \underline{G} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \quad \underline{H} = [1 \quad 2]$$

and assume you are using feedback of the form $u = -\underline{K}\underline{x} + r$, where r is a reference input signal

Show that there exists a $\underline{K}$ such that $(\underline{F} - \underline{G}\underline{K}, \underline{H})$ is unobservable. (10%)