

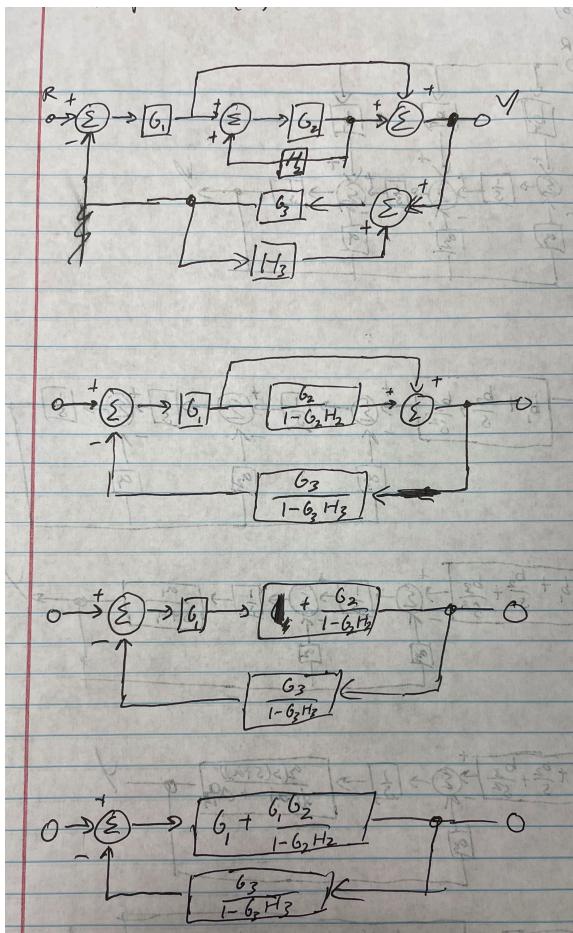
ECE 141 Homework 2

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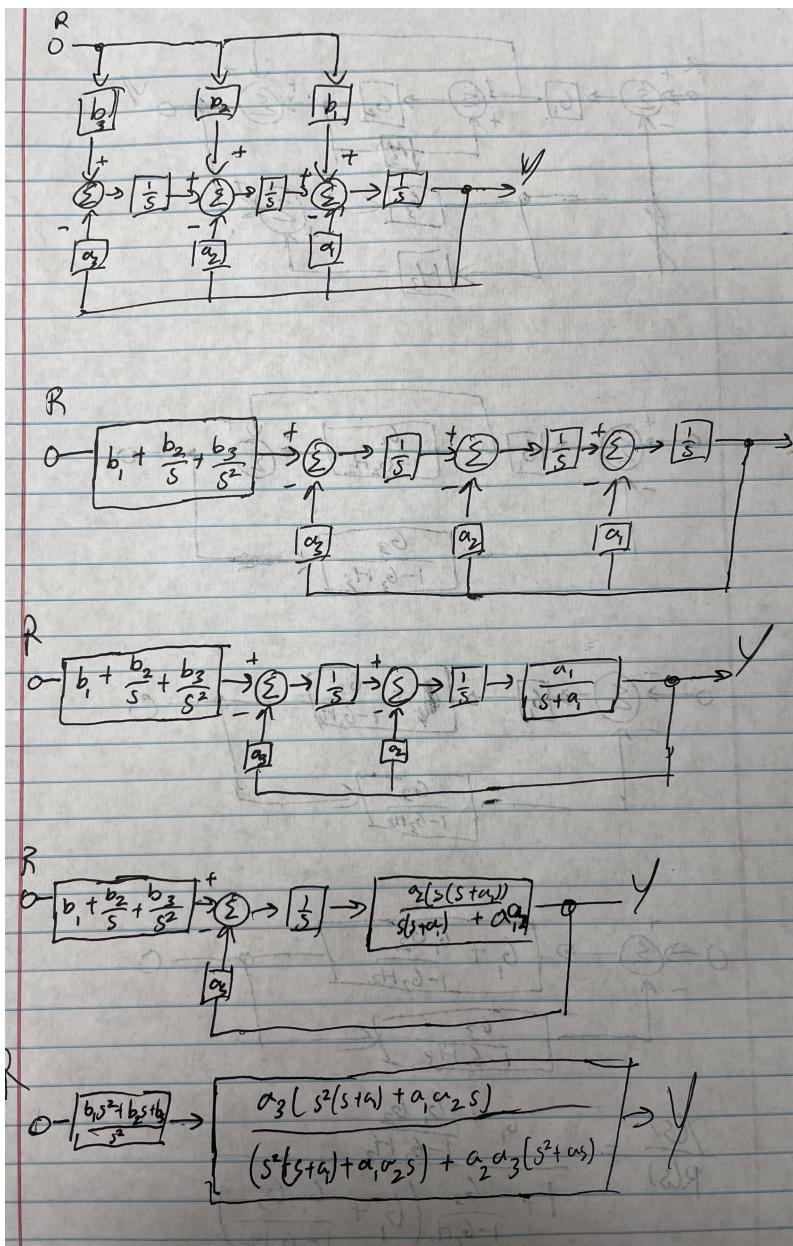
Problem 3.21

(a)



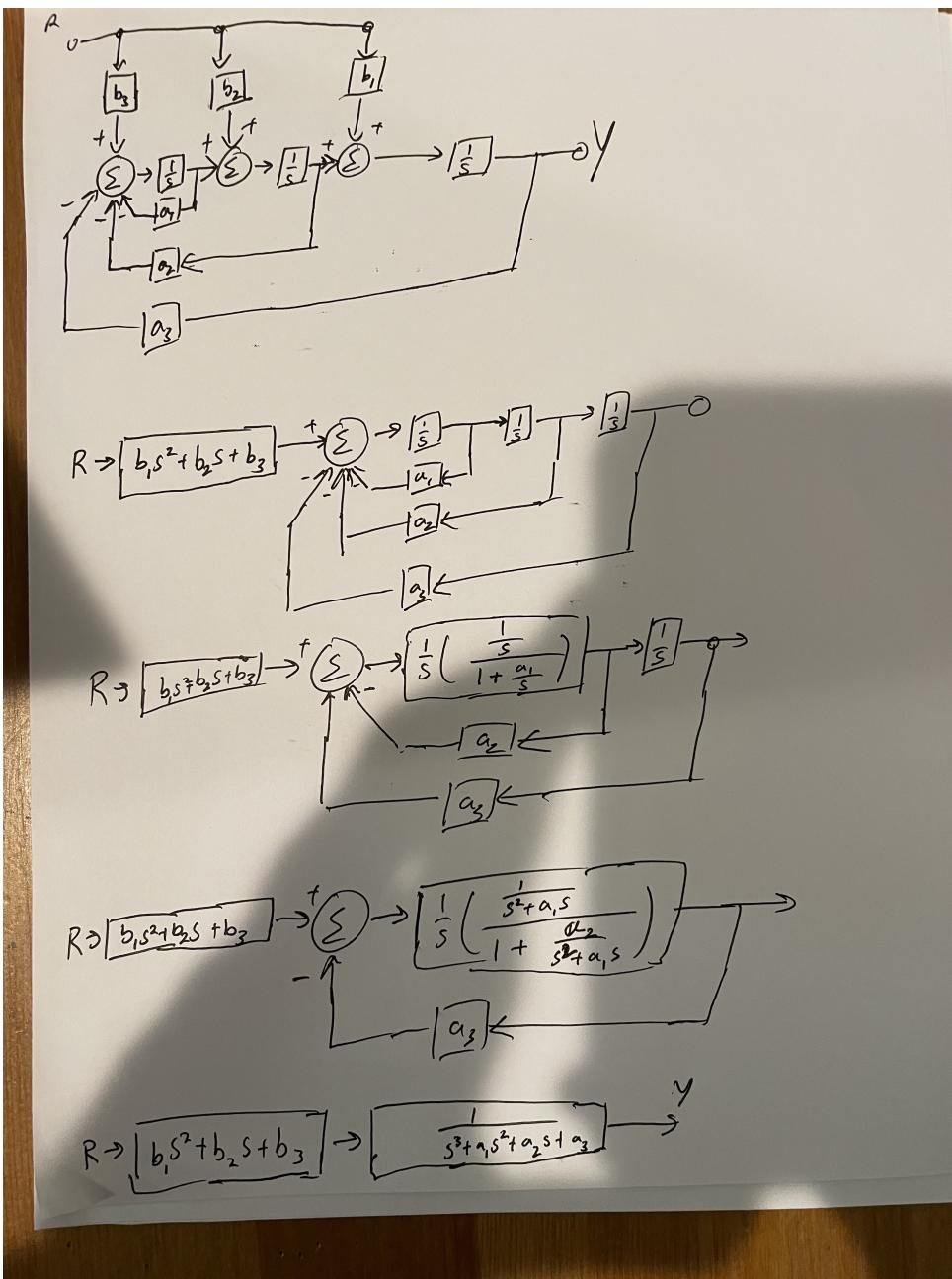
$$\frac{Y(s)}{R(s)} = \frac{G_1 + \frac{G_1 G_2}{1-G_2 H_2}}{1 + \left(G_1 + \frac{G_1 G_2}{1-G_2 H_2} \right) \frac{G_3}{1-G_3 H_3}}$$

(b)



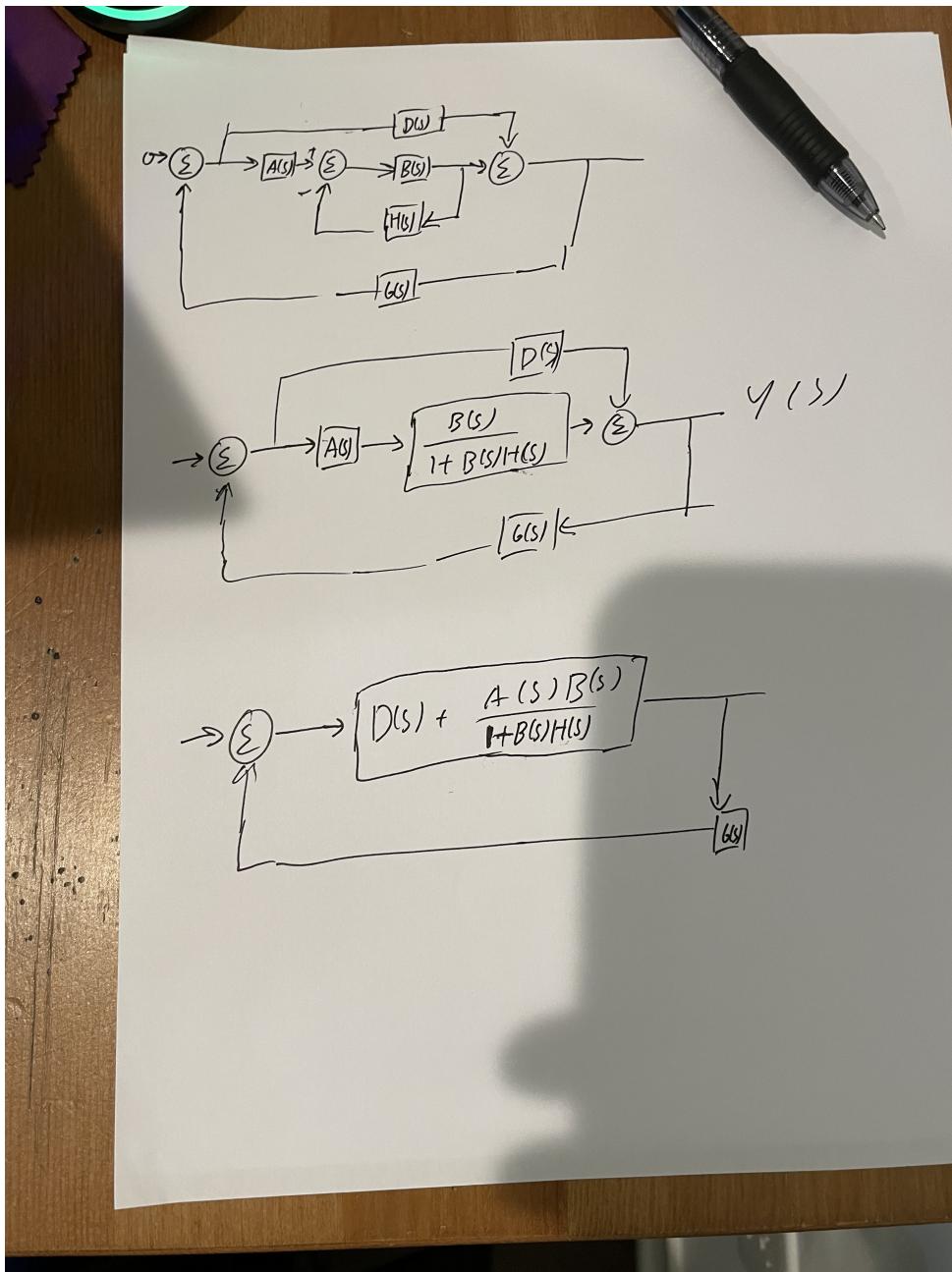
$$\frac{Y(s)}{R(s)}=\boxed{\frac{b_1s^2+b_2s+b_3}{s^2}+\frac{a_3(s^2(s+a_1)+a_1a_2s)}{s^2(s+a_1)+a_1a_2s+a_2a_3(s^2+a_1s)}}$$

(c)



$$\frac{Y(s)}{R(s)}=\boxed{\frac{b_1s^2+b_2s+b_3}{s^3+a_1s^2+a_2s+a_3}}$$

(d)



$$\frac{Y(s)}{R(s)} = \boxed{\frac{D(s) + D(s)B(s)H(s) + A(s)B(s)}{1 + B(s)H(s) + G(s)(D(s) + D(s)B(s)H(s) + A(s)B(s))}}$$

Problem 3.30

We have

$$16\% \geq M_p = e^{-\pi \frac{\zeta}{\sqrt{1-\zeta^2}}}$$

$$6.9 \geq t_s = \frac{4.6}{\zeta \omega_n}$$

$$1.8 \geq t_r = \frac{1.8}{\omega_n}$$

Therefore we get that

$$\ln(0.16) = -\pi \frac{\zeta}{\sqrt{1-\zeta^2}}$$

$$\zeta \omega \geq \frac{4.6}{6.9}$$

$$\omega_n \geq 1$$