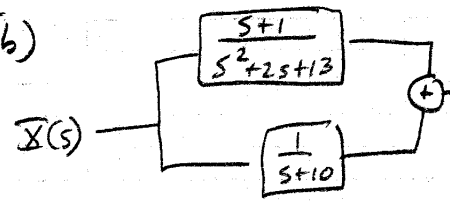
(1) Text, 15-17 b, c

(b)



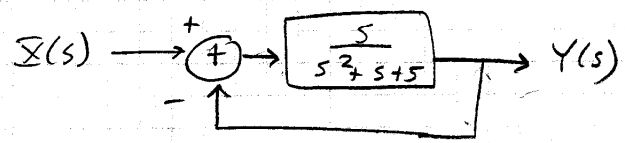
$$H(s) = \frac{1}{s+10} + \frac{s+1}{s^2+2s+13}$$

$$= \frac{s^2+2s+13 + (s+1)(s+10)}{(s+10)(s^2+2s+13)}$$

$$= \frac{s^2+2s+13+s^2+11s+10}{(s+10)(s^2+2s+13)}$$

$$= \frac{2s^2+13s+23}{(s+10)(s^2+2s+13)}$$

(c)



$$H(s) = \frac{\frac{s}{s^2+s+5}}{1+\frac{s}{s^2+s+5}} = \frac{s}{s^2+2s+5}$$

(2) Text 15-41 c, d, e

(c) $H(s) = \dfrac{s^2}{s^2+4s+8}$ ← poles at $s = -2 \pm j2$

All poles in LHP ⇒ <u>Stable</u>

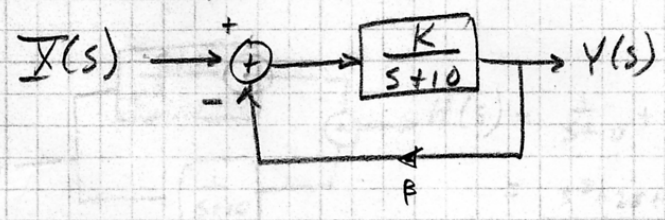
(d) $H(s) = \dfrac{s^2}{s^2-4s+8}$ ← poles at $s = 2 \pm j2$

poles in RHP ⇒ <u>NOT stable</u>

(e) $H(s) = \dfrac{s}{s^3+4s^2+8s} = \dfrac{\cancel{s}}{\cancel{s}(s^2+4s+8)}$ ← poles at $s = -2 \pm j2$

all poles in LHP ⇒ <u>Stable</u>

(3) Text 15-42 a, b



$$H(s) = \frac{\frac{K}{s+10}}{\beta + \frac{K}{s+10}} = \frac{\frac{K}{\cancel{s+10}}}{\frac{\beta(s+10)+K}{\cancel{s+10}}}$$

$$= \frac{k}{\beta s + (10\beta + k)} = \frac{k/\beta}{s + (10 + \frac{k}{\beta})}$$

pole at $s = -(10 + \frac{k}{\beta})$

(a) $\beta = 1$ $\quad H(s) = \dfrac{k}{s + (10+k)}$

pole at $s = -(10+k)$

system stable as long as $10 + k > 0$

or $\boxed{k > -10}$

(b) $\beta = -1$ $\quad H(s) = \dfrac{-k}{s + (10-k)}$

pole at $-(10-k)$

system stable as long as $10 - k > 0$

or $\boxed{k < 10}$