B-5-27. From Figure 5-89(b) we have

$$\frac{C(s)}{R(s)} = \frac{K}{Js^2 + KK_h s + K} = \frac{\frac{K}{J}}{s^2 + \frac{KK_h}{J} s + \frac{K}{J}}$$

By substituting $K/J = 4$ into this last equation, we obtain

$$\frac{C(s)}{R(s)} = \frac{4}{s^2 + 4K_h s + 4}$$

Since $\omega_n = 2$, $\zeta = 0.6$, and $2\zeta\omega_n = 4K_h$, we have

$$K_h = \frac{2\zeta\omega_n}{4} = 0.6$$

B-5-30.

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1+G(s)} = \frac{Ks+b}{s^2+as+b}$$

Hence

$$(s^2+as+b)\,G(s) = (Ks+b)\left[1+G(s)\right]$$

or

$$G(s) = \frac{Ks+b}{s(s+a-K)}$$

The steady-state error in the unit-ramp response is

$$e_{ss} = \frac{1}{K_v} = \lim_{s\to 0}\frac{1}{sG(s)} = \lim_{s\to 0}\frac{s(s+a-K)}{s(Ks+b)} = \frac{a-K}{b}$$