20. Given the system of Figure P7.8, design the value of K so that for an input of $100tu(t)$, there will be a 0.01 error in the steady state. [Section: 7.4]

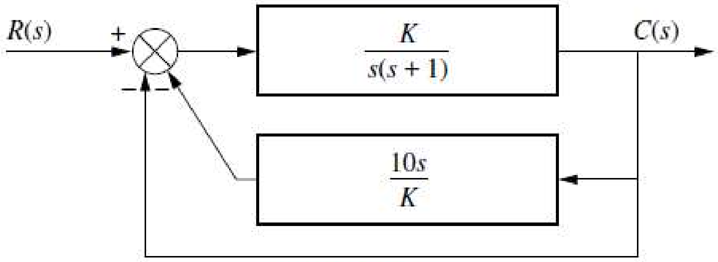

FIGURE P7.8

CEVAP:

Find the equivalent G(s) for a unity feedback system. $G(s) = \dfrac{\dfrac{K}{s(s+1)}}{1+\dfrac{10}{s+1}} = \dfrac{K}{s(s+11)}$

$$e(\infty) = \frac{100}{K_v} = \frac{100}{K/11} = 0.01 \quad \Rightarrow \quad K = 110{,}000.$$

25. Given the unity feedback system of Figure P7.1, where

$$G(s) = \frac{K(s+6)}{(s+2)(s^2+10s+29)}$$

find the value of K to yield a steady-state error of 8%. [Section: 7.4]

CEVAP:

$$e(\infty) = \frac{1}{1+K_p} = \frac{1}{1+\frac{6K}{58}} = 0.08. \text{ Thus, } K = 111.$$

38. Find the total steady-state error due to a unit step input and a unit step disturbance in the system of Figure P7.14. [Section: 7.5]

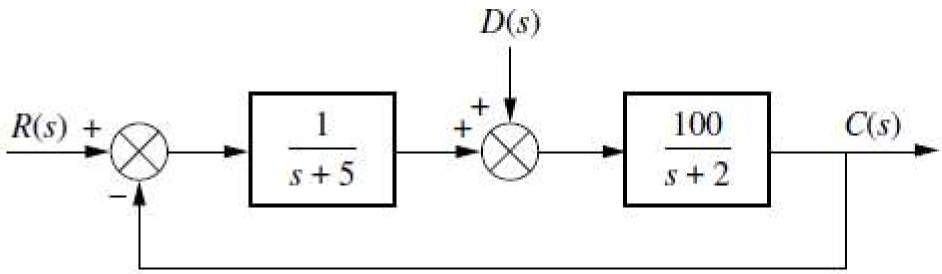

FIGURE P7.14

CEVAP:

$$e(\infty) = \lim_{s\to 0} \frac{sR(s) - sD(s)G_2(s)}{1 + G_1(s)G_2(s)}, \text{ where } G_1(s) = \frac{1}{s+5} \text{ and } G_2 = \frac{100}{s+2}$$

$R(s) = D(s) = \frac{1}{s}$. Hence, $e(\infty) = \lim_{s\to 0} \dfrac{1 - \dfrac{100}{s+2}}{1 + \dfrac{1}{s+5}\dfrac{100}{s+2}} = -\dfrac{49}{11}$.