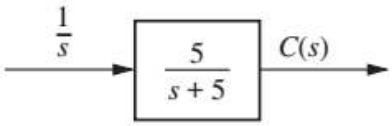
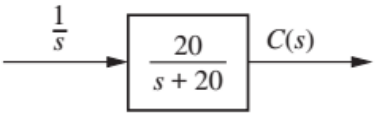
Homework # (5)
Transient Response

1. For each of the systems shown in Figure.
   I. **Find** the output response, $c(t)$,
   II. **Find** the time constant, rise time, and settling time for each case.
   III. From output response, **Find** the impulse and ramp responses for each case, assuming zero initial conditions.



(a)



(b)

2. For each of the transfer functions shown below,
   I. **Find** the locations of the poles and zeros,
   II. **Plot** them on the s-plane, and then
   III. **State** the nature of each response (overdamped, underdamped, and so on).

a) $G(s) = \frac{2}{s+2}$

b) $G(s) = \frac{5}{(s+3)(s+6)}$

c) $G(s) = \frac{10(s+7)}{(s+10)(s+20)}$

d) $G(s) = \frac{20}{s^2+6s+144}$

e) $G(s) = \frac{(s+2)}{s^2+9}$

f) $G(s) = \frac{(s+5)}{(s+10)^2}$

3. Consider the unit-step response of a unity-feedback control system whose open-loop transfer function is $G(s) = \frac{1}{s(s+1)}$

   Obtain the rise time, peak time, maximum overshoot, and settling time.

4. Consider the closed-loop system given by

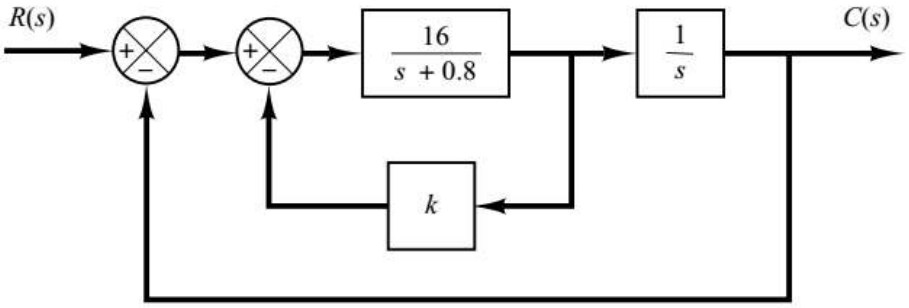
$$\frac{C(s)}{R(s)} = \frac{\omega_n^2}{s^2+2\zeta\omega_n s+\omega_n^2}$$

   Determine the values of ζ and ω_n so that the system responds to a step input with approximately 5% overshoot and with a settling time of 2 sec. (Use the 2% criterion.).

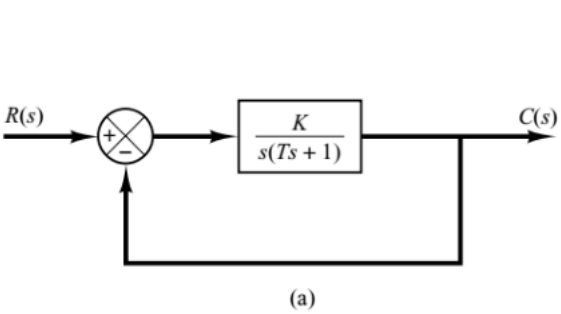
5. **Obtain** the unit-impulse response and the unit step response of a unity-feedback system whose open-loop transfer function is

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

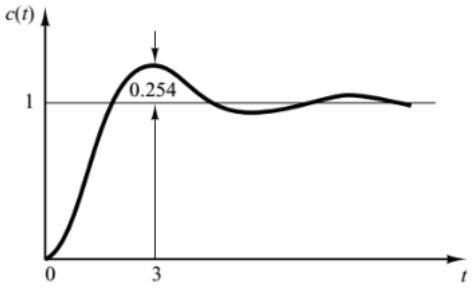
6. Consider the system shown in Figure. **Determine** the value of k such that the damping ratio ζ is 0.5. Then obtain the rise time t_r, peak time t_p, maximum overshoot M_p , and settling time t_s in the unit-step response.



7. When the system shown in Figure (a) is subjected to a unit-step input, the system output responds as shown in Figure (b). **Determine** the values of K and T from the response curve.



(a)



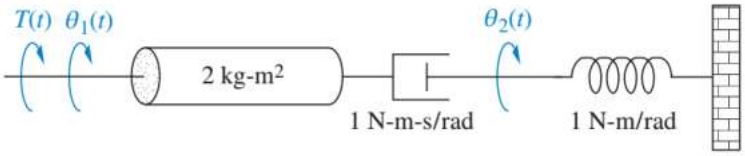
(b)

8. For the system shown in Figure, a step torque is applied at $\theta_1(t)$.

Find:

i. The transfer function, $G(s) = \theta_2(t)/T(s)$

ii. The percent overshoot, settling time, and peak time for $\theta_2(t)$.



Note:

1. Complete analysis must be presented.

2. Scan with High resolution is must

Due to 03/11/2021