

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS  
ELECTRICAL ENGINEERING DEPARTMENT

EE380 [081] sec# \_\_\_\_\_

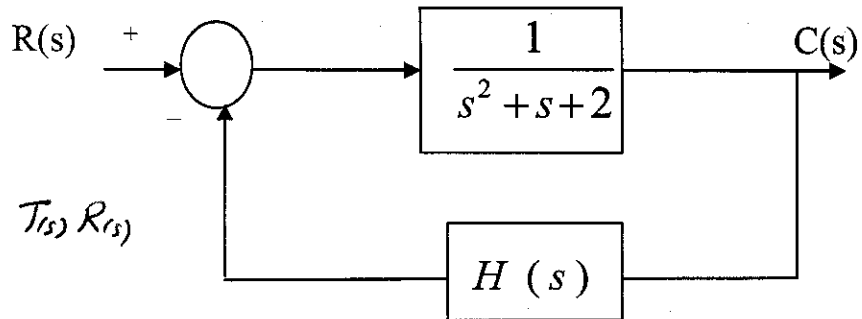
Quiz # 6

Name: Key ID: \_\_\_\_\_ Grade: \_\_\_\_\_

Find the steady state error for a unit step input for the following 2 cases:

1)  $H(s) = 1$

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



$$E(s) = R(s) - C(s) = R(s) - T(s)R(s)$$

$$= (1 - T(s))R(s)$$

$$e_{ss} = \lim_{s \rightarrow 0} s E(s) = \lim_{s \rightarrow 0} s R(s) [1 - T(s)] = 1 - T(0) \quad \text{for a step input}$$

Case ① :  $H(s) = 1 \Rightarrow T(s) = \frac{1}{s^2 + s + 3} \Rightarrow e_{ss} = 1 - T(0) = 1 - \frac{1}{3} = \frac{2}{3} \triangleleft$

another method:  $K_p = \lim_{s \rightarrow 0} G(s) = \frac{1}{2} \Rightarrow e_{ss} = \frac{1}{1 + K_p} = \frac{1}{1 + \frac{1}{2}} = \frac{2}{3} \triangleleft$

Case ② :  $H(s) = \frac{1}{s+1} \Rightarrow T(s) = \frac{s+1}{(s^2 + s + 2)(s+1) + 1}$

$$e_{ss} = 1 - T(0) = 1 - \frac{1}{2+1} = 1 - \frac{1}{3} = \frac{2}{3} \triangleleft\triangleleft$$