

## Automatic Control Systems – June 13, 2023

Student: \_\_\_\_\_ ID: \_\_\_\_\_

1. Given the LTI system defined by the transfer function  $G(s)$ ,

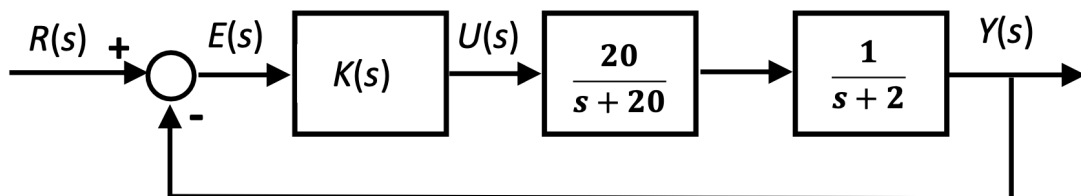
$$G(s) = \frac{s + 10}{s^2 + 3s + 2},$$

calculate the analytic expression of the forced response to a step input of unitary amplitude (i.e., step response).

2. Draw the qualitative step response of the following LTI system:

$$\dot{x} = \begin{pmatrix} 0 & 1 \\ -4 & -4 \end{pmatrix} x + \begin{pmatrix} 0 \\ 2 \end{pmatrix} u$$
$$y = (1 \quad 0)x$$

3. For the closed loop system shown in figure,



devise  $K(s)$  in order to satisfy the following requirements:

- $e_{\infty} = 0$  for a reference signal  $r(t) = 1(t)$ ;
- overshoot  $s \leq 20\%$ ;
- settling time  $t_{s5\%} < 1$  s.

**Time available: 2 hours**