

Automatic Control Systems – June 23, 2022

Student: _____ ID: _____

1. Compute the analytic expression of the step response of the LTI system defined by the following transfer function:

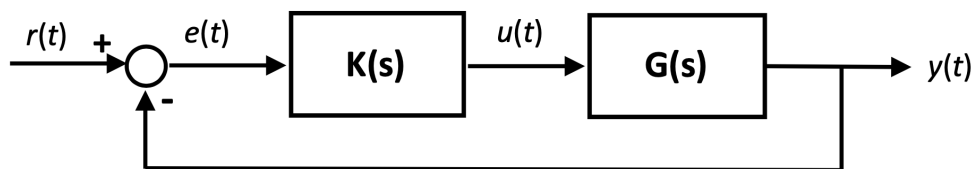
$$G(s) = \frac{s + 20}{s^2 + 4s + 3}$$

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

$$\dot{x} = \begin{pmatrix} 0 & 1 \\ -4 & -1 \end{pmatrix} x + \begin{pmatrix} 0 \\ 1 \end{pmatrix} u,$$

$$y = (1 \ 0)x$$

3. For the control system shown in figure



with

$$G(s) = \frac{2}{(s + 4)(s + 1)},$$

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

- a. $e_{\infty} = 0$ for a reference signal $r(t) = 1 \cdot 1(t)$;
- b. overshoot $s \leq 30\%$;
- c. settling time $t_{s5\%} < 1$ s.

Time available: 2 hours