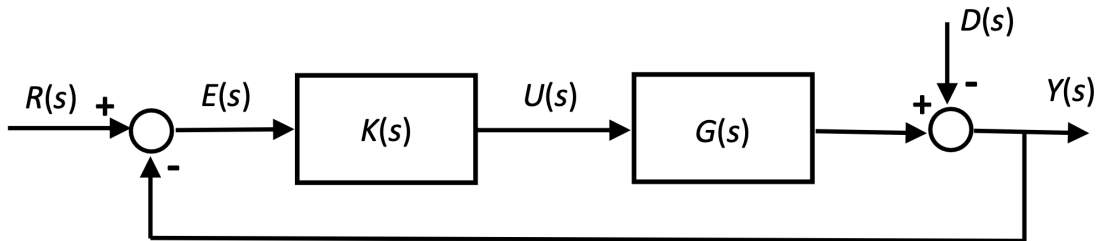# Automatic Control Systems – May 9, 2024

Student:_____ **ID:**_____

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

$$G(s) = \frac{2(s + 20)}{(s^2 + 2s + 10)},$$

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

   b. draw the qualitative step response.

2. For the closed loop system shown in figure,

   where

$$G(s) = \frac{10}{(s^2 + 11s + 10)},$$

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

   i. $e_\infty = 0$ in the presence of both reference, $r(t)$, and disturbance, $d(t)$, step input signals;

   ii. $y(t)$ with overshoot $s \le 15\%$ to a step reference input $r(t)$;

   iii. settling time $t_{s5\%} \le 1$ s;

   b. draw the qualitative response $y(t)$ of the devised closed loop system to the following inputs:

   $r(t) = 1(t)$;

   $d(t) = 0.3 \cdot 1(t - 6)$.

   Time available: 2 hours