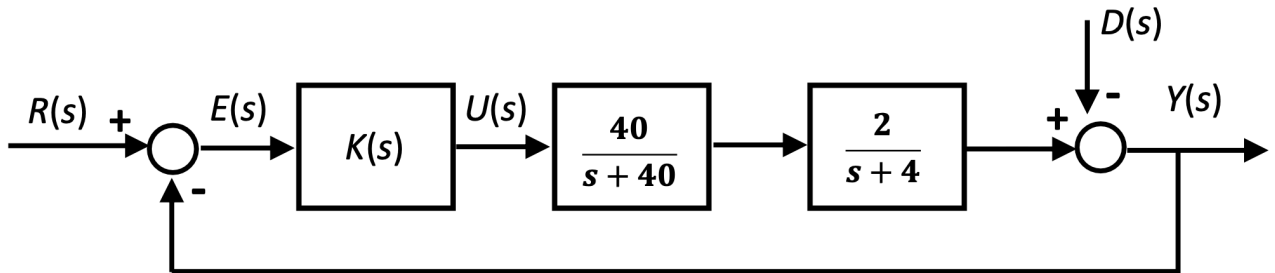# Automatic Control Systems – September 12, 2023

Student:_____ **ID:**_____

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

$$G(s) = \frac{s + 20}{s^2 + 4s + 5},$$

   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 the reference r and the disturbance d are step signals,

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

   i. $e_\infty = 0$;

   ii.   overshoot $s \leq 20\%$;

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

   b. calculate the gain stability margin of the devised control system.

Time available: 2 hours