Automatic Control Systems – September 3rd, 2024

Student:_____ ID:_____

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

$$G(s) = \frac{25(2s+1)}{(s^2+15s+50)},$$

- 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

$$G(s) = \frac{15}{(s^2 + 13s + 30)},$$

- a. design K(s) in order to satisfy the following requirements:
 - i. $e_{\infty}=0$ w.r.t. a step reference input r(t);
 - ii. y(t) without overshoot to a step reference input r(t);
 - iii. settling time $t_{s5\%} \leq 1$ sec.
- b. draw the qualitative response y(t) of the devised closed loop system to the following inputs:

$$r(t) = 2 \cdot 1(t);$$

 $d(t) = d_0 1(t - t_0)$ with $d_0 = 0.1$ and $t_0 = 3$ sec.

Time available: 2 hours