

## ***Automatic Control Systems – April 30<sup>th</sup>, 2025 - B***

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

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

$$G(s) = \frac{(s + 80)}{(s^2 + 9s + k)},$$

- i. discuss the stability by varying  $k \in (-\infty, +\infty)$ .
- ii. calculate the analytic expression of the forced response to a step input of unitary amplitude (i.e., step response) for  $k = \mathbf{18}$ ;
- iii. draw the qualitative step response for  $k = \mathbf{180}$ .

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

$$G(s) = \frac{32s}{(s^2 + 8s + 16)},$$

- i. draw the asymptotic Bode diagrams;
- ii. calculate the steady state response to the input signal  $u(t) = 3 \sin(4t)$ .

**Time available: 2 hours**