Last name **Name** **student ID No.:**

PC No. ___________

Section 4: STABILITY OF LINEAR DYNAMIC SYSTEMS

A dynamic process G_p has the following transfer function

$$G_p = \frac{(s+n)^2}{(s^2+2n)\left(s+\frac{n}{2}\right)}$$

where n = PC No.

I. How much is the **gain**?

Part A: *Root locus*

For the **system** G(s), plot the *root locus* by means of Matlab and SisoTool resources, attach it and answer here the following questions:

1. Determine poles, zeroes and No. of trajectories.
2. Discuss and determine the **breakaway point**, if any

Part B: Frequency response

For the **dynamic system** $G_p(s)$ and a *P controller with* K_c=1:

1) Plot the **Bode Diagrams** by means of Matlab resources, with a *log scale of the magnitude (NOT in dB),* and attach them here
2) Does a **resonance** frequency exist? How much is it?
3) Does a *crossover* frequency exist? How much is it?
4) Does a *gain crossover* frequency exist? How much is it?
5) Decide if the Bode stability criterion is applicable
6) If yes, is the above system closed-loop stable?
7) Plot the **extended Nyquist diagram** *together with the unit circle* by means of Matlab resources and attach it here
8) Check, on the base of the **Nyquist** stability criterion, if the above system is closed-loop stable

Part C: Dynamic responses in the time domain

For the **dynamic system** $G_p(s)$ and a *P controller with* $\mathbf{K_c}$**=1/n**
use the Matlab resources to:

a. plot the **open-loop** dynamic response to a unit step, attach it here and give your comments
b. plot the **closed-loop** dynamic response to a unit step change in *set point*, attach it here and give your comments

Part D:

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