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

PC No. ___________

Section 4: STABILITY OF LINEAR DYNAMIC SYSTEMS

A dynamic process G(s) has the following 4 **poles**:

0
−0.05*(2*n+0.5)/(2*n−0.5)
−0.1
−2

the following 2 **zeroes**:

−1
−0.5*(2*n+0.5)/(2*n−0.5)

the following **transfer constant**:

1

where n = PC No.

I. How much is the **order**?
II. How much is the **type "g"**?
III. How much is the **gain**?
IV. How many and how much are the **time constants**?
V. Is this an **inverse response** system?

Part A: *Root locus*

For the **system** $G_p(s)$:

A.1. Plot the root locus by means of Matlab and SisoTool resources and attach it here
A.2. Discuss and, if possible, calculate the **asymptotes**
A.3. Calculate the value of the **critical gain** K_c*
A.4. Discuss in detail the closed loop BIBO stability of the system when K_c is changed

Part B: Frequency response

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

B.1 Plot the **Bode Diagrams** by means of Matlab/SisoTool resources, with a *log scale of the magnitude (NOT in dB)*, and attach them here
B.2 Decide if the Bode stability criterion is applicable
B.3 If yes, is the above system closed-loop stable?

B.4 Plot and attach here the **extended Nyquist diagram** *together with the unit circle and the Peak Response* by means of Matlab and SisoTool resources, then discuss it in details

B.5 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

C.1. assign a *suitable value* to the **controller gain** K_c such as the system G(s) would be closed loop stable

C.2. plot the **open-loop** dynamic response to impulse, attach it here and give your comments

C.3. plot the **closed-loop** dynamic response to a unit step in **set point**, attach it here and give your comments

C.4. plot the **closed-loop** dynamic response to a unit step in **disturbance**, attach it here and give your comments

Part D:

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