

Due date: October, 30, 2017, (5 marks out of 100 will be reduced for a day delay)

Project overview:

The system inputs have to be the same in all parts of your project

1. Provide Mathematical model for the DC motor with and without loads (J_1 and J_2). Check the appendix for the motor constants. (20)

Description	Figure number	check
Block diagram without any assumption	1	
Simplified transfer function	2	

2. Plot the step responses of the mathematical model transfer functions
Show the phase and gain margin on the bode plots.

Discussion about the effect of the load on the step response (rise time, overshoot and etc.)

Discussion about the correlation of the damping ratio and phase/gain margin. (25)

Description	Figure number	check
Step responses of 3 different loading conditions /open loop position transfer function	3	
Step responses of 3 different loading conditions/closed loop position transfer function	4	
Bode diagrams of 3 different loading conditions/open loop position transfer function	5	
Bode diagrams of 3 different loading conditions/closed loop position transfer function	6	

3. According to the frequency domain method, design a cascade lag-type controller for 20 % overshoot.

Comment on the controller performances according to the step response and bode diagrams. (25)

Description	Figure number	check
Step response with lag without load, with J_1 and J_2 load	7	
Bode diagram of the system without load, with J_1 and J_2 load	8	

4. Convert the best controller which is designed in the part 3 to digital and show the system step response.

Comment on improper and proper sampling times (20)

Description	Figure number	check
Step response with lag without load (different proper and improper sampling times)	9	
Step response with lag with J_1 load (different proper and improper sampling times)	10	
Step response with lag with J_2 load (different proper and improper sampling times)	11	

Points: (10)

Font size: 24 and 16, Times New Romans, Bold for the cover page (1)

Font size: 12, Times New Romans, Normal, Margin 1 inches for all sides for the report, single line spacing. (2)

Please justify your paragraphs. (1)

All figures and table must have caption and legend. (1)

Report must have following part:

First page (Course name, report name, group members name an ID number and ...) (1)

Abstract (2)

List of contents, list of figures (2)

The best presentation will get 5 marks as a bonus

To find Bode diagram:

Use identified transfer function and using MATLAB function “bode” or “Bode plot” Simulink block or use the “bode” function after defining the transfer function in the workspace.

