ELEC 481
General Guidelines for the Lab. Work

For the selected ECP target application you need to perform the following tasks. Your report should provide sufficient details regarding the design procedure, validation and verification through simulations evaluation and analysis. All the details corresponding to these may be included in an Appendix to ensure readability of the report. The main body of the report should address only your main observations, results, and discussions. Only ONE report is to be handed in for each group. The deadline for submission of the report is the date of the Final Exam.

1) Starting with the input-output equations of the system, derive the state and output equations.
2) Find the transfer function of the open-loop system.
3) Obtain the controllable, observable, and Jordan canonical forms in (1).
4) Obtain the impulse response and the step response in (1) with arbitrary initial conditions.
5) Plot the Bode plot of the uncompensated system as well as the root-locus of the open-loop system.
6) Design a lead-lag or a PID controller to meet certain design specifications (of you own choice). Try to include both transient as well as steady state characteristics.
7) Obtain the step response, square wave and sinusoidal responses.
8) Examine the robustness of the design by introducing noise and parameter variations or uncertainty in the system.
9) Design a full state feedback control to meet the design specification indicated in (6).
10) Obtain the step, square wave and sinusoidal responses with arbitrary initial conditions and compare the results with those in (7).
11) Design a full-order and a reduced-order observer and obtain step and sinusoidal responses.
12) Find the transfer function of the observer and controller. What type of controller do you get?
13) Provide a comparative study between the classical control design advantages and disadvantages with that of the modern control theory design.
14) Provide justifications for your comparative study through numerical simulations by Matlab.