MEM 351 Final Report Format

This report will reflect the lessons and findings accumulated in the past six labs. One hardcopy and an electronic copy of the lab report are to be submitted **per group**. The report should range between 15 and 20 pages. There will be a box in the MEM department office to deposit labs. The deposit box will be emptied at the above deadline times. Those that are late will incur at **25% late penalty**. The deadlines were announced in class.

Leverage your 5-page pre-report. The final report format is as follows:

Section 1: Introduction

- Overall objective and motivation

Section 2. Theory (refer to Homework 1)

- Compound pendulum equations of motion
  - Free-body-diagram
  - Derivations of equations of motion
  - General 2nd order differential equation
  - Derivation for calculating the damping ratio and natural freq
  - Derivation for calculating the viscous damping coefficient and moment of inertia
  - Pole locations (based on Lecture entitled “Dynamic Equations of Motion”
  - Relationship between pole values, damping ratio and natural frequency
- Pole Placement Control (refer to Lecture entitled “Pole Placement Control”)
  - Block diagram
  - General procedure for calculating gains
  - PID Control (refer to Homework on “Pole Placement and PID Simulation”
  - Block diagram
  - Final value theorem of the PID control for determining steady-state value

Section 3: Simulink Simulations (refer to Lab entitled “Simulation of Pole placement and PID Control”)

Provide Simulink screen shots and scope outputs and describe how these simulations implement the theory you described in Section 2

- Pole placement control
  - Verify your design meets your desired pole positions
- PID control
  - Case 1: Overshoot with significant settling time (e.g. more than 10 seconds)
  - Case 2: No overshoot but mediocre settling time (e.g. more then 5 seconds)
  - Case 3: Slight overshoot (i.e. fast transient response) and fast settling time (e.g. less than 5 seconds)

Section 4: Experiments (refer to Lab entitled “PID Experiment”)

- Description of experimental setup
- Photo of setup with annotated text or a drawing (use a computer program to draw lines, boxes, etc. No hand sketches)
- LabVIEW screen shots of front panel and block diagram. Describe how the program works i.e. the role of each control in the block diagram
- Provide Excel plots of acquired data from PID control
  - Case 1: Overshoot with significant settling time (e.g. more than 10 seconds)
  - Case 2: No overshoot but mediocre settling time (e.g. more then 5 seconds)
  - Case 3: Slight overshoot (i.e. fast transient response) and fast settling time (e.g. less than 5 seconds)

Section 5: Observations and Conclusions

- Describe how well Section 4 experimental data relates to Section 3 simulations
- Comment on how the labs achieve the objectives in Section 1.

Grading

The final report grade is weighted as follows. Each student in a group will receive the same final grade on the report

Item	Amount
Introduction	15%
Theory	25%
Simulation Results	20%
Experiment Results	20%
Conclusions	10%
Presentation of final report	10%