

# **BME 630 Control Systems and Bio-Robotics**

## **Lab Instructions and Guidelines**

**Department of Electrical, Computer and Biomedical Engineering  
Faculty of Engineering and Architectural Science  
Toronto Metropolitan University**

## Course Information

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## Laboratories Schedule and Topics

Week	Topic	Lab Description
2 – 3	Lab 1.1	Lab # 1.1: Introduction to Simulink, Open-Loop Control vs. Closed-Loop Control
4 – 5	Lab 1.2	Lab # 1.2: Transient Response Analysis and Stability of 2nd and 3rd Order Systems.
6 – 7	Lab 2.1	Lab # 2.1: Transfer Function Modeling of Physical Systems and Control.
8 – 9	Lab 2.2	Lab # 2.2: Introduction to Lead and Lag Compensators
10 – 11	Lab 3.1	Lab # 3.1: Introduction to PI PD and PID Controllers
12 – 13	Lab 3.2	Lab # 3.2: State Space Modeling of Physical Systems and Control.

# General Information and Instructions

## Laboratory Instructions:

- Labs will be completed in groups of two, and students should find a group partner. If a student is not able to find a partner, the TA will assign one to the student.
- There will be three labs, each lab will have two parts, each of which will take two weeks to complete.
- Each lab is worth 7% of the overall grades. Lab reports must be submitted with both parts included and in pairs (i.e., one report per group).

## Lab Report Submission and Deadlines

The lab reports must be submitted within 24 hours after the completion of the lab module (i.e., on the 4<sup>th</sup> week of the lab). For example, if the final lab session is on January 24<sup>th</sup> at 3 p.m, students must submit their lab report on D2L by January 25<sup>th</sup> at 3 p.m.

The lab reports must be submitted on D2L in the drop box of Assignments. Two submissions are required:

- A pdf of the lab report.
- Zip file containing all codes, including singular Matlab scripts, and Simulink files. Not submitting MatLab scripts or Simulink files will result in a 10% deduction.

## Late Submissions and Penalties.

The following penalties will be applied for lab submissions:

- 10% deduction if submitted within 24 hours after the due date.
- 20% deduction for every day after that.

## Late Reports

The lab reports should include the following:

- Cover page.
- All requested figures, graphs and tables for each section, neatly separated.
- Summary at the end of the report.
- Appendix that must include screenshots of your entire Matlab script.

## Lab Marking Scheme:

### Formatting: /10

- Inclusion of proper cover page
- Page numbers included.
- Sections properly outlined (i.e. A.1, A.2, etc.)
- Figures all have proper and consistent labeling
- Graphs all have titles and legends

Lab work: /75

- Based on the correctness and completeness of all lab sections

In-class demos and attendance: /12 (6% + 6%)

- Demos are worth 6% of your lab grade
  - However, if It is found that your demo answers are inconsistent with your report (or cheating/code copying is suspected) you will lose 50% of your lab grade.
  - Demos are done in groups, but will be evaluated individually.
  - The demos will test your understanding of both the theory and the code. Therefore BOTH students should have a full understanding of what their code does and how it does it to receive full marks.
- Attendance is also worth 6% of total lab grade
  - If lab session is missed, you will lose 6% of total lab grade.
  - If you miss 2 or more lab sessions, you will receive a zero on the lab
  - Caveat: if students demonstrate that they have fully completed the lab part that the lab session is geared towards, they may be allowed to leave early (UNLESS they need to complete a lab demo that day)

Summaries: /3

- Summaries are individual, and should be MAXIMUM 1 page per student (including summaries for both parts of lab)
- Should discuss the following:
  - What was the purpose of each lab part
  - Primary conclusions made
  - Any problems or ways the experiment could be improved/reasons for error