University of Waterloo

Department of Chemical Engineering

ChE 390 CHEMICAL ENGINEERING LABORATORY 3 (Spring 2023)

COURSE INSTRUCTOR

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Office hour: email me any time or appointment by email for an in-person or Teams meeting

TEACHING ASSISTANTS

Name	Lab Assignment	Office Hour	Email
Zhongyi Liu	E1 and E2	13:30~14:30, Friday	*zhongyi.liu@uwaterloo.ca*
Carlos Andrés Elorza Casas	E3 and E4	13:30~14:30, Friday	*caelorzacasas@uwaterloo.ca*
Tola Titcombe	Project-based labs	13:30~14:30, Friday	*aatitcombe@uwaterloo.ca*

COURSE DESCRIPTION, OBJECTIVES, AND LEARNING OUTCOMES

ChE 390 Chemical Engineering Laboratory 3 involves the experimental and numerical studies of core chemical engineering subjects. The primary objective of this course is to reinforce the understanding and practical applications of chemical engineering theories and concepts from the lecture courses through hands-on experiments with pilot-scale unit operations. Some other course objectives, with reference to the CEAB learning outcomes, can be found on Pages 1~3 of the lab manual. At the end of the laboratory course, you should be able to:

1. Identify and formulate practical chemical engineering (ChE) experimental, process, and design problems by applying the knowledge and underlying principles from previous lecture courses [1, 2, 4].
2. Conduct experimental investigations of ChE fundamentals and process problems by appropriately selecting experimental methods and procedures, critically analyzing and interpreting experimental results [3].
3. Apply modern engineering tools (online data acquisition and control, numerical computations) and problem-solving skills to solve the practical ChE experimental and process problems and reach valid conclusions [2, 3, 5].
4. Locate and evaluate relevant standards and technical literature, and seek out and use the well-established information to validate experimental results and underlying theories [1, 3, 11], and further implement an open-ended design or simulation project [4, 9, 11, 12].
5. Communicate clearly and effectively in oral, written, and/or visual form through working in a lab team and writing technical reports [6, 7].

6. Contribute to and manage laboratory assignments and experimental activities including following all the lab safety protocols and academic policy as a member and/or a leader of an engineering team [6, 7, 8, 10].

PREREQUISITE AND CO-PREREQUISITE: ChE 211, ChE 231, ChE 241, ChE 291, ChE 314

LAB COURSE MANUAL AND REFERENCES

1. Zhang, M., "ChE 390 Chemical Engineering Laboratory 3", Spring 2023, available on LEARN.
2. Green, D. W. and Southard, M. Z., "Perry's Chemical Engineers' Handbook", 9th ed., McGraw-Hill, 2019, electronic version is available at:
   https://www-accessengineeringlibrary-com.proxy.lib.uwaterloo.ca/content/book/9780071834087
3. References specific to individual experiment are available in the lab handout.

COURSE CONTENTS AND LAB LOCATION

➢ The laboratory course consists of the following five laboratories:
Experiment 1: Optimization of Polymer Injection Molding Using Tensile Test and Factorial Design **(DWE 1513)**.
Experiment 2: Pressure Losses of Turbulent Pipe Flow (**DWE 1513**).
Experiment 3: Python Laboratory Module I (**DWE 2529**).
Experiment 4: Python Laboratory Module II (**DWE 2529**).
Project-Based Laboratories and their lab locations are as follows:

Lab code	Project	Lab location
A1	Scale-up and Optimization of Mechanically Agitated Bioreactors	**DWE 1520**
B1	Packed-Bed and Fluidized-Bed Reactor for Biochemical Wastewater Treatment	**DWE 1514**
B2	Design and Calibration of a Flow Meter for Distillation Column	**DWE 1513**
C1	Centrifugal Pump Characteristics, Design, and Optimization for a UV Wastewater Treatment Process	**DWE 1513**
C2	Centrifugal Pump Characteristics, Design, and Configuration for Viscous Fluid Transport	**DWE 1513**

➢ Experiments 1 and 2 are physical labs with fully-developed handouts in the lab manual. The project-based laboratory is an open-ended laboratory with a project statement for each laboratory project in the lab manual. Experiments 3 and 4 are Python modules with separate lab handouts available on LEARN. **All the course materials (the lab manual and handouts) in this course are copyrighted.**

LAB SCHEDULES

➢ Two weekly lab sessions: 1:30~4:30 pm on Tuesday and 1:30~4:30 pm on Thursday for lab groups with scheduled labs and Python modules.

➤ You can form your own lab group of 4 with anyone in your registered course section, and all your labs will be scheduled to your lab day if the overall lab schedule permits. Alternative arrangement is possible on a case-by-case basis. See Page 4 for a tentative lab schedule, and you can sign up your lab group at:

https://docs.google.com/document/d/17XA3QufnHaOtxQuFsLBzGf9NbNp5Yz0i5gZuBEdjQ2I/edit?usp=sharing

LAB ATTENDANCE AND PERFORMACE

➤ Lab session attendance is required of all students for the regular labs, Python lab modules, and project-based lab consultations and labs. If there is a compelling reason for the absence of any of the scheduled lab sessions, you must contact the instructor in advance so that alternative arrangement can be made.

➤ Lab attendance is a prerequisite for lab report. Lab attendance/performance mark will be based on actual lab attendance, performance, and following lab safety rules.

LAB REPORTS

➤ Lab report requirement for each lab experiment is as follows (see the detailed guidelines for lab report format and marking rubric on Page 5 of the lab manual):

E1: Group full report
E2: Individual full report
Project-Based Laboratory: Group partial prelab and group full project report (see detailed report requirements on Page 2 of the lab manual).
E3 and E4: Individual In-Class Exercise and group partial Assignment and Report

➤ Lab reports for the regular labs and Python lab modules are due two weeks from the lab date. The due date for the project-based lab is generally the end of the project period. All lab reports and other required submissions must be submitted electronically to proper dropbox on LEARN. The penalty for late submission is 10% per week, which will be applied on a daily basis.

ASSESSMENT AND GRADE DISTRIBUTION

➤ Overall grade distribution:
- 34% for regular labs (E1 14% and E2 20%)
- 40% for project-based lab.
- Python laboratory modules (E3 and E4): 26%

➤ Grading scheme for the regular labs:
- Lab quiz: 10%
- In-lab submission: 4%
- Lab attendance and performance: 4%
- Lab report: 82%

➤ Grading scheme for the project-based laboratory:
- Project consultation meeting: 5%
- Prelab project proposal: 11%
- Lab attendance and performance: 4%
- Project lab report: 65%
- Project lab presentation: 15%

➤ 1% bonus mark for accessing/participating the course survey at the end of term.

LABORATORY SAFTETY AND REGULATIONS

➢ All students are required to adhere to the laboratory safety rules summarized in Pages 8 and 9 of the lab manual. Any unsafe practice and unprofessional conduct in the lab session will result in a deduction of marks. A serious violation of any of the laboratory safety rules may lead to immediate dismissal from the lab session.

➢ You may request to view or examine equipment during normal working hours prior to your scheduled lab, but under no circumstance should you work on or operate an experiment alone or without proper supervision.

➢ Labs must be done on the scheduled lab dates with all members' presence and active participation.

ACADEMIC INTEGRITY AND DISCIPLINE: UW POLICY # 71

➢ Inappropriate academic behaviors and misconducts such as plagiarism, cheating, copying and sharing will be strongly prohibited for this laboratory course, and can result in serious consequences. For detailed information on the academic integrity and student discipline, see UW Policy # 71 at:
https://uwaterloo.ca/secretariat-general-counsel/policies-procedures-guidelines/policy-71

➢ Turnitin, a text-matching software tool, will be used for encouraging academic integrity and detecting downright plagiarism. Your lab submissions will be compared to a large pool of textual materials from, but not limited to, dropboxes in this course, open websites, ejournals etc. If you want to have an alternative to Turnitin, you will need to contact the course instructor in the first two weeks of the term.

ChE 390 Lab Schedule (Spring 2023)

Lab Group	May 16, Tuesday	May 18, Thursday	May 23, Tuesday*	May 25, Thursday	May 30, Tuesday	June 1, Thursday	June 6, Tuesday	June 8, Thursday	June 13, Tuesday	June 15, Thursday	June 20, Tuesday	June 22, Thursday	June 27, Tuesday	June 29, Thursday	July 4, Tuesday	July 6, Thursday	July 11, Tuesday	July 13, Thursday	July 18, Tuesday
G1	E1				E3				A1								E4		E2
G2	E1				E3				B1								E4		E2
G3		E2		E3						A1						E1		E4	
G4		E2		E3						C1						E1		E4	
G5		E3		E2						B1						E4		E1	
G6		E3		E2						C1						E4		E1	
G7		E3		E1							A1						E2		E4
G8		E3		E1							B1						E2		E4
G9	E2				E3				C2								E4		E1
G10	E2				E3				B1								E4		E1
G11		E1		E3					A1							E2		E4	
G12		E1		E3					C2							E2		E4	
G13		E3			E2						C1						E1		E4
G14		E3			E2						C1						E1		E4
G15																			
G16																			

*Monday schedule on May 23.
Project-Based Laboratory Presentations: July 20, 25, and 27.

ChE 390 Laboratory Groups (Spring 2023)

Group No.	Group Members
G1	Long Luu, Allen Zhang, William Tranchemontagne, Samuel Asrat, Govind Sharma
G2	Matthew Liu, Connor Smith, Michael Shelley, Max Freudenthaler, Ethan Coutinho
G3	Khali Abdi, Nehita Oko-Oboh, Aisha Biobaku, Ahreum Kim, Aknan Ali
G4	Riley Purdie, Leah Metcalfe, Zoey Wei, Madeline Sain
G5	Ilker Livvarcin, Nirav Sinhal, Huffington Xu, Boss Omeire
G6	Julie Kim, Danyang Fan, Sunny Ke-Jiang, Melina Brajuka, Fan Zhang
G7	Samia Ahmed, Britney Sao, Wamia Wamia, Kjerste Thomas
G8	Brendan Ng, Daniel Fonseca-Cerrato, Ahmed Khan, Cedric Jean-Charles
G9	Logan Haggard, Louise Tayzon, Maeve Seto
G10	Alex Winter, Gavin Liu, Sophie Campbell, Rachel Kumara
G11	Bavneet Grewal, Huda Almalki, Saihaan Garasia, Sam Erfani
G12	
G13	Ray Xu, Allan Zhang, Benjamin Lee, Donghoon Kim, Marcus Liu
G14	Annie Zhang, Emaad Alam, Jonathan Pileggi, Kyle Vandermulen
G15	
G16	