Department of Chemical Engineering

ChE 491 CHEMICAL ENGINEERING LABORATORY 5 (Winter, 2023)

COURSE DESCRIPTION AND OBJECTIVES

ChE 491 Chemical Engineering Laboratory 5 involves the experimental investigation of chemical engineering unit operations through open-ended project laboratories, focusing on solving practical chemical engineering experimental, design, and simulation problems through the integration of fundamental unit operation concepts and pilot-scale laboratory experiments. The primary objectives of this course are (1) to enhance the in-depth understanding and applications of chemical engineering theories to the performance of authentic unit operation processes through hands-on experience, and (2) to integrate the unit operation theories and experimental observation into practical chemical engineering design and simulation. Some other additional objectives can be found in the learning outcomes of the projected-based laboratory on Page 13 of the lab manual.

LABORATORY INSTRUCTOR

Name	Office & email	Office Hour and Labs
John Zhang	DWE 2530B, x35815 *m78zhang@uwaterloo.ca*	Email any time for questions for all the labs, and email for appointment or Teams meeting on weekdays.
Cheryl Newton	DWE 2530A, x35809 *cheryl.newton@uwaterloo.ca*	Emails or messages on Teams on weekdays, 8am~4pm, for Labs H3, G4, G5, G1.

TEACHING ASSISTANTS

Name	Lab assignment	Office Hour	Email
Tola Titcombe	G1, G5	Appointment by email	*aatitcombe@uwaterloo.ca*
Susan Davari	G2, G3	Appointment by email	*s3davari@uwaterloo.ca*
Yasmin Shabeer	H2, H3	Appointment by email	*yshabeer@uwaterloo.ca*
Abhishek Mishra	H1, G4	Appointment by email	*abhishek.mishra@uwaterloo.ca*
Mike McKague	H4, H5	Appointment by email	*mgmckague@uwaterloo.ca*

LAB COURSE MANUAL AND REFERENCES

1. Zhang, M., and Newton, C., ChE 491 Chemical Engineering Laboratory 5, Winter 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-accessengineeringlibrarycom.proxy.lib.uwaterloo.ca/content/book/9780071834087***
3. Sinnott, R. K., "Coulson and Richardson's Chemical Engineering Volume 6 - Chemical Engineering Design", 4th ed., Elsevier, 2005. Electronic version of the book is available on Knovel site at: ***https://subjectguides.uwaterloo.ca/c.php?g=695419&p=4931331***
4. Coker, A. K., "Ludwig's Applied Process Design for Chemical and Petrochemical Plants", Chapter13, Volume 2, 4th ed., Elsevier, 2010. Electronic version of the book is available at: ***http://www.accessengineeringlibrary.com/subject/chemical_engineering***
5. References specific to individual experiments are available in the lab manual.

COURSE CONTENTS

- The laboratory course consists of two project-based laboratories.
- Each lab group is recommended to select one laboratory project from each of the two lab series (G and H) listed below, but having both laboratory projects from the same lab series is entirely possible if lab scheduling for the class is permitted.
- A project statement outlining the scope and design specifications of each lab project is available in the lab manual, along with the recommended references and relevant lab equipment information.

ChE 491 Project-Based Laboratories and Laboratory Locations

Project Code	Project-Based Lab Experiment	Lab Location
G1	Catalytic Reactor Design for the Removal of VOCs in Air	DWE 2526
G2	Pilot Distillation Operation, Design, and Optimization	DWE 1513
G3	Design and Optimization of Stripping Column for CO_2 Capture and Utilization	DWE 1513
G4	Packed Column Design for Bioethanol Separation via Continuous Liquid-Liquid Extraction	DWE 1520
G5	Packed Column Design for Gas Absorption and Dehumidification	DWE 2526
H1	Batch and Fed-Batch Bioethanol Fermentation: Operation, Design, and Optimization	DWE 1520
H2	Application and Design of Ion Exchange Chromatography for the Purification of Major Whey Proteins	DWE 1520
H3	Hydrogel Synthesis and Design for Controlled Drug Delivery	DWE 1519
H4	Lithium Ion Battery Design for Sustainable Energy Storage and Applications	DWE 1518
H5	Vanadium Redox Flow Battery: Performance, Design, and Optimization for Renewable Energy Storage	DWE 1518

LAB GROUPS AND SCHEDULES

- You can form your own lab group of 4 with anyone in your lab section or stream, and your labs will be scheduled on your lab day if the overall schedule permits. Alternative arrangements are possible on a case-by-case basis.
- Two weekly lab sessions: 8:30 to 12:20 on Tuesdays and Thursdays. Additional lab sessions can be arranged with the lab TA or lab instructor.
- See Page 4 for a tentative lab schedule, and you can sign up your lab group at:
  https://docs.google.com/document/d/1l4bcqcaVEydqWluzq22rhdHeAlddJWyIqAvLy2o4BqE/edit?usp=sharing

LAB ATTENDANCE, SAFETY, AND PERFORMACE

- The scheduled lab session attendance is mandatory for all the labs, and attendance is also required of all students for the project-based lab consultation. The required lab attendance will be counted as part of the project lab grade for lab attendance and performance as well as prelab proposal.
- When attending in-person labs, you must obey the general lab safety rules summarized in the lab manual (Pages 3~4) and any lab specific safety instructions. Lab safety is part of the lab attendance mark, and failing to obey all the lab safety rules can result in an expulsion from the in-person lab.
- As a deep understanding of lab equipment, process, and experimental observation is paramount for data analyses and design for the unit operation labs, active participation of all the lab activities through hands-on operation as well as active observation and interaction is strongly encouraged.
- Lab participation is also a perquisite for lab report.

LAB REPORTS

- Group partial report for the prelab proposal and group full lab reports for the project lab reports (see detailed lab report requirements and marking scheme on Pages 6 and 14 of the lab manual).
- The prelab project proposal for the project-based lab is due on the scheduled lab day and the final project report due **three** weeks after the lab day by 11:59 pm. All lab reports must be submitted electronically to the designated folders on LEARN.

ASSESSMENT AND GRADE DISTRIBUTION

- Overall grade distribution:
  - Project labs: 88% (each project 44%).
  - Presentation of the first project lab: 12%
  - 1% bonus mark for accessing/participating the course survey at the end of term.
- Grading scheme for the individual project labs:
  - Project consultation: 10%
  - Prelab project proposal: 15%
  - Lab attendance and performance: 5%
  - Lab report: 70%
- See detailed grading scheme for project-based labs on Page 14 of the lab manual.

ACADEMIC INTEGRITY AND DISCIPLINE: UW POLICY # 71

- Inappropriate academic behaviors and misconducts such as **plagiarism, cheating, copying, excessive collaboration, and sharing** are strongly prohibited for this laboratory course, and can result in serious consequences of the academic offences. For detailed information, see Procedures Related to Academic Offences and UW Policy 71 at:
  https://uwaterloo.ca/engineering/procedures-related-academic-offences-and-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 491 Lab Schedule (Winter 2023)

Lab Group	Jan. 19, Thursday	Jan. 24, Tuesday	Jan. 26, Thursday	Jan. 31, Tuesday	Feb. 2, Thursday	Feb. 7, Tuesday	Feb. 9, Thursday	Feb. 14, Tuesday	Feb. 16, Thursday	Feb. 21, Tuesday*	Feb. 23, Thursday*	Feb. 28, Tuesday	March 2, Thursday	March 7, Tuesday	March 9, Thursday	March 14, Tuesday	March 16, Thursday	March 21, Tuesday	March 23, Thursday	March 28, Tuesday	March 30, Thursday	April 4, Tuesday
G1			*G1*										*H3*									
G2				*H2*										*G3*								
G3							*G1*										*H4*					
G4						*H5*												*G2*				
G5			*G2*										*H5*									
G6				*G2*										*H5*								
G7					*G1*										*H2*							
G8								*G2*										*H4*				
G9			*G4*										*H1*									
G10				*H4*										*G5*								
G11					*G3*										*H4*							
G12						*G1*										*H2*						
G13								*G5*										*H3*				
G14				*H1*										*G4*								
G15					*G5*												*H2*					
G16						*H3*										*G2*						
G17			*H3*										*G4*									
G18							*H4*										*G1*					
G19					*H4*										*G2*							
G20						*H2*										*G3*						
G21				*G4*										*H2*								
G22							*G3*										*H3*					
G23							*H1*										*G2*					
G24					*H3*										*G1*							
G25							*G2*										*H5*					
G26						*G2*										*H4*						
G27							*H3*										*G3*					
G28								*H5*										*G3*				
G29					*H5*										*G5*							
G30								*G3*										*H5*				

*[1]. *Reading Week, Tuesday, Feb. 21~Thursday, Feb. 23*

[2]. Green color for physical labs, and yellow color for the first project presentations.

ChE 491 Laboratory Groups (Winter 2023)

Group No.	Group Members
G1	Alexa Salvatore, Guen O'Hara, Sawyer d'Entremont, Aleksi Luoma
G2	Irene Dauz, Jasnain Dhaliwal, Victor Luu
G3	Loria Ou, Casey Dudding, Amber Rutyna, Cassidy Good
G4	Shania Joseph, Aryan Ahmed, Mohamed Abayazeed, Jarrell (Jeng Haw) Yau
G5	Kendall Magro, Elizabeth Mackay, Faith Rowntree, Amanda Fryland
G6	Rithu Muthalathu, Alice Feng, Param Dave, Elliot Cho
G7	Jin Yun Zhu, Taylor Henshaw, Darby Grech, Idamae Joyce
G8	Tirth Patel, Arvind Balaji, Jacky Liang, Haider Rizvi
G9	Mariana Lozano, Adrian Foell, Fabian Villa, Xinge Yang
G10	Arsalan Chughtai, Matthew Dutaud, Peter Greuel, Aranjan Gnanachandran
G11	Marianna Cuba Coltsmann, Jeanie Chan, Farisa Hasan, Sophia Kim
G12	Hao Wang, Shiani Raj, Troy Lewis, Zhen Ye
G13	Danielle Vinzon, Jazmine Catly, Angeline Nguyen, Alice Tong
G14	Ryan Hurd, Ali Afifi, Joshua Melanson
G15	Abin Varghese, Irfan Khan, Amrita Kaur, Jason Pun, Sid Kanade
G16	Craig Harrison, Jason Tong, Tobe Ohaka, Bishal Thapa
G17	Ally Villeneuve, Nusayba Sultana, Eveline Thevasagayam, Harumi Diaz
G18	Sebastian Garcia-Marroquin,Yazan Al Katanani, Alex Dima, Adithya Swaminathan
G19	Rahim Khan, Zain Asrani, Rithik Chaudhary, Mahir Ahmad
G20	Faique Ahmad, Matthew Baun, Aden Mohammed, Jeffrey Skidmore
G21	Chris Tran, Tina Nia, Chelsea Yang, Hao Yu Zhang
G22	Tarela Okoronkwo, Anthonia Byron, Shraddha Pandey, Luca Romagnoli
G23	Michael Kiszka, Aamer Akhand, Brian Choi, Jared Byers, Gregory Hufton
G24	Danny Kang, Jakob Staines, Emily Adamson, Robert Ohl
G25	Antonius Ariawan, Sunho Bae, Jason Buskell, Yun Woo Choi, Alex Tse
G26	Helen Ding, Songbo Cui, Soobin Kim, Yiran Liu
G27	Alexa Nicholson, Fatima Aldovino, Priyanka Jindal, Aaliyan Kapadia, Perikilis Alikiotis
G28	Jarrid Brake, Cyrus Malakooti, Derian Tinline, Daniel Kim
G29	Thomas Chen, Duo Sun, Sylverster Li, Jingtian Liu
G30	Olamide Olatunbosun, Shannon McNeil, Sayjal Sharma, Emily Smyth