CME 310
Chemical Engineering Laboratory I: Unit Operation Fundamentals

Credits and Contact Hours: 2 credits; 3 hours and 50 minutes

Course Instructor: Devinder Mahajan/Vladimir Zaitsev

Text(s):

1. Perry's Chemical Engineers' Handbook (7th Edition), R.H. Perry and D.W. Green (eds.). McGraw Hill, New York (2008). 8th Edition.
2. Unit Operations of Chemical Engineering, 7th ed. W. L. McCabe, J. C. Smith and P. Harriott (2005). ISBN# 0-07-284823-5.
3. Laboratory Notes.

Specific course information

a. Introduction to general safety in a chemical engineering laboratory, handling high-pressure equipment. Selection and identification of unit components. Batch and continuous units. Reactor types: stirred, bubble column and slurry-phase reactors. Precise measurements of pressure and temperature variables. Mass balance in a chemical reaction. Simulated distillation.

b. B- or higher in CME 304; Corequisite: CME 300, CME Major
c. Required course

Specific goals for the course:

1. Learn fundamentals of unit safety.
2. Learn principles of unit operation.
3. Perform analysis and mass balance on a chemical system.
4. Learn to operate various reactors, process variables process description.

Criterion 3 a-k: Outcomes	**%contribution**
a. Ability to apply knowledge of math, engineering, and science	10%
b1. Ability to design and conduct experiments	20%
b2. Ability to analyze and interpret data	20%
c. Ability to design system, component or process to meet needs	15%
d. Ability to function on multi-disciplinary teams	5%
e. Ability to identify, formulate, and solve engineering problems	10%
g. Ability to communicate effectively (technical writing shills)	10%
k. Ability to use techniques, skills, and tools in engineering practice	10%
Any other outcomes and assessments?	
	100%

Brief list of topics to be covered (including exams/quizzes):

Week 1.	Chemical engineering lab introduction, Lab report template, Grading policy discussion and template, Writing in Chemical Engineering. Safety in the workplace. Homework: ELS002 and ENV001 on-line training.
Week 2.	Safety in the workplace: SBU policy and examples from CSB web site. Safety quiz.
Week 3.	Data collection-I: LabVIEW hardware Lab Report 1.
Week 4.	Data collection II: LabVIEW programming and set-up Lab Report 2.
Week 5.	High-pressure hardware: a) standards, b) Identification and c) connecting fittings (threaded and compression) for high-pressure operation. Lab Report 3.
Week 6.	Compressed gases: Operation of pressure regulators, gauges and flow meters. Compressed gas delivery system set-up. Lab Report 4.
Week 7.	Calibrations: Pressure transducer, Mass flow meter, and Thermocouple for temperature measurement. Lab Report 5.
Week 8.	Fluids: Behavior of liquids under flow conditions: Laminar and turbulent flows. Determination of Reynolds Number. Lab report 6
Week 9.	Heat exchanger: Concept of steady-state. Determination of heat transfer coefficient. Lab report 7.
Week 10.	Batch Unit Features. Process Control: High-pressure: Rupture disc, Pressure relief valves. Temperature: High T cut-off. Stirring speed: Magnedrive limit. Lab report 8.
Week 11.	Mass Transfer and Henry's Law: Gas dissolution in liquids; Effect of stirring on gas dissolution, Calculation of Henry's Law constant for CO_2. Lab Report 9.
Week 12.	Mass Balance. High pressure liquid pumping against high-pressure in the reactor. Lab Report 10.
Week 13.	Batch Reactor: PID controller. Temperature control; Gas sampling under pressure and reactor content identification using Gas chromatography. Material balance
Week 14	Make-up week.
Week 15	Power Point Presentation on any one completed labs (2 per team). Hand-in Course portfolio.