

ECHE 460 Spring 2010 Course Syllabus: Part I

Title: Chemical Engineering Laboratory I

Description: In this course, you will carry out experiments in stoichiometry, heat transfer, mass transfer, fluid mechanics, and thermodynamics. Areas you will gain proficiency in include unsteady-state heat conduction, particle filtration, centrifugal pumps, vapor-liquid equilibria, rotating disk electrodes, rheology, adsorption and diffusion in zeolites, and membrane gas permeation. Based on the experiments and the results you obtain during the course, you will become proficient in verifying theoretical developments, correlating experimental data with theoretical models, and evaluating fundamental property and design data. You will also become proficient in analyzing data and models using computer analysis techniques, analyzing data using statistical techniques, and presenting technical ideas and reporting them in technical reports.

Course Objectives:

- Reinforce chemical engineering fundamentals through directed experimental projects.
- Learn to use modern experimental and analytical equipment.
- Learn to plan experiments and analyze data.
- Learn to write reports and make technical presentations.
- Learn to work in groups.

Prerequisites: ECHE 310, ECHE 320, C or better in Math 242

Co-requisites: ECHE 311, ECHE 321

Scheduling:

Time:	2:30 to 5:30 pm
Days:	Mondays and Wednesdays or Tuesdays and Thursdays
Location:	Swearingen Engineering Center
Room:	2A19 or Chemical Engineering Laboratories
Time:	2:30 to 3:20 pm
Days:	Fridays
Location:	Swearingen Engineering Center
Room:	2A19

Instructor: **Dr. Edward P. Gatzke**

Office Hours:	Two Hours Per Week
Time:	3:30 to 5:30 pm
Days:	Fridays
Location:	Swearingen Engineering Center
Room:	3C19

Engineer: **Mr. Charles E. Holland**

Office Hours:	By Appointment Only
Location:	Swearingen Engineering Center
Room:	3B47

Teaching Assistants: **18, Two Assigned to Each Experiment and two Graders**

Office Hours:	Scheduled Laboratory Times
Days:	Tuesdays and Thursdays (or M-W)

ECHE 460 Spring 2009 Course Syllabus: Part II

Required Texts: Chemical Process Equipment. Selection and Design, S.M. Walas. Butter-worth-Heinemann, Newton, MA. (1990 or latest edition).

The ACS Style Guide: A Manual for Authors and Editors, 2nd. Ed. Janet S. Dodd, ed., American Chemical Society (1997 or latest edition). Required reading: Ch. 1,3,4,5,6,9, and 12.

Department of Chemical Engineering Chemical Hygiene Plan (provided to you).

Reference Texts: Introduction to Chemical Engineering Thermodynamics, 5th ed., J. M. Smith, H. C. Van Ness, and M. M. Abott, McGraw-Hill, NY (1996).

Chemical Engineering Thermodynamics, 2nd, S. I. Sandler, Wiley, NY (1989).
Fundamentals of Fluid Mechanics, 2nd ed., B. R. Munson, D. F. Young, and T. H. Okiishi, Wiley, NY (1994).

Experiments in Physical Chemistry, 6th ed., D. P. Shoemaker, C. W. Garland and J. W. Nibler, McGraw Hill, NY (1996).

Statistics for Experimenters, G. E. P. Box, W. G. Hunter and J. Hunter, Wiley (1978).

Activities: All work will be done in groups of two or three persons. Randomly selected teams will remain fixed for the entire semester.

For two and three person groups, four projects will be completed (I to IV) during Periods I to IV

- For three person groups, Project IV will also be a compilation project and involve compiling all the data from when the Project IV experiment was run during the semester.
- For two person groups, Project IV will be a normal project and not involve compiling all the previous data.

All four projects will involve experimentation, oral presentations, and written reports.

- For three person groups, each student will serve as Engineer 1, Engineer 2, and Engineer 3 once during the first three projects. A three person group is free to choose who will serve as Engineer 1, Engineer 2, and Engineer 3 for Project IV.
- For a two person group, each group member alternates twice from serving as Engineers 1 and 2 (combined duties) and Engineer 3. Note that these role rotations override the role rotations specified in the ECHE 460 and ECHE 461 Laboratory Manual.

Grading for ECHE 460: All assignments except the Technical Report, Quizzes and the 20 Questions will be graded A, B, C, D, F, or 0 (see the Lab Manual and sample grading sheets). As an example, for final numerical averaging, A=93, B+=88, B=83, C+=78, C=73, D+=68, D=63, F=50 or less. **A grade of 0 will be assigned for unexcused absences, unsafe laboratory behavior, or failure to submit required work.**

The instructor may deduct points from any grade for failure to participate and cooperate with the team. The specific weighting for each assignment is shown in Table 1 below. The last two columns of the table give sample grades and a sample calculation of a final numerical average. General criteria for a letter grade are given in Table 2.

Four experiments will be completed during lab Periods I – IV. For Periods I, II and III, each team member will receive an individual grade for his or her performance during a project Technical Presentation; during Period IV, each team member will receive the same grade for the team performance during a project Technical Presentation. Also, each team member will receive the same grade for the project Technical Report for all four periods. Hence, it is in your best interest to contribute your share to the report, and to assist your teammates as necessary. The specific responsibilities are explained in the ECHE 460 and ECHE 461 Laboratory Manual. The bottom line is that a portion of each team member's grade will depend on the quality of the report. To receive a grade for the Technical Report, a disk or CD containing the entire Technical Report in one MS Word file (including title page, abstract, figures and tables, etc.) and all the calculations in other file formats such as MS Excel or MathCad must be turned in at the same time. These documents will be checked for originality and correctness (see Academic Responsibility below).

Team Policy for ECHE 460: In the event that a member of the team does not meet his/her responsibilities, the remaining team members may elect to not include that person's name on the report. The group has a responsibility to notify the offending individual in advance, in writing that this action will be taken and to document in writing the tasks that were assigned to that team member and the warnings that were given to correct the behavior but ignored. The course instructor is to be copied on all such warnings. **If this action is taken by the remaining team members, the offending team member will receive a grade of zero for that report.**

Team Policy for ECHE 460: If a team member repeatedly fails to fulfill his/her responsibilities for several experiments, the remaining team members should issue him/her a written warning, with a copy to the course instructor. If no improvement is forthcoming, they may, by unanimous consent and also with consent of the instructor, fire that individual from the team, notifying both the student and the course instructor in writing that this action will be taken. **A student who is fired from a team will receive zeros for the remaining report grades.**

A single grade for Team Performance will be assigned at the end of the semester. Team Performance grades will be based on the Confidential Team Evaluations, TA grade sheet comments, and Dr. Gatzke's observations. A member in each group will evaluate independently the team-performance of each of the other members in their group. Each student will submit a Confidential Team Evaluation report at the end of the semester.

A single grade for Lab Performance will be assigned at the end of the semester. Lab performance grades will be based on the TA grade sheets. Teaching assistants will submit their grade sheets after every project.

The grade sheets to be used this semester are in the ECHE 460 and ECHE 461 Laboratory Manual. Table 1 (below) shows the weightings of the different grades and a sample grade calculation for a student in a three person group. The TA is responsible for the grade on the Teaching Assistant grade sheet. Dr. Gatzke is responsible for the grades on the Oral Presentations grade sheet, the Technical Report grade sheet (with the assistance of two report graders), and the Quizzes. The students are responsible for filling out the Confidential Team Evaluation Sheets. *(Please be aware that our Industrial*

Advisory Board strongly supports the development of teamwork skills, and recommended that a specific evaluation of contributions to the team be added to the grading of ECHE 460 and 461.)

A pre-experiment quiz (PEQ) will be given to each student during the Friday class period just prior to the beginning of each Experimental Period. A 10-15 min individually written PEQ will be administered on the experiment the group is scheduled to carry out. You must answer **five** of the **seven** questions correctly **to pass the PEQ**, and **you must draw a detailed flow sheet of the experimental apparatus**, which will be graded on a Pass/Fail basis. If you pass the PEQ, that's great! **If you do not pass it, 3 points will be deducted from your final numerical average**, which means that a maximum of 12 points could be deducted if you fail all four of the PEQs during the semester. These quizzes are intended to make you read the experimental handout before carrying out the experiment; hence, if you read the handout and other literature (i.e., the text book, etc.) on the scheduled experiment, you should not have any difficulty passing these quizzes. In fact, I do not expect any failures, but you never know!

New for ECHE 460: Basic Skills Quizzes (BSQ): Multiple quizzes may be offered during the semester to ensure that you know the basics for this class. This may include safety topics or basic mathematical / engineering concepts. The quizzes will be taken directly from online testing materials. It is expected that you will practice these quizzes online to master them before you are evaluated during class period. **If you do not pass a BSQ, 3 points will be deducted from your final numerical average.**

An eight-section, 60 min exam will be administered on the last Friday lecture period of the semester (or close to this date). An individual section will be devoted to one of the seven experiments. **You must answer the question(s) on five of the seven sheets but turn in all seven sheets.** The list of 20 questions for each experiment will be helpful in studying for this final exam, especially for the experiments you did not do. Also, your required attendance at presentations given by other groups for each experiment you did not do will also be helpful in studying for this final exam (see below). Each question will be graded correct or incorrect and the percentage correct will be weighted as specified below.

Group presentations will be scheduled, as best as possible, during the allotted 3 hr time slot. However, since 60 min time slots will be reserved for each group and only the group has to report to the room during this time to give their presentation, a slot may begin at 1:00 pm or a slot may begin at 7:00 pm for both sections. For example, slots include: 1:00-2:00, 2:00-3:00, 3:00-4:00, 4:00-5:00, 5:00-6:00, 6:00-7:00 and 7:00-8:00 pm. Please show up 5 to 10 minutes before you scheduled time so the changing of the groups can be done quickly. A group will be given a time slot at the beginning of the semester and keep it for the entire semester. If you fail to show up on time, a group's initial grade will be reduced by one increment, for example, from an A to B+ for every 5 minutes tardy.

Presentation Participation Points (PPP) You, as an individual class member, must attend one presentation given by another group for each experiment you did not run. This means that you must attend three presentations during the semester, one for each experiment you did not do. You will have the presentation schedule, so this should not be a scheduling problem. The goal is for you to become familiar with each of the experiments you did not have a chance to run this semester. As mentioned above, you will be tested on these experiments, as well as the ones you did run, during the final exam. Also, as mentioned above, the 20 questions for each of these experiments will be a helpful study tool. **For each presentation you do not attend, of the three presentations you must attend, 3 points will be deducted from your final numerical average**, which means that a maximum of 9 points could be deducted if you do not attend any of these presentations during the semester.

A list of up to 20 questions about an experiment will also be provided to the group sometime before they run the experiment. Everyone in the group needs to know the answers to these questions prior to delivering the presentation! After a 20 to 30 minute presentation, at random, two of the 20 questions will be asked of each member in the group. The responses will be given orally by the group member. Five minutes will be given to answer both questions. A grade of 0, 10 20, etc. up to 100% will be given depending on the responses by the group member. Each series of questions counts toward 2% of your grade (see below). If both responses are completely incorrect, then a zero may be given. No help may be offered from the other group members. E1 will be asked first, then E2 and finally E3.

Academic Responsibility: To be frank, academic responsibility refers to cheating. Cheating of any sort will be taken very seriously in this course. As a team, you must prepare your own presentations and reports, and you must generate your own spreadsheets containing the calculations. You are not to share any of these documents with any other group taking the course this semester, and you are not to use any documents from past ECHE 460 courses that you may have access to. The instructor has special software that will be used to check groups of words in the Technical Report you turn in for similarities with groups of words in numerous reports that have been collected on the same experiment from past classes. The TAs will be checking over the calculations and have access to current and past MS Excel and MathCad documents on each experiment. Encoded document identifiers will be checked, and any obvious similarities with other files will be questioned and possibly prosecuted. If you are caught cheating in this class in any way, manner or form, your group will receive a zero for the entire period and you may be brought before the College Academic Responsibility Committee. Excuses from individual teammates will not be tolerated! As a team, it is each team members responsibility to know what the other team members are doing and how they obtained their calculations and write-ups.

Attendance: Attendance is mandatory for all scheduled laboratory work, presentations, lectures, report submissions, calculation sessions, team meetings, and scheduled help sessions. Absences for illnesses and emergencies *must be* documented by a doctor's notice or equivalent. School-related travel and other reasonable excuses must be arranged in advanced with Dr. Gatzke, if possible. One unexcused absence will result in a deduction of one letter grade for the course. Two unexcused absences will result in a deduction of two letter grades, and three unexcused absences will result in an "F." The teaching assistants do not have authority to excuse any absences. In addition, the instructor reserves the right to lower the final course grade for unsafe behavior in the laboratory. See the Laboratory Manual for further details.

Semester Schedule: The calendars and rotation schedules for this semester will be provided in a separate handout. The calendar was developed to meet the following objectives: (1) start lab work as soon as possible, but after sufficient introduction in logistics and/or safety; (2) allow time for students to prepare calculations, oral presentations, and written reports; (3) complete most of the requirements of this course before Final Exam week.

Grading Policy:

The overall final grading breakdown is as follows:

Four Labs (18% each):

Presentations	4x7%	28%
Oral Quiz	4x2%	8%
Technical Report	4x8%	32%
Executive Summary	4x1%	4%

Team and Lab Performance 10%

Quizzes and Assignments 8%

Final Exam 10%

PEQ* 4x(0 to -3)% 0% to -12%

PPP* 3x(0 to -4)% 0% to -9%

BSQ* 3x(0 to -4)% 0% to -9%

Labs, Presentations: For Periods I, II and III, each team member will receive an individual grade for his or her performance during a project Technical Presentation; during Period IV, each team member will receive the same grade for the team performance during the project Technical Presentation.

Labs, Oral Quiz: After a 20 to 30 minute presentation, at random, two of the 20 questions will be asked of each member in the group. The responses will be given orally by the group member.

Labs, Technical Report: Each team member will receive the same grade for the project Technical Report for all four periods. Hence, it is in your best interest to contribute your share to the report, and to assist your teammates as necessary. The specific responsibilities are explained elsewhere. The bottom line is that a portion of each team member's grade will depend on the quality of the report.

Labs, Executive Summary: Each team member will prepare a 1 page executive summary INDIVIDUALLY. This written report will summarize the motivation for the lab, the procedure, theory, and results.

Lab reports are to be turned in to Dr. Gatzke by 12:00 noon on Monday. **To receive a grade for the Technical Report, a disk or CD containing the entire Technical Report in one MS Word file (including title page, abstract, figures and tables, etc.) and in other files all the calculations in MS Excel or MathCad format must be turned in at the same time.** These documents will be checked for originality and correctness (see Academic Responsibility).

Team and Lab Performance: A single grade for Team Performance will be assigned at the end of the semester. Team Performance grades will be based on the Confidential Team Evaluations, TA grade sheet comments, and Dr. Gatzke's observations. A member in each group will evaluate independently the team-performance of each of the other members in their group. Each student will submit a Confidential Team Evaluation report at the end of the semester. Lab performance grades will be based on the TA grade sheets. Teaching assistants will submit their grade sheets after every experiment.

Quizzes and Assignments: Four or more unscheduled, 30 to 40 min quizzes will be given throughout the semester. They may be handed out at the beginning of a lecture period so be on time! Also, simple writing assignments may be given during the semester.

Table 1. Weighting of Grades for ECHE 460, and Sample Grade Calculation for One Student in a Three-Person Group

<u>Assignment</u>	<u>Weighting (%)</u>	<u>Sample Grade</u>	<u>Numerical Grade</u>
Project I			
Engineer 1			
Presentation	7	C (73)	5.11
Oral Questions	2	B (83)	1.66
Technical Report	8	62	4.96
Executive Summary	1	B (83)	0.83
Project II			
Engineer 2			
Presentation	7	C	5.11
Oral Questions	2	A (93)	1.86
Technical Report	8	66	5.28
Executive Summary	1	B (83)	0.83
Project III			
Engineer 3			
Presentation	7	B	5.81
Oral Questions	2	B+ (88)	1.76
Technical Report	8	72	5.76
Executive Summary	1	A (93)	0.93
Project IV			
Engineer 1			
Presentation	7	C	5.11
Oral Questions	2	D (63)	1.26
Technical Report	8	65	5.20
Executive Summary	1	C (73)	0.73
Additional grades			
Laboratory Performance	5	A	4.65
Team Performance	5	A	4.65
Lecture Quizzes	8	85	6.80
Exam	10	75	7.50
TOTAL	100%		75.8
PEQ (failed two)		-6	69.8
Mandatory Presentations (missed one)		-3	66.8
BSQ (failed two)		-6	60.8

General Criteria for Letter Grades:

A: Student thoroughly understands the objectives, approach, methods, and conclusions. Critical thinking is evident. Objectives are stated clearly and specifically. Conclusions are relevant to the objectives and contain quantitative results whenever possible. Work is complete and correct with no, or only very minor technical omissions or errors. Work is neat, readable, with correct units and proper significant digits. There are almost no spelling or grammar errors. Written and spoken materials are well organized. Paragraphs have strong topic sentences. Student demonstrates sound grasp of technical material, answers questions well. Writing and presentations are clear, authoritative, and thorough. Sentence and paragraph structure is strong. Graphs, tables, and visual aids are well-designed and readable. Figures and tables are discussed and analyzed, not just presented. Oral presentations are strong and confident. All work is submitted on time.

B: Student has a good grasp of the project but has one or two lapses in critical thinking. Work is substantially complete, but with some omissions and perhaps one or two noticeable errors: some lapse of units and proper significant digits; some spelling or grammar errors but not too many. Student knows most of the material but is unclear on some points, and has a little difficulty with some questions. Written and oral materials could benefit from some editing, but with one more round of editing and practice could probably be an “A” project. Writing is OK but student struggles a bit with presenting complicated ideas. Work is submitted on time.

C. Student has a fair grasp of the project but has not shown critical thinking and putting together the big picture. Work is somewhat complete, but some significant omissions and errors that should have been obvious. There is insufficient analysis and discussion of results. Evidence that student did not manage time well on this project. There is evidence of not participating in group activities. Student would clearly benefit from more study of material. There are several spelling or grammar errors; weak writing structure. The student has difficulty answering questions, and struggles with writing and oral presentations. However, a good-faith effort and with extra work and practice could improve to a B or possibly an A. Work is submitted on time.

D. Student does not understand the objectives, apparatus, methods, or theory. No critical thinking is evident. There are significant omissions of work. The analysis and discussion is very weak. The student clearly does not understand most of the material. There are numerous spelling and grammar errors. Writing and speaking is extremely weak; it would be difficult to take the student’s present work and improve it to a C or B without starting over completely. Work is submitted late.

F. Work of very low quality; incomplete; not a good-faith effort. Work is submitted late. (Work not submitted at all earns zero points.)