Fall 2025

MEMORANDUM FOR STUDENTS ENROLLED IN CHEN 4170 – Section 01

SUBJECT: CHEN 4170 – Chemical Plant Design I - Administrative Instructions

Lecture times: Mo/We 11:15 am – 12:15 pm, Th 5:00 pm – 6:00 pm

Office Hours: Tu/Th 1:00 pm – 2:30 pm

Instructors: Fernando Resende and Barry Keys

E-mails: fresende@uttyler.edu; Barry.Keys@momentummidstream.com

Welcome to CHEN 4170 – Chemical Plant Design I. In this capstone course, students will apply concepts learned in previous courses to design a plant for a chemical process that is industry sponsored.
This course will utilize engineering concepts, industry experience, and simplified methods to help students design a new chemical facility as designated by the Instructors. Through lectures, homework assignments, and project assignments, students will apply their knowledge and think-outside the box where needed to solve engineering problems related to equipment and facilitates design.
A Case Study will be assigned to students giving them an opportunity to apply concepts and present a solution to the instructor. Students will learn how to size and select various type of process equipment throughout the course.
This is the first part of the capstone course. Students successfully completing the course will be prepared to take their final Senior Capstone Course, CHEN 4371, Chemical Plant Design II.

CHEN 4170 Plant Design Course Objectives:

1. Develop a simple project execution plan to design and construct a chemical process facility based on needs specified by a client;
2. Develop a set of diagrams intended to represent the design of a chemical plant. The diagrams should increase in complexity to provide guidance for the following steps;
3. Initiate the design of the components of the process, including selection of equipment and materials of construction;
4. Work effectively in teams;
5. Employ process design softwares to aid in calculations;
6. Develop communication skills via written reports and debrief meetings;
7. Achieve 25 % completion of the final design plans

Mode of delivery: This is a face-to-face course.

1. The course has one prerequisite which must be completed successfully prior to taking this course:
   - ✓ CHEN 3302 (Thermodynamics II)

It also has two co-requisites that must be taken simultaneously:

- ✓ CHEN 4310 (Separation Processes), CHEN 4330 (Process Control and Safety)

2. The goal of our faculty is to be commonly available to you for assistance, so you are encouraged and expected to seek **additional instruction**. Take advantage, it is FREE and really will help! There are several ways you can seek additional instruction:
   - ✓ You are welcome to stop by the instructor's office at any time. However, for your own satisfaction, you can ensure the instructor is available at the office by using the following options:
   - ✓ Come to Office hours. This is the time the instructor has set aside to answer your questions;
   - ✓ E-mail or call the instructor to set up a mutually agreeable time to meet with the instructor,
   - ✓ E-mail your questions to the instructor (this is the least preferred option because of the limited effectiveness of e-mail communication), but it is acceptable if other options are not possible.

3. Use of Artificial Intelligence (AI) in course assignments:
   I expect all work students submit for this course to be their own. I have carefully designed all assignments and class activities to support your learning. Doing your own work, without human or artificial intelligence assistance, is best for your efforts in mastering course learning objectives. For this course, ***I expressly forbid using ChatGPT or any other generative artificial intelligence (AI) tools for any stages of the work process, including brainstorming.*** Deviations from these guidelines will be considered a violation of UT Tyler's Honor Code and academic honesty values.

4. Class Room Procedures:

a. Bring study notes, **textbooks**, note-taking material, and calculator to every class. You may not borrow or exchange calculators during graded events. If your calculator fails during a graded exercise, I am not responsible to furnish a substitute. Class preparation is your individual responsibility.

b. Textbooks:

Analysis, Synthesis, and Design of Chemical Processes; Turton, Whiting, Shaeiwitz, 5th Edition.

Optional:

Welty, J.R.; Rorrer, G.; Foster, D.G.; "Fundamentals of Momentum, Heat, and Mass Transfer", John Wiley & Sons, New York, 2014, 6th Edition (WRF).

Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. Dewitt, Fundamentals of Heat and Mass Transfer, 7thEd., John Wiley & Sons, 2011 (BLID).

McCabe, Smith, and Harriott: "Unit Operations of Chemical Engineering", 7th edition. McGraw-Hill Inc. (2005) (MS)

Transport Processes and Separation Process Principles", 4th ed., Geankoplis, Prentice Hall, 2003. (G)

c. *Process Simulation Tool:* Students can use software packages to assist with the modelling and optimization of the design. Promax is the recommended package for this purpose.

d. Engineering Design Problem:

This course includes a semester long design problem with 2 written submissions. When submissions are complete you will have executed a portion of a complex design. The design problem requires students to demonstrate the following abilities:

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3) an ability to communicate effectively with a range of audiences;
4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;
5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;
6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions;
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The submission will document critical stages of the design process, namely a 10 % and a 25 % submission. The 25 % submission will consist of a written report and oral presentation.

5. Evaluations:

a. *ACADEMIC DISHONESTY:* Representation of other's work as your own will not be tolerated. Cheating on examinations, quizzes, reports, and homework and the false representation of work will be interpreted as academic dishonesty. Academic dishonesty will be subject to disciplinary action as outlined by the UT Tyler Student Guide on Conduct and Discipline.

b. *Writing Assignments:* As part of the report presentation, you will be required to submit a writing assignment on a weekly basis. The writing assignments are intended to constitute portions of the written report, and will focus on one or two topics per week. Weekly assignments are usually going to be due on Thursdays.

c. Late Submissions. It is a basic principle of professionalism that **"Professionals are not Late."** A "COORDINATED LATE" submission occurs when you will miss the due date for a graded assignment and you contact me in advance. Notification immediately before the submission will not suffice. Point cuts up to the amounts below **may** be assessed for a "COORDINATED LATE" submission:

1. 0-24 hours late — a deduction of 25% of the earned grade
2. 24-48 hours late — a deduction of 50% of the earned grade
3. More than 48 hours late — No credit.

Obviously, there are circumstances that will occur and make a timely submission impossible and I will work with you when and if they occur.

- Engagement, demonstrating initiative to work on problems, and actively participating in the discussions;
- Asking questions outside class: after class, during office hours, and by e-mail;

d. *Leadership:* For each major project milestone (10 % and 25 %), groups will be assigned leaders which will be responsible to oversee the project. At the delivery of the milestone, the leaders will assign grades to each of the group members based on their contributions to the project. Likewise, members of the team will grade the leader on leadership skills. These peer evaluations will constitute 25 % of the Leadership grade. The remaining 75 % will be assigned by the Instructors, based on the following observations:

- Attendance in class and punctuality;
- Level of participation in class, asking questions about the material and answering questions from the instructor;
- Engagement, demonstrating initiative to work on problems, and actively participating in the discussions;
- Asking questions outside class: after class, during office hours, and by e-mail;
- Any other factors that may contribute to the instructor's perception of a student contribution to the project

e. Sustainability Surveys
The design project will heavily emphasize environmental considerations in chemical plant design. As part of this focus, students will be required to complete two Sustainability Surveys. The first survey will be administered early in the semester to assess baseline understanding and attitudes toward sustainable engineering practices. The second survey will be completed after several key assignments and project milestones, allowing students to reflect on how their design decisions have evolved in response to environmental, economic, and social factors. These surveys are intended to foster awareness of sustainability principles and will contribute to the course evaluation.

6. Grading:

Grades will be based entirely on the student's demonstrated ability to develop detailed, neat, organized, and correct solutions to the problems presented. Correct answers accompanied by incorrect, incomplete, or untidy solutions may receive no credit.

Grade Distribution

Writing assignments (7 at 5 points each)	35 (35 %)
10 % Design Report (18 points total)	18 (20 %)
10 % Leadership (7 points total)	7 (7 %)
25 % Presentation (10 points total)	10 (10 %)
25 % Design Report (20 points total)	20 (20 %)
25 % Leadership (8 points total)	8 (8 %)
Sustainability Surveys (2 points total)	2 (2 %)

Total 100 (100%)

The Design Project is a team project and is an essential component of this course. Therefore, ***students who fail to turn in the Final Report will automatically receive an F grade for the course***.

Grade Scale based on points

Higher than 85 points	A
Between 70 and 85 points	B
Between 60 and 70 points	***C***
Between 30 and 60 points	D
Less than 30 points	F

You need at least 60 points total to pass the course with a C grade and advance to CHEN 4350 (Chemical Plant Design II) in the Spring semester.

7. Collection of Student Work:

Throughout the semester I will collect student work (best, average, and worst) for the ABET course and outcomes notebooks. This will require me to make a copy of your work, keep your original and return a copy of the graded work to you. I will not draw attention as to what level of work you accomplished.

8. Assigned readings:

The class schedule will include assigned reading for every lecture. Students who read the corresponding sections of the book *before each class* will certainly make the most of the lectures, so this is highly recommended. In addition, the instructor will periodically post the lecture notes on the course website. Doing the assigned reading prior to class will help you to understand the

material presented during the instruction and will fill in gaps for things we do not cover (***I will not cover everything***). It will also make you more familiar with terms and concepts to be covered.

9. **UT Tyler Honor Code** - Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

10. **Students Rights and Responsibilities:** to know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php.

11. **Campus Carry** - We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at http://www.uttyler.edu/about/campus-carry/index.php.

12. **UT Tyler a Tobacco-Free University** - All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors. Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products. There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit www.uttyler.edu/tobacco-free.

13. **Grade Replacement/Forgiveness and Census Date Policies** - Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar. Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract. The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:
    - Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
    - Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
    - Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
    - Being reinstated or re-enrolled in classes after being dropped for non-payment
    - Completing the process for tuition exemptions or waivers through Financial Aid

14. **State-Mandated Course Drop Policy** - Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date). Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

15. **Disability/Accessibility Services** - In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.

16. **Student Absence due to Religious Observance** - Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

17. **Student Absence for University-Sponsored Events and Activities** - Revised 05/19 If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

18. **Social Security and FERPA Statement** - It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

19. **Emergency Exits and Evacuation** - Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

20. **Student Standards of Academic Conduct** - Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in

whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

i. "Cheating" includes, but is not limited to:

- copying from another student's test paper;
- using, during a test, materials not authorized by the person giving the test;
- failure to comply with instructions given by the person administering the test;
- possession during a test of materials which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes". The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
- using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
- collaborating with or seeking aid from another student during a test or other assignment without authority;
- discussing the contents of an examination with another student who will take the examination;
- divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
- substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
- paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
- falsifying research data, laboratory reports, and/or other academic work offered for credit;
- taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and
- misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.

ii. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.

iii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

iv. All written work that is submitted will be subject to review by plagiarism software.

21. UT Tyler Resources for Students

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu
- UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu

- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- UT Tyler Counseling Center (903.566.7254)

Schedule:

week		August	Material	Assigned Reading	Evaluation due
1	Mo	25	Syllabus, Introduction, Soft skills (Conflict Resolution)	-	-
	We	27	Soft skills - Leadership, Teamwork, Communication	-	-
	Th	28	Project Intro and Definition of Tasks	-	-
		September	**Material**	**Assigned Reading**	**Evaluation due**
2	Mo	1	*No class - Labor day*	-	-
	We	3	Diagrams	1	-
	Th	4	10 % Project Report Requirements	-	-
3	Mo	8	Diagrams	1	-
	We	10	PFDs	2	-
	Th	11	Concept Selection	-	Sustainability survey: part 1
4	Mo	15	PFDs	2	-
	We	17	Promax training, part 1	-	-
	Th	18	Strategy Table		Writing assignment 1: Concept Selection
5	Mo	22	Promax training, part 2	-	-
	We	24	Sustainability, Environmental Issues	-	-
	Th	25	TECOP analysis		Writing assignment 2: Strategy Table
6	Mo	29	Risk Assessment, part 1	-	-

		October	**Material**	**Assigned Reading**	**Evaluation due**
6	We	1	Risk Assessment, part 2	-	-
	Th	2	Process Equipment - Amine contactor	-	Writing Assignment 3: TECOP Analysis
7	Mo	6	Green Engineering	-	
	We	8	Carbon Capture	-	
	Th	9	Process Equipment - still	-	Writing Assignment 4: Process Description / PFD
8	Mo	13	Product Design / Tracing Chemicals	4, 5	
	We	15	Process Conditions	6	
	Th	16	Process Equipment - heat exchangers	-	Writing Assignment 5: Project chemistry and thermodynamics
9	Mo	20	Process Conditions	6	
	We	22	Fluid Machinery: Pump Classification, Centrifugal Pumps, Pump performance	WRF 14	
	Th	23	Promax examples	-	10 % report
10	Mo	27	Net Positive Suction Head	WRF 14	
	We	29	Scaling Laws for Pumps and Fans	WRF 14	
	Th	30	10% report feedback	-	10 % peer evaluation, Sustainability survey: part 2
		November	**Material**	**Assigned Reading**	**Evaluation due**
11	Mo	3	Matching system to pump characteristics	WRF 14	
	We	5	*No class - AIChE Conference*	-	
	Th	6	Promax examples	-	Writing assignment 6: Pumps/fans/compressors sizing
12	Mo	10	Recitation 1	-	
	We	12	Heat Transfer - fundamental concepts	BLID 11.1-11.3	-
	Th	13	Promax examples	-	Writing Assignment 7: Promax simulations
13	Mo	17	Heat Transfer - fundamental concepts	BLID 11.1-11.3	-

	We	19	Heat Exchanger Types, Overall Heat Transfer Coefficient , LMTD	BLID 11.1-11.3	-
	Th	20	25 % presentation and feedback	-	25 % presentation
14	Mo	24	Thanksgiving Holiday	-	-
	We	26	Thanksgiving Holiday	-	-
	Th	27	Thanksgiving Holiday	-	-
		December	**Material**	**Assigned Reading**	**Evaluation due**
15	Mo	1	Heat Exchangers - General Method for Design	BLID 11.6	-
	We	3	Recitation 2	-	-
	Th	4	TBD	3	25 % report / Peer evaluations (25 %)