TUSKEGEE UNIVERSITY
COLLEGE OF ENGINEERING
CHEMICAL ENGINEERING DEPARTMENT
CENG 380 MASS TRANSFER
Spring Semester, 2024

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CLAS ROOM	
CLASS SCHEDULE	10:00 am -11:00 pm (noon) (MWF)
OFFICE HOURS	M: 12:00 pm (noon) – 5:00 pm Tu: 8:00 am – 1:00 pm
TEXT	Phillip C. Wankat, Separation Process Engineering, Fourth Edition, Prentice Hall, 2017.
PREREQUISITE	CENG 310, Heat Transfer and CENG 350, Chemical Engineering Thermodynamics II

COURSE OBJECTIVES:

Students will:

1. Apply vapor-liquid phase equilibrium and thermodynamic property data to designing separation processes with computer software.
2. Design flash separators for binary and multicomponent systems with computer software.
3. Design distillation columns for binary and multicomponent systems with McCabe-Thiele method and computer software.
4. Design absorption, stripping and extraction separation processes.
5. Utilize computer software in preparing homework assignments and design reports.

COURSE OUTCOMES:

Outcomes	1	2	3	4	5	6	7
Objective 1	x	x	x				
Objective 2	x	x	x				
Objective 3	x	x	x				
Objective 4	x	x	x				
Objective 5	x	x	x				

Student Outcomes

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.

Covid:

All students in the class room must wear masks that covers both their nose and their mouth.
Excuses related to **Covid infection** as well as exposure have to be received from the Dean of Students office. Students should request the excuse for absence from the Dean of Students office as soon as they become aware of covid infection or exposure. Students may request a class-missed memo by completing this form (https://forms.gle/4ozusHX2tTCUW4yK6) and then contact the Office of the Dean of Students and Student Conduct (334) 727-8421, via e-mail THarper@Tuskegee.edu or by going into the office located in suite 203 Tompkins Hall.

COURSE OBJECTIVES AND TASKS:

Objectives		Tasks	
1	Apply vapor-liquid phase equilibrium data to designing separation processes	1	Vapor-Liquid equilibrium data
		2	Graphical mass balance of equilibrium systems
2	Design flash separators for binary and multicomponent systems.	3	Binary flash distillation calculations
		4	Multi-component flash distillation calculations
		5	Sizing flash separator
3	Design distillation columns for binary and multicomponent systems with McCabe-Thiele method and computer software.	6	External column mass and energy balances
		7	Stage-by-stage calculation (Lewis method) and McCabe-Thiele method
		8	Sizing distillation columns
4	Design Absorption, Stripping and Extraction separation processes	9	Absorption columns
		10	Stripping columns
		11	Immiscible and miscible extraction
5	Utilize computer software in preparing homework assignments and design reports	12	Prepare homework assignments and design projects with computer software such as MS Word, EXCEL, and ASPEN PLUS

COURSE REQUIREMENTS AND POLICES:

Credit hour: 3
Contact hour: 3

	Percentage	Score	Grade
Homework	15	90-100	A
Test	50	80-89	B
Final Exam	25	70-79	C
Design	10	60-69	D
		0-59	F

Policies:

- Homework assignments are due next class.
- Our CENG 380 class starts on 11:00 am.
- The course outline, homework assignments, and announcements are posted in the Canvas
- Students are expected to attend all scheduled classes and be on time.
- Students are expected to carry out all assigned homework assignments, and to take tests and final examination for the period designated by the instructor.
- Answers to homework problems, tests and final examination should be hand-written on 11-inch x 8.5-inch papers. Answers to homework problems should be well organized, paginated, and have a typed cover page indicating your name, course name, and assigned homework problems. Each student should prepare his/her own reports.
- Design reports should be typewritten on 11-inch x 8.5-inch papers, using a word processor. Calculation sections of reports should be hand-written on

11-inch x 8.5-inch papers. Reports should be well organized, paginated, and have a completed mark sheet. Schematic diagrams of design reports are prepared by each student, and not copied from textbooks and websites

- No late homework assignments will be accepted.
- Late Design reports will be penalized 5 points/day.
- You should show your all works (solution procedures) in tests, final examination, homework problems or design problems to get partial credits on your works, even if your answers are wrong.
- Additional policies will be issued, if they are necessary.

REFERENCES

1. Seader, J.D & Henley, E.J., Separation Process Principles, John Wiley & Sons, Inc., 1998
2. Geankoplis, C. J., Transport Processes and Unit Operations, 3rd Edition, Prentice Hall P T R, 1993.
3. McCabe, Smith & Harriott, Unit Operations of Chemical Engineering, McGraw-Hill, 4th Edition, 1985.
4. Treybal, R. E., Mass Transfer Operations, McGraw-Hill, 1980.
5. King, C. J., Separation Processes, 2nd edition, McGraw-Hill, 1981.
6. Ernest J. Henley and J.D. Seader, Equilibrium-Stage Separation Operations in Chemical Engineering, John Wiley & Sons, 1981

COURSE OUTLINE AND READING ASSIGNMENT SCHEDULE

Session	Topics	Reading Assignments, Pages
1 - 2	Chapter 1 Introduction to Separation Process Engineering	1 – 10
3- 10	Chapter 2 Flash Distillation	15– 53
11	Test #1	
12 -15	Chapter 3 Introduction to Column Distillation	81 - 97
16	Test #2	
17 - 21	Chapter 4 Binary Column Distillation: Internal Stage-by Stage balances	105 - 162
22	Test #3	
23 -25	Chapter 5 Introduction to Multi-component Distillation	189 - 206
25 - 28	Chapter 10 Staged and Packed Column Design	375 - 421
29	Test #4	
30 - 35	Chapter 12 Absorption and Stripping	481 - 510
37	Test #5	
36 - 42	Chapter 13 Liquid-Liquid Extraction	527 - 586
43	Test #6	
44	Final Review	