

ENCH 445: Separation Processes Fall term, 2020

Instructor: Professor Doug Frey, TRC 252B, 455-3418; dfrey1@umbc.edu

On-line office hours: Tuesday and Thursday at 4 pm (tentative)

Standard Textbook: *Separation Process Engineering (SPE)*, 4th Ed. by P. C. Wankat

On-line Textbook: *Professor Frey's Separation Processes WebBook (SPW)*. This reference is contained in the ENCH 445 course website given below.

ENCH 445 Course Website: <http://userpages/umbc.edu/~dfrey1/ench445/>

Grading: Two midterms: 40%; Final: 40%; Homework: 20%.

Course Goals: Processes for separating mixtures are critically important in the chemical, pharmaceutical, and food industries, and in the environmental engineering field. The purpose of this course is to develop skills in qualitative reasoning and the conceptual design of separation processes, as well as skills in the detailed quantitative design of separation equipment. An example of qualitative reasoning is the selection of what is likely the most efficient separation method based on an inspection of the physical properties of the components to be separated. An example of quantitative design is the determination of the optimal solvent to use, the optimal solvent flow rate, and the corresponding optimal number of equilibrium stages for a liquid extraction process which removes a pollutant from wastewater.

Specific Learning Objectives:

By the end of this course students will be able to:

1. Apply basic principles of thermodynamics and numerical methods for the simulation and design of single-stage separation processes.
2. Apply the description rule, degree of freedom analysis, identification of separation agent, and related basic principles to provide a fundamental understanding of the behavior and mathematical structure of separation processes.
3. Determine the basic behavior of idealized liquid-liquid extractors, distillation columns, absorbers, strippers, and related types of equilibration separation processes using graphical methods.
4. Apply software packages such as Aspen and COCO for the detailed simulation and design of equilibration separation processes such as liquid-liquid extractors, distillation columns, absorbers, and strippers.
5. Apply results for staged separation processes to the simulation and design of separation processes employing packed columns.
6. Perform simple calculations that describe the behavior of membrane processes.
7. Use simple principles based on the inspection of component physical properties and experience-based heuristic rules for selecting an efficient separation processes.

Course Outline:

Week	Readings		Topics
	SPE [†]	SPW [‡]	
1	Ch. 1	Ch. 1	Organize course, general features of separation processes.
2		Ch. 2 Ch. 3	Basic elements of numerical methods Numerical methods using Excel and Matlab
3	Ch. 2	Ch. 4	Phase equilibrium.
4	Ch. 2	Ch. 5	Binary and multicomponent single-stage processes, lever rule, description rule, rate-governed processes
5	Ch. 3	Ch. 6 Ch. 6	Staging of separation processes Introduction to ChemSep, COCO and Aspen
6, 7	Ch. 4	Ch. 7	Binary distillation
8	Ch. 5	Ch. 8	Binary distillation (cont.), multicomponent distillation. Midterm 1: October 15
9,10	Ch. 12	Ch. 9	Absorption, stripping, Kremers-Sauders-Brown equation
11	Ch. 13		Extraction
12	Ch. 10	Ch. 10	Stage efficiency, equipment capacity
13	Ch. 10, 16	Ch. 11	Packed column contactors Midterm 2: Nov. 19
14	Ch. 17	Ch. 12	Membrane processes
15		Ch. 15	Energy considerations, selection and synthesis of separation processes

Final examination: Thursday, Dec. 10, 1 - 3 pm

[†]**SPE: Separation Process Engineering (P. C. Wankat)**

[‡]**SPW: Professor Frey's Separation Processes WebBook**

Additional Information Related to Course Outline:

1. Course will be conducted on-line for the Fall term of 2020. The first session will be conducted live on Blackboard at 2:30 pm on Aug. 27.
2. Dates given for examinations are approximate and might change to account for scheduling considerations.
3. Topics and reading assignments are subject to revision based on scheduling considerations.
4. Weighting factors for determining the final grade are subject to minor revision depending on various factors. The **approximate** grade ranges (which are subject to minor revisions) are A: 85 – 100%; B: 75 – 85%; C: 60 – 75%; D: 50 – 60%.
5. Course materials such as lecture materials, homework assignments, tutorials, and detailed descriptions of the reading assignments are given on the ENCH 445 course website (<http://userpages/umbc.edu/~dfrey1/ench445/>) and **not on Blackboard**.

Statement on Academic Conduct:

By enrolling in this course, each student assumes the responsibility of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the UMBC Faculty Handbook, the UMBC Policies Section of the UMBC Directory, or the UMBC website.

In order for the grading in this course to be as fair as possible, you are prohibited from accessing homework and examinations given in any of the previous years that this course has been taught. Adequate samples of previous work will be provided to you as needed. Anyone who does not abide by this prohibition will be in violation of the Academic Conduct Policy for this course.

Regrading Policy:

Deadline: Requests to regrade material must be submitted no later than one week after the material in question was returned to the class or was made available to be picked up.

Additional Information: You should submit material to be regraded only if you think a serious grading error is present, and not because you want to argue about partial credit judgement calls made by the grader. All requests for regrading must include a concise written description of the alleged grading error. You should also be aware that graded material will be stored electronically. Instances where regrading is requested for student work that has been altered after it has been graded will be treated as a case of serious academic misconduct.

Homework Policy:

You will learn the course material best if you work on the homework entirely by yourself. However, if you feel that you learn better by working in a small group, you are permitted to do so. If you do decide to work in a small group, note that each student must turn in his/her unique solution for grading. Any evidence of direct copying of homework solutions will be considered as a violation of the Academic Conduct Policy for this course. All homework must be submitted as single document in pdf format to Blackboard.

Accessibility and Disability Accommodations, Guidance and Resources:

Support services for students with disabilities are provided for all students qualified under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that would create equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at sds.umbc.edu for registration information and office procedures.

SDS email: disAbility@umbc.edu

SDS phone: (410) 455-2459

If you will be using SDS approved accommodations in this class, please contact me (instructor) to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.

Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination:

UMBC's [Policy on Sexual Misconduct, Sexual Harassment and Gender Discrimination](#) and Federal Title IX law prohibit discrimination and harassment on the basis of sex in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment or retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources:

Mikhel A. Kushner, Title IX Coordinator (she/her/hers)
410-455-1250 (direct line), kushner@umbc.edu

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in or thinking about making a report, please see the [Online Reporting Form](#). Please note that, while University options to respond may be limited, there is

an anonymous reporting option via the online form and every effort will be made to address concerns reported anonymously.

Notice that Faculty are Responsible Employees with Mandatory Reporting Obligations:

All faculty members are considered *Responsible Employees*, per [UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination](#). Faculty are therefore required to report possible violations of the [Policy](#) to the Title IX Coordinator, even if a student discloses something they experienced before attending UMBC.

While faculty members want you to be able to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report Sexual Misconduct to the Title IX Coordinator so that the University can inform students of their [rights, resources and support](#).

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of [Confidential Resources](#) available to support you:

- The [Counseling Center](#): 410-455-2742 / After-Hours 410-455-3230
- [University Health Services](#): 410-455-2542
- Pastoral Counseling via [Interfaith Center](#): 410-455-3657; interfaith@umbc.edu

Other Resources:

- [Women's Center](#) (for students of all genders): 410-455-2714; womenscenter@umbc.edu.
- [Shady Grove Student Resources](#), [Maryland Resources](#), [National Resources](#).

Child Abuse and Neglect:

Please note that Maryland law and [UMBC policy](#) require that I report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police.

Additional Resources and Information:

- [Student Safety](#)
- [Technology: Access, Requirements, Resources, Support](#)
- [COVID-19: Safety Expectations and Guidelines](#)
- [Academic integrity in the Online Instruction Environment](#)
- [Resources to Help you Succeed in Online Courses](#)
- [Enrollment Dates and Deadlines](#)
- [Religious Observances](#)
- [Hate, Bias, Discrimination and Harassment](#)
- [Pregnancy](#)