ChE-402: Diffusion and Mass Transfer

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Classroom
CH B3 31

Meeting time
Tuesday, 10:15 – 13:00
Lectures will be done in the first two sessions (10h15 to 11h00, 11h15 to 12h00), and exercise in the last session (12h15 to 13h00). The teaching assistants will conduct exercise sessions.

Moodle Site
Course information, including the syllabus, lecture notes and announcements, can be found at the Moodle site.
https://moodle.epfl.ch/course/view.php?id=9401

Course Summary
This course aims to provide an in-depth understanding of diffusion and mass transfer and their role in several chemical processes.

Intended Learning Outcome
By the end of the course, students should be able to

- Understand the origin of diffusion and roles of diffusion and convection in overall mass transport in several scenarios.
- Set up mathematical models that describe complex mass transport cases.
- Apply various diffusion and mass transfer models to analyze and solve a wide-range of problems dealing with mass transport.
- To model mass transfer in membrane processes.

Course Content

1. Fundamentals of diffusion
2. Diffusion in dilute solutions
3. Diffusion in concentrated solutions
4. Diffusion coefficients in gases, liquids, and solids
5. Diffusion of ions
6. Diffusion in nanoporous materials
7. Multicomponent diffusion
8. Introduction to mass transfer
9. Theories in mass transfer
10. Modeling membrane process
11. Diffusion in chemical reactions

Textbooks
Diffusion: Mass Transfer in Fluid Systems by E. L. Cussler (available in the library).

Teaching Method

1. Projector slides would be used to deliver the course content to the students in class.
2. Some exercise problems will be conducted during the lecture. The rest of the exercise problems will be conducted during the last hour of the class (exercise session).
3. Lecture notes of a specific class will be available on the moodle page (https://moodle.epfl.ch/course/view.php?id=9401) before the class.
4. Your smartphone would be used to conduct quizzes (usually multiple-choice questions). These quizzes are meant to support the learning process. For example, questions could be asked during the class to gauge understanding of the subject and review concepts. Your responses would be anonymous. Answers will not be used for formal assessment.
5. To participate in quizzes using smartphone, you can open the URL http://ttpoll.eu Then add che402 as the session id.

Ed Discussion Forum

Questions/discussions on the concepts, in-class exercises, and homework problems can be discussed on this forum. It can be accessed via Moodle. I encourage you to ask questions when you struggle to understand a concept—you can even do so anonymously.

Please post your questions in the forum instead of emailing me or TA's directly. Think of it as a Q&A wiki for the class.

Grades

1. Homework (15% of the total grade). 2 homework in total (see details below).
2. Mid-term exam (25% of the total grade), **scheduled on November 4**
3. Group project (in a team of 3, report, presentation, and Q&A, 20% of the total grade)
4. Final written exam (40% of the total grade), scheduled during exam period (**January 2026**)

About Homework: Typically, homework will comprise 2-3 questions focused on the key concepts. Students are expected to submit the homework on Moodle before the deadline.

Students are expected to consult each other on how to solve the homework. However, students must arrive at the solution and write their homework independently. Homework should be done on an A4 sheet and should be written clearly. The solution to the homework will be posted after the submission deadline.

Clarifications related to homework problems can be posted on the Ed Discussion forum under the relevant homework folder.

Homework 1: Will be posted on Moodle on **October 14**, submission deadline **October 28**
Homework 2: Will be posted on Moodle on **November 25**, submission deadline **December 9**

About Group Project: Toward the end of the semester, we will organize a group project (group of 3) where students will model a given challenge involving membrane-based separation processes, prepare a short report, and present their findings to the class. Grades will be given for the quality of the report, presentation, and Q&A.

Group project presentation: **December 16**