# CBE 318 (3 Cr.) – Chemical Engineering Mass Transfer

Spring Semester 2018
Department of Chemical and Biological Engineering
South Dakota School of Mines and Technology
2018.02.06

## COURSE SYLLABUS

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**Instructor:** Travis Walker
Email: travis.walker@sdsmt.edu
Phone: 605.394.2543
Office: CBEC 3310
Office Hours: MWF 1400-1500, TR 1100-1200, and by appointment

**Graduate Teaching Assistant:** Joshua Adeniran
Email: joshua.adeniran@mines.sdsmt.edu
Office Hours: W 1200-1300, R 1400-1500, and by appointment
Location: TBA

**Dates:** 2018.01.08-05.04
**Lectures:** MWF 1300-1350
**Classroom:** CBEC 3305

**Course Description:** CBE 318 Chemical Engineering Mass Transfer
Credits: (3-0) 3
The fourth course on the theory and practice of chemical engineering with emphasis on molecular diffusion, membranes, convective mass transfer, drying, humidification, and continuous gas-liquid separation processes.
Prerequisites: CBE 218 or permission of instructor.
CRN: 10893

**Course Website:**
`https://webpages.sdsmt.edu/~twalker/secure/teaching/2018/2018_01/cbe318.html`

**Required Textbook:**

> C.J. Geankoplis. *Transport Processes and Separation Process Principles (Includes Unit Operations*, 4th ed. Prentice Hall Professional Technical Reference (2003).

**Recommended Textbook:**

> R.B. Bird, W.E. Stewart, E.N. Lightfoot. *Transport Phenomena*, 2nd ed. John Wiley & Sons, New York (1999). ISBN 0-47011-539-4.

**Course Grading:**

| | |
|---|---|
| Homework | 20% |
| Group Project | 15% |
| Regular Examinations (3) | 45% |
| Final Examination | 20% |

**Grade Policy:** Work received up to 24 hours late will receive 50% credit. Work received beyond 24 hours late will receive 0% credit. Group work on homework is permitted, but each student must submit his or her own individual assignment with a list of contributors.

**Grading:** If you determine that a regrade is necessary, the entire assignment will be regraded.

Final performance percentage will be assigned a minimum letter grade by the following scale (implying that the percentage requirements for a particular grade may be decreased at the instructor's sole discretion but will not be increased):

| | |
|---|---|
| 90-100 | A |
| 80-90 | B |
| 70-80 | C |
| 60-70 | D |
| 00-60 | F |

**Course Objectives and Rationale:** The overall objective of this course is to introduce you to computational and numerical techniques that may be used to solve a variety of chemical engineering problems. Like the calculator, these tools will make solving problems in subsequent chemical engineering courses easier.

**Course Outcomes:** By the end of the course, a student will be able to do the following:

- analyze and design single and multiple effect evaporators/evaporation systems;
- demonstrate the knowledge of fundamental aspects of diffusion and convective mass transfer (rate of mass transfer under stagnant and convective conditions);
- analyze and design absorption and/or stripping columns (tray and packed bed systems);
- estimate basic equipment dimensions for drying equipment;
- estimate basic equipment dimensions for adsorption and ion exchange equipment; and
- analyze mass transport through membranes and identify potential applications.

**Course Structure:**

***Communication:***

The course website will be used to distribute information, while email to MINES addresses will be used for course communication. I do my best to answer emails as promptly as possible, but I reserve the right to have 24 hours to answer all email inquires. Under certain circumstances this timeline could be longer.

***Lectures:***

Lectures will be used for the following:

- content instruction,
- homework feedback and questions,
- examinations, and
- examination feedback and questions.

Attendance in lectures is expected. You are expected to be punctual and to minimize disruptions. Cell-phones need to be off during class. Also, no use of laptops or other electronic devices for activity outside of its use in this class will be tolerated. If you miss a class, you are responsible for obtaining lecture notes from other students.

While the University is a place where the free exchange of ideas and concepts allows for debate and disagreement, all classroom behavior and discourse should reflect the values of respect and civility. Behaviors that are disruptive to the learning environment will not be tolerated. As your instructor, I am dedicated to establishing a learning environment that promotes diversity of race, culture, gender, sexual orientation, and physical disability. Anyone noticing discriminatory behavior, or who feels discriminated against, should bring it to the attention of the instructor or other institutional personnel as appropriate.

***Homework:***

Homework will be due on Fridays at 1300. Homework will be assigned every week. To increase efficiency in the grading process, homework will be graded in the following manner.

| | |
|---|---|
| ✓+ | excellent |
| ✓ | satisfactory |
| ✓- | unsatisfactory |
| 0 | not submitted |

To aid in the understanding of the information, complete solutions will be posted to the course website following the submission of the homework. Inquiries will be directed to these solutions for comparison to the returned homework, while further discussion will be saved for office hours.

***Group Project:***

A course project will be completed by groups of one, two, or three (1, 2, 3) students depending on the number of students in the course. The project will be used as an overall assessment of the students' understanding of key concepts described throughout the course. The deliverable will consist of a written report. Further information will be distributed in a separate document entitled Project Description.

***Examinations:***

Four examinations will exist in this course: three regular examinations and one final examination during finals week. The tentative dates of the examinations are the following:

- Midterm Examination I: Week 06, Friday, 2018.02.16 from 1300-1350 in class
- Midterm Examination II: Week 11, Wednesday, 2018.03.28 from 1300-1350 in class
- Midterm Examination III: Week 15, Wednesday, 2018.04.25 from 1300-1350 in class
- Final Examination: Week 16, Monday, 2018.04.30 from 1600-1750 in room TBA

Unless otherwise stated, during examinations you may only use your copy of the required textbook and any materials provided during the course. You cannot "share" a textbook during an examination or use copies of pages from the book. You may write notes in your textbook about topics that are covered in class but not included in the textbook. Laptops, calculators, or phones are not allowed during exams.

Make-up examinations will only be allowed in the case of documented emergencies or with prior authorization (i.e., prior to the examination time) from the instructor. If you must miss one of the examinations for an emergency situation, please let me know as soon as possible (travis.walker@sdsmt.edu). You will not have an opportunity to make up the examination without an approved reason.

***Tentative Dates:***

- **Classes:**
  January 08, 10, 12, 17, 19, 22, 24, 26, 31
  February 05, 07, 09, 12, 14, 16, 21, 23, 26, 28
  March 02, 12, 14, 16, 19, 21, 23, 26, 28, 30
  April 02, 04, 06, 09, 11, 13, 16, 18, 20, 25, 27, 30
- **Recitations:**
  January 29
- **No Classes:**
  January 15 (Martin Luther King, Jr., Day)
  February 02
  February 19 (President's Day)
  March 05, 07, 09 (Spring Break)
  March 30 (Passover)
  April 23

**Important Dates:**

Add/Drop . . . . . 2018.01.17
Midterm Examination I . . . . . 2018.02.16 1300-1350
Midterm Examination II . . . . . 2018.03.28 1300-1350
Withdraw . . . . . 2018.04.03
Midterm Examination III . . . . . 2018.04.25 1300-1350
Project Deadline . . . . . TBA
Final Examination . . . . . 2018.04.30 1600-1750

**Tentative Course Outline (2018.02.06):** This tentative list is subject to change depending on class needs. All topics in the chapters may not be covered, and some topics may be covered to a greater depth than others. Additional reading material might be provided as well.

| **Topic** | **Chapter** |
|---|---|
| Dimensional Analysis | Extra |
| **Part 1. Transport Processes** | |
| Principles of Mass Transfer | 06 |
| Principles of Unsteady-State and Convective Mass Transfer | 07 |
| **Part 2. Separation Process Principles** | |
| Evaporation | 08 |
| Drying of Process Materials | 09 |
| Stage and Continuous Gas-Liquid Separation Processes | 10 |
| Liquid-Liquid and Fluid-Solid Separation Processes | 12 |
| Membrane Separation Processes | 13 |

**Academic Integrity:** Students are expected to abide by the SDSM&T policies of academic integrity (with regard to cheating, plagiarism, etc.), as outlined in the Course Catalog.

**ADA Statement:** *Students with special needs or requiring special accommodations should contact the instructor, (Travis Walker, at travis.walker@sdsmt.edu or 605.394.2543) and/or the Director of Counseling and Disability Services, Ms. Megan Reder-Schopp, at megan.reder-schopp@sdsmt.edu or 394-6988 at the earliest opportunity.*

**Freedom in Learning Statement:** *Under Board of Regents and University policy student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact the Provost and Vice President for Academic Affairs to initiate a review of the evaluation.*

**Addition Support**

- The Student Success Center is a hub for learning support, resources, and help in identifying sources of assistance or support on campus. Go to `http://www.sdsmt.edu/Academics/Student-Success-Center/` for more information or stop by the office in the Surbeck Center (across from the Dean of Students office) to visit with Lisa.Carlson@sdsmt.edu or Tyg.Long@sdsmt.edu. The phone number is 605.394.5261.

- Student Resource List:
  `http://www.sdsmt.edu/Campus-Life/Student-Resources/Student-Resources-List/`

- Information about how to use or access ITS resources (e.g., computer, Internet, email):
  `http://www.sdsmt.edu/Campus-Services/ITS/How-Do-I/`

- Title IX of the Educational Amendments Act of 1972 is the federal law prohibiting discrimination based on sex under any education program and/or activity operated by an institution receiving and/or benefiting from federal financial assistance. Behaviors that can be considered "sexual discrimination" include sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct, and gender discrimination. You are encouraged to report these behaviors. Reporting: SD Mines can better support students in trouble if we know about what is happening. Reporting also helps us to identify patterns that might arise – for example, if more than one complainant reports having been assaulted or harassed by the same individual.

  SDSM&T is committed to providing a safe and positive learning experience. To report a violation of sexual misconduct or gender discrimination, please contact the Title IX Coordinator at 605-394-1203. Please note that as your professor, I am required to report any incidences to the Title IX Coordinator. Confidential support for students is available by contacting the Student Counseling Center at 605.394.1924.