Chemical Engineering 4M3, Fall 2014
Separation Processes

Instructor

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Class time and location

PC (Psychology Complex), Room 155, on Tuesday, Wednesday and Friday morning, 09:30 to 10:20

Disclaimer

This outline **may be modified**, as circumstances change.

1 About the course

Official description

Overview of separation processes, liquid-liquid extraction, supercritical fluid extraction, adsorption, chromatography, filtration, membrane separation processes, introduction to bioseparations.

Prerequisites

CHEM ENG `3A04` (heat transfer), `2O04` (fluid mechanics), `3M04` (mass transfer)

What you must be able to demonstrate by the end of the course

This course will bring together multiple aspects from other Chemical Engineering courses: fluid flow, heat transfer, mass transfer, mass and energy balance calculations. We will also be introducing concepts of process analysis and operations, which tie in the `4N4` and `4W4` courses.

The other courses you have taken at McMaster, such as physics and fluid flow will be heavily used to derive the principles underlying various separation processes. Your math courses will be used to solve the equations we derive.

Be prepared to go back to these course notes during assignments, and when preparing for class.

Course materials

The course website will be permanently available at: http://learnche.mcmaster.ca/4M3

Course materials, assignments and solutions, project postings, grades, *etc* will be available from the website.

Course announcements will only be posted to the main page of the website - students are expected to check the website at least 3 times per week. Please note that this is not an Avenue course website. You may also choose to receive all course notifications from the Twitter feed at @4m3separations.

Required textbook

There is no official course textbook. We will be using the departmental material based on notes from previous instructors: Jim Dickson, Raja Ghosh and Santiago Faucher, and myself.

Recommended readings

The following texts are highly recommended for the course:

1. Geankoplis, C. J., Transport Processes and Separation Process Principles, any edition may be used (pages numbers to 3rd and 4th edition will be given in class). You likely have this textbook already from prior courses at McMaster.

2. Perry's Chemical Engineering Handbook (any edition will do). Here's a link to the university's electronic subscription (only works from campus computers and via VPN access). Please make the most use of it while you are at McMaster.

Additional reference texts are listed on the course website and are generally available in Thode Library.

Course outline (differs somewhat from the official description)

The course is divided into several main sections, taught over 12 weeks. The course structure and order is not fixed, but will be determined based on class input in the first class.

1. Overview of separation processes

2. Thickeners and clarifiers (sedimentation), cyclones, centrifuges, particle size distributions, and filtration

3. Membranes, ultrafiltration, microfiltration, dialysis, and reverse osmosis

4. Liquid-liquid extraction

5. Adsorption separations (chromatography and ion-exchange, time permitting)

6. Evaporation and drying

Enrichment topics may be covered throughout the course, time permitting.

2 Grading

To assess your understanding of the course materials, the grading for the course will be:

Component	Fraction	Notes
Assignments	18%	Expect around 5 to 6 assignments; can be completed individually, or in groups of 2 (no exceptions).
Midterm	15%	A written midterm exam.
Quests	10%	Several short tests that you complete online
Project	12%	A short project report.
Final exam	45%	A written exam, lasting 3 hours.

NOTE: To pass the course you must gain a grade of at least 50% on the final exam, and you must also submit a course project.

Policies regarding grading

- We encourage you to complete the assignments in groups of no more than 2 members.

- You, and your group, will receive the greatest benefit if you each do **all** the questions yourselves. Arrange to meet and review your solutions, discussing various approaches.

- Assemble a **single submission** for the group – the TAs will not grade loose sheets handed in after the first submission. All group submissions must clearly show the names of the group members.

- You are defeating the purpose of the group-based assignment if you simply divide the assignment into sections, one for each group member. This is definitely not recommended, because you are losing out on the learning opportunity of seeing your mistakes and the group member's mis takes, and learning from them.

- No sharing of any work may be done between groups for assignments and projects. This includes handwritten documents and electronic files of any type. Reusing solutions from previous years will be considered plagiarism. Please ensure that you have read the University's academic integrity policy (part of which is reproduced below).

- This is a large class of about 100 students, so late hand-ins interfere with the TAs to efficiently grade your assignments. Late assignments will be penalized by deducting 30% per day for every late day. A grade of zero will be given for submissions handed in after the solutions are posted (usually within 2 days of assignment hand-in).

- Emergencies and such arise, so each person has 2 "late day" credits for assignments. So you can hand in one assignment 2 days late, or 2 assignments each one day late, without penalty. Late day credits cannot be used for midterms or projects, only for assignments.

- Grading of assignments and tests will include contributions for clarity and organization of presentation.

- No make-ups will be given for assignments.

- Any paper-based materials (textbooks, notes, *etc*) are allowed during tests and exams.

- Any calculator may be used during the tests and exams.

- The *midterm is optional* and there is no make-up for it. If you choose not to write the midterm, or cannot write it due to illness or other reasons, then the usual approach will be followed: the contribution from the midterm will be added to the final examination weighting.

  The midterm will be followed by a collaborative review session. You will work on the midterm again in groups of 4 students and submit a single submission per group. That group submission will count 15% of the midterm grade, and the individual portion will be 85% of the midterm grade. Your overall midterm grade will be that weighted sum, or 100% of your individual portion, whichever is highest.

- All assignments will be graded, and the mean of **all** assignments used to calculate the assignment grade. You should expect $N \approx 5$ or 6, and the assignments will be more frequent at the start of the course, slowing down at the end.

- The final percentage grades will be converted to letter grades using the Registrar's recommended procedure.

- Adjustment to the final grades may be done at the discretion of the instructor.

- The final exam will be cumulative, based on the entire semester's material.

3 Important notes

Class participation:

Please bring a calculator to every class. A cell phone, laptop, tablet computer, or some sort of device to connect to the internet in the class rooms, while not mandatory, will help you for tutorials and answering questions during class.

Course software

No specific software is required, however programs such as MATLAB, Python, Excel, or whatever software best suits your needs, may be used to answer assignment questions and the project.

The course project **must** be submitted electronically. Grading will be done electronically in the document to minimize the use of paper reports. Please see the website for more details and a video demonstration.

Out-of-class access and email

Office hours will be arranged during the first 2 weeks of the course and posted on the course website and the instructor's website, http://learnche.mcmaster.ca.

The TAs for this course can be contacted by email - please see their email address above. Try to send email from your McMaster account - email from personal accounts are sometimes discarded by spam filters. Your instructor filters his email, so emails from @mcmaster.ca addresses receive higher priority than personal addresses.

4 Academic integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.

2. Improper collaboration in group work: this point is particularly important and will be strongly penalized in this course.

3. Copying or using unauthorized aids in tests and examinations.

Consider this course outline to be a first warning; any lack of academic integrity will not be accepted.

5 Accessibility

The instructor aims to make this class accessible to all students. Please forward and optionally discuss any accommodation granted by Student Accessibility Services with the instructor before the third week of the course. Please raise any other accessibility issues with the instructor as soon as possible, e.g. accessibility of the course website and course materials.

6 Important dates

A list of *tentative* dates:

Date	Description
5 September 2014	First class: course overview
17 September	Assignment 1 due
24 September	Assignment 2 due
7 October	Project topics selected
8 October	Assignment 3 due
14 October	Project outline due
16 October	Written midterm
29 October	Assignment 4 due
07 November	Project due
19 November	Assignment 5 due
5 to 20 December	Final exams