CONCORDIA UNIVERSITY
DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

CHEM 650
SELECTED TOPICS IN MULTIDISCIPLINARY CHEMISTRY

Modules for Advanced Materials
Syllabus – Winter 2024

1. GENERAL INFORMATION

Modules for Advanced Materials (CHEM 650) is a one-term, 3.00 credit course open to all graduate students in the chemistry or biochemistry program.

2. COURSE DESCRIPTION

Functional or advanced materials are materials that combine advantageous structural properties with at least one function, such as an environmental response, detection, energy conversion, filtration, and more. These new materials play an increasingly important role in our lives. Their study involves many interdisciplinary topics in physics, chemistry, engineering, and sometimes even in pharmacy and medicine. This multi-university course is offered by the members of the Centre Québécois sur les Matériaux Fonctionnels (CQMF)/Quebec Center for Advanced Materials (QCAM). The course will introduce students to basic concepts in the field of advanced materials. This course is intended for graduate level students interested in the subject.

INSTRUCTOR	Professor Ashlee J. Howarth Office: Zoom, unless requested in-person ashlee.howarth@concordia.ca
COURSE FORMAT	Lectures
LECTURE HOURS	Wed 1:00pm – 4:30pm (Online, in person twice, see schedule below)
LOCATION	http://cqmf-qcam.ca/activities/qcam-course?lang=en In-person meeting locations TBD
COURSE WEBSITE	Moodle: CHEM 650 02 2234
OFFICE HOURS	email any time, office hours by appointment

3. TERRITORIAL ACKNOWLEDGEMENT

I would like to begin by acknowledging that Concordia University is located on unceded Indigenous lands. The Kanien'kehá:ka Nation is recognized as the custodians of the lands and waters on which we gather today. Tiohtià:ke/Montréal is historically known as a gathering place for many First Nations. Today, it is home to a diverse population of Indigenous and other peoples. We respect the continued connections with the past, present and future in our ongoing relationships with Indigenous and other peoples within the Montreal community.

4. IMPORTANT DATES

Class Begin (Get to Know You form due): Wednesday January 17th
Deadline to withdraw with tuition refund (DNE): Monday January 29th
Team Values and Expectations form due: Wednesday January 31st
Bullet point Summary of Workshop #1 due: Wednesday January 31st
Initial Proposal (1st draft) due: Wednesday February 14th
Revision of Initial Proposal (2nd draft) due: Wednesday February 21st
Team Member Review #1 due: Wednesday February 21st

Midterm Quizzes and Speed Dating (Midterm Proposal Presentation): Wednesday March 20th
Peer Feedback on Midterm Proposal Presentations due: Wednesday March 27th
Revision of Midterm Proposal Presentation due: Wednesday April 10th
Team Member Review #2 due: Wednesday April 10th
Bullet point Summary of Workshop #2 due: Friday April 12th
Deadline to withdraw (DISC): Wednesday April 17th
Final Presentation Date: TBD
Team Member Review #3 due: TBD (same as above)

5. LECTURE FORMAT, PROJECT & ASSIGNMENTS

This course is offered at several universities at the same time. The course has been developed by the academic committee of QCAM: Profs Howarth from Concordia, Cibian from UQTR, Dorval Courchesne from McGill, and St-Onge and Wustrow from U Sherbrooke. These five professors (referred to as "course organizers" in this document) oversee the course and participate in several of the activities.

In addition to this, each university has an instructor who deals with logistics, and ensures the smooth running of the course according to the expectations and rules of the university. The course has two parts, one dedicated to the acquisition of knowledge through video lectures, the other to the development of a project related to a field of advanced materials science.

A. Lectures

Lectures will be given either in streaming mode or pre-recorded. The live (Zoom) lectures will run on Wednesdays at 1:00 pm from Jan 17-March 13, 2024. There will be a total of 10 lectures, five of them in English and five in French. Each student must study the content of five lectures of their choice, in English and/or French. The acquisition of knowledge of these lectures is evaluated by a quiz of 20 minutes / lecture. The five quizzes will be taken in one session on March 20th in person. The quiz questions are given in both languages and the students are free to answer in either English or French. The list of lectures scheduled is in appendix A.

B. The project

The project is completed in a team of three to four students. The composition of the teams is determined by the course organizers, with the goal of maximizing diversity between Universities while making sure that language and time of availability is not a barrier among team members. To help team formation, each student will complete a short survey (the Get to Know You form) that will guide the organizers in forming the teams.

The teams will have to choose a current problem that has potential to be solved by materials science, falling into the research areas covered by QCAM (www.cqmf-qcam.ca). Examples of such topics will be covered in the course lectures. The project cannot be directly related to any graduate project of one of the members of the team.

Project preparation may require travel between major cities in Quebec. The CQMF / QCAM can reimburse your travel related to the project preparation.

For students in Montreal (Varennes), Quebec City, Trois-Rivières and Sherbrooke, the rules are as follows: only day trips can be reimbursed. The train, bus, sharing services (Amigo Express, for example) are refundable with a sum not exceeding $100 per round trip. A maximum of two trips per student is refundable. Evidence (bus tickets, etc ...) must be provided. For other students, please contact the QCAM coordinator, Mr. Petr Fiurasek (petr.fiurasek@mcgill.ca) to schedule a trip.

B.1 Initial proposal

The team will provide a summary of 3000 characters or less (including spaces) in which the choice of topic will be presented. This summary (initial proposal) will briefly present the problem that will be tackled by the team. The solution must be related to the materials science topics covered by the QCAM and cannot correspond to the research projects of the members of the group. The summary will identify what problem the team wants to solve, present the state of the art in the field (e.g., existing solutions), and what is the proposed materials-based solution. The course organizers will provide quick feedback on this summary, and on the adequacy of the chosen problem with the objectives of the course. Minor or major revisions may be requested. In this case, a second summary

(revision of initial proposal) will have to be provided by the team. The final version of the summary will be evaluated based on its clarity and relevance to the field of advanced materials.

Note: along with the final revised version of this proposal summary, students will have to submit a contribution chart that outlines how every member contributed to the submission (Team member review #1).

B.2 Mid-term 5-minute presentation: speed-dating

Once the final summary is accepted, the team will prepare a five-minute oral presentation. This presentation will highlight the following points:

i. What is the theme of the proposal in the field of functional materials
ii. What is the problem identified
iii. What are the existing solutions for this problem
iv. What is the new materials-based solution proposed by the team
v. An impact analysis about the solution should be proposed

This presentation will be given to other students at an in person "speed-dating' session on Wednesday March 20th. During this session, students will present their presentation to other teams, meeting up in pairs that quickly rotate. Each period of speed-dating lasts about 20 minutes: at first, one team presents to another team (5 min); after this, the other team will present their project (5 min). A final period of 10 minutes is allocated for questions and comments. This format may be adjusted depending on number of teams speaking the same language present in the course.

While listening to presentations from other teams, students are encouraged to take notes, since after the speed-dating session each student will have to provide feedback to the other teams that they have listened to (see peer feedback section, below).

A week later, all peer review comments, rendered anonymous, will be compiled, and sent to each team. A revised version of the five-minute presentation will have to be uploaded on the course Moodle page on April 10th and will be evaluated.

Note: along with the revised presentation, students will have to submit a contribution chart that outlines how every member contributed to the submitted presentation (Team member review #2).

The evaluation criteria of the 5-min presentation are:

a. Clarity of the presentation (clarity of the presentation of the problem, existing solutions, and the proposed materials-based solution) 25%
b. Domain knowledge (possibility to introduce and explain new concepts, reference to recent works) 25%
c. Creativity and originality (demonstration of how the proposed solution addresses the problem, how the proposed solution differs from what already exists) 25%
d. Communication and teamwork (quality of the oral presentation, quality of PowerPoint support, distribution of tasks in the team) 25%
e. Final presentation

Quiz and speed-dating day (March 20, 2024)

In the morning you will take a quiz on five lectures of your choice and speed dating will take place during the afternoon. This day will be held at one of the participating universities. Travel between your university and this one will be organized in due time. Travel expenses will be reimbursed by the QCAM for all students. Meals and a coffee break will be provided.

Peer feedback form (Speed-Dating)

This form consists of 4 questions:

i. What is the presentation about?

ii. What are the highlights of the presentation?
iii. What are the weak points of the presentation?
iv. Do you have any other comments or suggestions for your peers?

The comments made will be forwarded to the teams anonymously (see above), but each student will receive a grade relative to their comments, based on their scientific quality and usefulness.

B.3 Final Report

At the end of the course, the team will present their project in more detail via a final report. The final report must be 10 pages maximum, written with a 1.5 line spacing, Times New Roman font 12 points (or equivalent), margins 1.5 cm plus. A maximum of 60 references must be used (references do not count in 10 pages). Format the references according to the ACS style (https://libguides.williams.edu/citing/acs). The document will be evaluated according to the following criteria:

a. Clarity of the presentation of the problem (20%)
b. Clarity of the presentation of the solution (20%)
c. Critical discussion of the solution (advantages, disadvantages, risks) (20%)
d. Use and understanding of contemporary concepts in functional and advanced materials sciences (20%)
e. Organization and didactic character (10%)
f. Good use of literature and quality of illustrations (10%)

Note: along with the report, students will have to submit a contribution chart that outlines how every member contributed to the submitted document (Team member review #3).

B.4 Final Oral Presentation

The oral presentation should last exactly 10 minutes followed by 5 minutes of questions. All members of the group must speak during the presentation. It will be evaluated according to the following points:

a. Clarity of the presentation of the problem (20%)
b. Clarity of the presentation of the solution (20%)
c. Critical discussion of the solution (advantages, disadvantages, risks) (20%)
d. Use and understanding of contemporary concepts in functional and advanced materials sciences (20%)
e. Answers to questions (10%)
f. Visual and oral quality of presentation (10%)

Note: along with the presentation, students will have to submit a contribution chart that outlines how every member contributed to the submitted presentation (Team member review #3).

The document and the presentation should address the following points:

i. What are the contributions of each team member
ii. What is the problem? Why is the problem chosen important? How is it relevant to the field of functional materials science?
iii. What are the existing solutions or what are the existing works that at least partially address the identified problem?
iv. What is the materials-based proposed solution? What assumptions are they based on? What are the advantages and disadvantages? How is this solution original and different from existing solutions?
v. What is the methodology for implementing the solution you propose? Can you identify difficulties? What is the level of risk?

Project presentation day (TBD)

This day will be held at one of the participating universities. Travel between your university and this one will be organized in due time. Travel expenses, meals and coffee break will be provided by the QCAM.

6. COURSE OBJECTIVES

a) Learn modern concepts on advanced materials, and in particular with modern concepts on polymers, nanoparticles, self-assembly, and materials applications in the field of energy, environment and biomedical.
b) Critically review literature in the field
c) Propose creative solutions to engineering problems
d) Effectively present in front of an audience
e) Effectively work in a team
f) Building a project in science and engineering and measure its impact
g) Provide constructive feedback
h) Take feedback into consideration to improve
i) Present effectively complex problems and solutions
j) Effectively write summaries and reports

7. COURSE OUTLINE and SCHEDULE

Winter 2024 **Wednesdays**	**Course Meetings (1:00pm-4:30pm)** Online = green In-person = pink	**Individual Assignments (due at noon of the day)**	**Team Assignments (due at noon of the day)**
Jan. 17	Intro and Lecture-1 (En)	Get to know you form	
Jan. 24	First Teamwork Workshop (E-IDEA)		
Jan. 31	Lecture-2 (En) and 3 (En)	Bullet point summary of workshop discussion	Team values and expectation form
Feb. 7	Lecture-4 (Fr) and 5 (Fr)		
Feb. 14	Lecture-6 (Fr)		Initial proposal
Feb. 21	Lecture-7 (En)	Team member review #1	Revision of initial proposal
Feb. 26-Mar. 1 Mar. 4-8 (CU)	**Spring break**		
Mar.13	Lecture-8 (Fr)		
Mar. 20	Quiz in AM Speed dating in PM Location TBD		Midway proposal presentation (first version before feedback)
Mar. 27		Peer feedback on midway proposal presentations (from speed dating)	
Mar. 29-Apr.1	**Easter Holiday**		
Apr. 3			
Apr. 10	Second Workshop – IP Development	Team member review #2	Revision of midway proposal presentation
Fri. Apr 12		Bullet point summary of workshop discussion	
Date and Location TBD between Apr. 18- May 1	Final presentation day	Team member review #3	Final report + oral presentation

8. BEHAVIOUR

All individuals participating in courses at Concordia are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the Code of Rights and Responsibilities (*https://www.concordia.ca/content/dam/common/docs/policies/official-policies/BD-3.pdf*) which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

Sexual violence, including sexual harassment and sexual assault, is not tolerated at Concordia. Please see Concordia's policy on sexual violence for more information about awareness and prevention, support for survivors/ victims, responding to disclosures and procedures for reports and complaints. You can also contact the Sexual Assault Resource Centre for information and support. More information and support are available at the Sexual Assault Resource Centre: concordia.ca/students/sexual-assault, by email sarc@concordia.ca or phone 514 848-2424 x 3353

9. IP

Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

10. ACADEMIC INTEGRITY *(Source: http://www.concordia.ca/students/academic-integrity.html)*

Plagiarism: The most common offense under the Academic Code of Conduct is plagiarism, which the Code defines as "the presentation of the work of another person as one's own or without proper acknowledgement." This includes material copied word for word from books, journals, Internet sites, professor's course notes, etc. It refers to material that is paraphrased but closely resembles the original source. It also includes for example the work of a fellow student, an answer on a quiz, data for a lab report, a paper or assignment completed by another student. It might be a paper purchased from any source. Plagiarism does not refer to words alone –it can refer to copying images, graphs, tables and ideas. "Presentation" is not limited to written work. It includes oral presentations, computer assignment and artistic works. Finally, if you translate the work of another person into any other language and do not cite the source, this is also plagiarism.

In Simple Words: Do not copy, paraphrase or translate anything from anywhere without saying where you obtained it!

11. PLAGIARISM AND OTHER FORMS OF ACADEMIC DISHONESTY

The academic code of conduct can be found in section 17.10 of the academic calendar (http://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html). Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied. The mandatory seminar is a clear and fair opportunity to learn what our faculty regards as academic misconduct. Failure to take part in this learning opportunity and thus ignorance of these regulations is no excuse and will not result in a reduced sanction in any case where academic misconduct is observed.

12. ACCESSIBILITY

If you have accessibility needs that require academic accommodations, please meet with an advisor from the Access Centre for Students with Disabilities (ACSD) as soon as possible to set up an accommodation plan. I welcome meeting with all students to discuss their accessibility needs. concordia.ca/students/ accessibility

13. STUDENT SERVICES

Access Centre for Students with Disabilities: concordia.ca/students/accessibility
Student Success Centre: concordia.ca/students/success
Academic Advisor: Dr. Gregor Kos (chembiochem.advising@concordia.ca)
Counselling and Psychological Services: concordia.ca/students/counselling-life-skills
Concordia Library Citation and Style Guides: https://library.concordia.ca/help/citing
Health Services: concordia.ca/students/health
Financial Aid and Awards: concordia.ca/offices/faao
Academic Integrity: concordia.ca/students/academic-integrity
Dean of Students Office: concordia.ca/offices/dean-students
International Students Office: concordia.ca/students/international
Student Hub: concordia.ca/students
Sexual Assault Resource Centre: concordia.ca/students/sexual-assault
Indigenous Student Resource Centre: concordia.ca/students/aboriginal

As a Concordia student, you are a member of the Concordia Student Union and have many resources available to you including: (a) HOJO (Off Campus Housing and Job Bank): https://www.csu.qc.ca/services/hojo/ (b) CSU Advocacy Centre: https://www.csu.qc.ca/services/advocacy/

14. COURSE GRADE

a) Quizzes: 5 x 4% = 20% (individual grade)
b) Initial Proposal Summary (revised): 5% (adjusted team grade)
c) Midterm presentation (revised): 16% (adjusted team grade)
d) Bullet point summary of workshop: 2 x 4% = 8% (adjusted team grade)
e) Peer feedback: 5% (individual grade)
f) 10 page project proposal: 23% (adjusted team grade)
g) Oral presentation: 23% (adjusted team grade)

Passing Grades:

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-
100-93	92-86	85-80	79-77	76-73	72-70	69-67	66-63	62-60	59-57	56-53	52-50

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

Appendix A: To monitor the updated list of lecture topics, professors teaching them, and language please check the website http://cqmf-qcam.ca/activities/qcam-course?lang=en

Lecture	En/Fr	Given	Title
January 17, 3pm	En	T. van de Ven	Cellulose-based Advanced Materials
January 31, 1pm	En	A.Wustrow	Synchrotons
January 31, 3pm	En	P. Le Magueres	Electron diffraction
February 7, 1pm	Fr	M. Robert	Fibres cellulosiques
February 7, 3pm	Fr	F. Brouillette	Papiers Spécialisés
February 14, 1pm	Fr	M. Siaj	Nouveaux matériaux 2D
February 21, 1:00pm	En	Len MacGillivray	Crystal Engineering
March 13, 1pm	Fr	M.-A. Fortin	Impression 3D de polymères biomédicaux
Recorded	En	N. Mendoza	Microwave atmospheric plasmas
Recorded	Fr	É. Boisselier	Dendrimères

APPENDIX B: How to become an effective team

When you start your work with your classmates, you may not realize yet that you are a team, and not merely a group of individuals. Groups of individuals may tend to work independently and simply pool work together with no discussion and may spend a lot of time in conflict over work-related or personal issues.

Team members instead always work together (in person or apart, but aware of who is doing what). They take different roles and responsibilities, help each other, resolve conflicts amicably, and keep personal issues from interfering with team functioning.

When you look for a job, teamwork skills, along with communication skills, are at the top of the list of your to-be employer. In this class we will help you develop this crucial skill through these workshops.

Workshop 1 – TeamWork - Team identity and expectation setting

Once teams are formed, each team will work together and meet their team members during Team workshop #1. At the end of this workshop, you will have defined your team name, and you will submit a team agreement form that provides an initial description of your team's identity and expectations (worth 4%, full marks given to all teams that submit a form with meaningful content within deadline).

Workshop 2 – Workshop on intellectual property (open to interested QCAM students for the first 1 h)

The workshop aims to educate participants about the fundamentals of intellectual property rights, including patents, trademarks, copyrights, and trade secrets. This involves explaining the differences between them, their importance, and how to protect them. Outcome valued at 4%: fill out an impact assessment document.

APPENDIX C. Peer evaluation

1. Overview

Peer evaluations form an integral part of Chem 650, both in terms of team process and course evaluation. Your evaluations will be anonymous and will allow you to give both quantitative and qualitative feedback to your teammates, with two goals:

1) Help your team grow throughout the class.
2) Allow individual's contribution to teamwork to be properly evaluated.

The evaluations consider five criteria:

1. **Assignment contributions:** to what degree did the teammate assume responsibility for their work and participate equitably in the assignment?
2. **Quality of work**: to what degree did the quality of the teammate's work meet overall team expectations?

3. **Communication**: to what degree did the teammate communicate effectively and constructively with other team members, in and out of class?
4. **Equity**: to what degree did the teammate contribute to creating a positive and inclusive team environment?
5. **Professionalism**: to what degree did the teammate act with professional behavior and communication etiquette?

Each criterion is evaluated on a 5-point scale based on the following general guidelines:

0. Unacceptable: Took away from team's ability to perform in the criterion
1. Emerging: Showed some effort, but created an impediment for the team to grow in the criterion
2. Marginally acceptable: Provided minimum contribution expected in the criterion; may have created an annoyance for the team the criterion
3. Accomplished: Performed individually at a high level in the criterion
4. Exemplary: Performed individually at a high level ***and*** helped other teammates to also perform at a high level in the criterion

2. When will you be requested to fill out a peer evaluation form?

Throughout the class, you will fill out 3 team member evaluations, i.e. every time your team has gone through a crucial team assignment:

a. After the initial project proposal submission
b. After the mid-way project proposal presentation
c. At the end of the class

3. Filling out peer evaluation forms

When an evaluation is available to you, the TA will send you a link to an Office Form that you will be able to fill online. ***You will have to fill out one peer evaluation form for each of your teammates***; in these forms, you will provide written feedback for each person and evaluate them on the five criteria above. In each evaluation, you will indicate to what degree each teammate performed in each criterion. A sample of the evaluation rubric is shown at the end of this document (again, the actual evaluation is done online using Office forms). Each peer evaluation event will be open for one week. Late evaluations will be accepted up to one week late but submitting a late evaluation will reduce your evaluation score received by 2% per day late.

4. Determining team score contributions

Your evaluation of each teammate will generate a raw score out of 20 (five criteria each with a maximum score of four). After the evaluation due date, each person will receive anonymous, randomly ordered comments and ratings from their teammates. Scores given by each person will be normalized to an average of 100.

Ex. 1: if the raw total evaluation scores you gave to your 5 teammates were 18, 18.5, 19, 19.5, and 20 (average of 19) these would be normalized, respectively, to 95, 97, 100, 103, and 105 (average of 100).

Ex. 2: if you gave every teammate a perfect score in every criterion, each teammate would receive a raw total evaluation score of 20 from you, the average would be 20, and each teammate would receive 100 for the evaluation (everyone is average).

Ex. 3: if you gave every teammate a score of 1 in every criteria, each teammate would receive a raw total evaluation score of 6 from you (1 pt per 6 criteria), the average would be 6, and each teammate would still receive 100 for the evaluation (everyone is average).

With this system, differences in evaluation standard between individuals are removed. Similarly, individuals do not penalize themselves by giving their teammates high evaluations, nor do they benefit by giving their teammates low evaluations.

The final peer evaluation score for each individual will be the average of all peer evaluations they receive from their teammates. Some individuals may have scores above 100 and some below, but the average evaluation score each person gives will be 100, and therefore the average final evaluation score for the whole team will be 100. These evaluations will be used as a multiplication factor to evaluate individual team grades.

For example: if the normalized scores in Example 1 were representative for the five team members shown, then ALL the items marked as adjusted team grade would be multiplied by 0.95, 0.97, 1, 1.03 and 1.05. So, if for example the team grade for the final project presentation was 80%, those five students would receive team grade components of 76% (i.e. 80% * 0.95), 78%, 80%, 82%, and 84%, respectively. The same would be true for all other evaluation items marked as adjusted team grades.

The individual contribution to each item that is stated as "adjusted team grade" in the table showing evaluation items in the syllabus will be determined using the multiplication factor calculated as discussed above, adjusted (+/- 0.1) by the professors based on the contributions described on the contribution charts submitted along with each team assignment.

You will see your raw "multiplication factor" as it evolves throughout the course on Moodle.

5. Final remarks

We encourage you to use the peer evaluation forms as only one tool for giving/receiving feedback in your team, in addition to in-class workshops, team clinics with the TA, and out-of-class teamwork time you will schedule. These forms often help bring issues forward before they might otherwise be discussed, and their anonymous nature makes it easier and more comfortable for some people to raise issues related to team dynamics. However, these evaluations alone are likely not sufficient for resolving complicated team issues, and some people find the anonymous nature awkward. Be prepared for this. Try to make sure that the feedback you give in your peer evaluation forms (and face-to-face) is constructive and balanced – let your teammates know what they are doing well in addition to where they might be able to improve.

A. J. Howarth
January 2024