QUEBEC CENTRE FOR ADVANCED MATERIALS (QCAM) COURSE SYLLABUS

Winter 2027

1. GENERAL INFORMATION

The QCAM course is a one-term, credit course open to all graduate students in the chemistry, materials science, biochemistry and related programs. It is offered at the following universities:

- Laval University, Prof. Jean-François Morin, CHM 7008A – Cours gradué interuniversitaire CQMF
- Université de Montréal, Prof. Christian Pellerin, CHM6465 – Matériaux fonctionnels
- Université de Sherbrooke, Prof. Patrick Ayotte, CHM777 – Sujets choisis en chimie des matériaux
- Concordia, Prof. Ashlee Howarth, Chem 650 – Selected Topics in Multidisciplinary Chemistry
- Université du Québec à Trois-Rivières, Prof. François Brouillette, NRG7703-2H – Problème spéciaux III

The course may also be taken by students from other universities in Quebec who enroll via the Inter-University Transfer Authorization application (AEHE).

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.

Chair	Professor Thomas Auvray Office: Zoom, unless requested in-person thomas.auvray@uqtr.ca
COURSE FORMAT	Lectures and workshops
LECTURE HOURS	Wednesday 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 platform hosted by U. of Sherbrooke
OFFICE HOURS	By email any time, office hours by appointment

3. IMPORTANT DATES

Please note: in-person sessions are in **bold** below.

Class begins: Wednesday, January 13th
Get to Know You form due: Wednesday, January 13th
Team Values, Agreements, & Expectations form due: Wednesday, January 27th
Bullet-Point Summary of Workshop #1 due: Wednesday, January 27th
Initial Proposal due: Wednesday, February 10th
Revised Initial Proposal due: Wednesday, February 17th
Team Member Review #1 due: Wednesday, February 17th
Midterm Quizzes and Presentation Day: Wednesday, March 17th
Peer Feedback on Midterm Presentations due: Wednesday, March 24th
Bullet point Summary of Workshop #2 due: Wednesday, March 31st
Revised Midterm Presentation due: Wednesday, April 7th
Team Member Review #2 due: Wednesday, April 7th
Final Presentation: TBD
Team Member Review #3 due: TBD (same as above)

4. 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 Auvray and Cibian from UQTR, Ayotte from U. of Sherbrooke and Howarth from Concordia. These four 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 (see point 1). 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 from 1:00 pm between Jan 13th and March 10th, 2027. There will be a total of 10 lectures, five 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 per lecture. The five quizzes will be taken in one session on **March 17th 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 can be found on the class Moodle and QCAM website.

B. 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 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 (https://cqmf-qcam.ca/carte-de-la-recherche?lang=en). 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 presentation 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 (qcam.chemistry@mcgill.ca) before scheduling any trip.

B.1 Initial Proposal

The team will provide a summary of 3000 characters (if in English) or 3500 characters (if in French) 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 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. A final version of the summary (Revised Initial Proposal) will then be submitted by the team.

The Revised Initial Proposal will be evaluated according to the following criteria:

a) Relevance to advanced materials (33% - 5 points)
b) Accurate and complete presentation of the problem (33% - 5 points)
c) Overall clarity and organization (33% - 5 points)

A penalty of 5% will be given for exceeding the character count with an additional 5% deduction for each additional 100 characters.

Note: Along with the Revised Initial Proposal, teams will have to submit a contribution chart that outlines how each member contributed to the submission (Contributions Chart #1, 1 per team). Finally, each student will fill out a peer review form evaluating the other member of their respective teams (Team Member Review #1). See Appendix C for details.

B.2 Midterm Presentation:

Once the final summary is accepted, the team will prepare a five-minute oral presentation. **All members of the group must speak during the 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 of the solution should be proposed.

This 5-min presentation will be given to other students at an **in-person session on Wednesday March 17th**. 30 minutes is allocated for questions, comments and discussions. This format may be adjusted depending on the number of teams in the course who speak the same language.

While listening to presentations from other teams, students are encouraged to take notes since after the presentations, each student will have to provide written 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 video-recorded, revised version of the five-minute presentation will have to be uploaded on the course Moodle page on April 7th to be evaluated.

The presentations will be evaluated according to the following criteria:

a) Clarity of the presentation of the problem – quality of visual elements (31% - 5 points)
b) Clarity of the presentation of the existing solutions – knowledge of state of the art (31% - 5 points)
c) Clarity of the presentation of the proposed solutions – originality and creativity (38% - 6 points)

A penalty of 10% will be given for exceeding the five-minute time limit on the video.

Note: Along with the revised presentation, teams will have to submit a contribution chart that outlines how each member contributed to the submission (Contributions Chart #2, 1 per team). Finally, each student will fill out a peer review form evaluating the other member of their respective teams (Team Member Review #2). See Appendix C for details.

Quiz and Midterm Presentation Day (March 17th, 2027)

In the morning, students will take five consecutive quizzes on the lectures of their choice. Midterm presentations will take place in the afternoon. This class meeting 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 on Midterm Presentations

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 Oral Presentation

The **in-person** oral presentation should last maximum 10 minutes (hard stop), followed by 15 minutes of questions. **All members of the group must speak during the presentation.**

The presentation 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) Visual and oral quality of presentation (10%)
f) Answers to questions (10%)

Both the Final Oral Presentation and Final Report should address the following points:

i. What is the problem? Why is the problem chosen important? How is it relevant to the field of functional materials science?
ii. What are the existing solutions or what are the existing works that at least partially address the identified problem?
iii. 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?
iv. What is the methodology for implementing the solution you propose? Can you identify difficulties? What is the level of risk?

Project presentation day (date 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.

B.4 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 (English) or 11 pages maximum (French), written with a 1.5 line spacing, Times New

Roman font 12 points (or equivalent), margins of at least 1.5 cm. 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 report 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, teams will have to submit a contribution chart that outlines how each member contributed to the **Final Report and Final Presentation** (Contributions Chart #3, 1 per team). Finally, each student will fill out a peer review form evaluating the other member of their respective teams (Team Member Review #3). See Appendix C for details.

5. COURSE OBJECTIVES

To help the student develop the following competencies:

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

6. EVALUATION

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%** (individual grade)
e) Peer feedback: **5%** (individual grade)
f) Oral presentation: **23%** (adjusted team grade)
g) Final report: **23%** (adjusted team grade)

All late work will be penalized by 10% per day and not accepted after 5 days.

Grade Assignment:

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.

7. COURSE OUTLINE AND SCHEDULE

Winter 2027 **Wednesdays**	**Course Meetings (1:00pm-4:30pm)** Online = **green** In-person = **orange**	**Individual Assignments (due at noon of the day)**	**Team Assignments (due at noon of the day)**
Jan. 13th	Intro and Lecture	Get to Know You form	
Jan. 20st	Workshop #1 – Teamwork (E-IDEA) and Lecture		
Jan. 27th	Lecture(s)	Bullet point summary of workshop #1	Team Values, Agreements, & Expectations form
Feb. 3rd	Lecture(s)		
Feb. 10th	Lecture(s)		Initial Proposal
Feb. 17th	Lecture(s)	Team Member Review #1	Revised Initial Proposal and Contribution Chart
Mar. 2nd-6th	**Spring break**		
Mar.10th	Lecture(s)		
Mar. 17th	Quiz (AM) and Midterm presentation (PM) day Location TBD		Midterm Presentation
Mar. 24th	Workshop #2 – IP Development	Peer Feedback on Midterm Presentations	
March 31st		Bullet point summary of workshop #2 discussion	
Apr. 7th		Team Member Review #2	Revised Midterm Presentation (video) and Contribution Chart
Date and Location TBD between Apr. 15- May 1	Final Presentation day	Team Member Review #3	Final Report, Final Presentation (oral), and Contribution Chart

8. BEHAVIOUR

All individuals participating in this course are expected to be professional and constructive throughout the course, including in their communications. Students should refer to the codes of conduct for their respective universities for any questions regarding behavioural expectations. These codes of conduct apply to students as well as to the teaching team. Complaints can be directed to qcam.chemistry@mcgill.ca.

9. ACADEMIC HONESTY AND INTEGRITY

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 person teaching. 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 in application within the institution of each participant.

Plagiarism: The most common offense under the Academic Code of Conduct of Concordia University (*http://www.concordia.ca/students/academic-integrity.html*)) 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!**

Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied, following the rules set in the participant institution.

Regarding the use of generative Artificial Intelligence: the inclusion of any content generated by an Artificial Intelligence tool is forbidden in this course, even with appropriate acknowledgment. Indeed, it would fall into the definition of plagiarism as it would be treated as content generated by someone else and introduced without proper reference acknowledging the origin of the work.

10. ACCESSIBILITY

If you have accessibility needs that require academic accommodations, please meet with an advisor your respective university. Ask the office to communicate with the course instructor from your school, who will communicate with the academic committee to ensure that the necessary accommodation is made. Please feel free to discuss these accommodations with **Prof. Auvray (thomas.auvray@uqtr.ca).**

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

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.

Participation in this workshop is mandatory and will be evaluated based on the team agreement form (2%, 1 per team) and workshop summary (2%, 1 per person). Grades will be given based on the effort put into each of these assignments, which can be written in full sentences or point form, avoiding one-word answers. The recommended length of the summary is ~1 page.

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.

Participation in this workshop is mandatory and will be evaluated based on the workshop summary (4%, 1 per person). Grades will be given based on the effort put into this assignments, which can be written in full sentences or point form. The recommended length of the summary is ~1 page.

APPENDIX C. Peer evaluation

1. Overview

Peer evaluations form an integral part of this class, 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 midterm 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 score 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 criterion, each teammate would receive a raw total evaluation score of 5 from you (1 pt per 5 criteria), the average would be 5, 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" along with your grade in the feedback section of each relevant assignement in 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.