

MATLS 4Z06A/B – MATERIALS ENGINEERING CAPSTONE

Fall 2021/Winter 2022

Co-ordinators: Dr. André Phillion and Daniella Pallisco
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Office hours: By Appointment

Project Mentors

The following MSE Faculty will be acting as specific project mentors for MATLS 4Z06:

Project Mentors	Office	E-mail
Dr. N. Bassim	JHE 258	bassimn@mcmaster.ca
Dr. J. Kish	JHE 343	kishjr@mcmaster.ca
Dr. A. Kitai	JHE A322	kitaia@mcmaster.ca
Dr. M. Niewczas	ABB 449	niewczas@mcmaster.ca
Dr. K. Sask	ABB C309	ksask@mcmaster.ca
Dr. D. Wilkinson	JHE 249	wilkinso@mcmaster.ca
Dr. B. Yu	ETB 403	bosco.yu@mcmaster.ca
Dr. H. Zurob	JHE 357	zurobh@mcmaster.ca

Lectures: Tuesdays 10:30 – 12:20 in both the Fall and Winter terms. In the fall, these will be virtual/synchronous lectures meaning (MS-Teams), also recorded for those who missed the lecture. In the winter, lectures are expected to be in-person. Lectures will be held on an intermittent basis for the fall term and only as required in the winter term. Scheduled lectures are outlined below (but subject to change as required). Final dates/times for each lecture will be posted on the course Avenue to Learn (A2L) site.

Laboratories: Mondays/Wednesdays, 11:30 – 14:30. The lab. period in the schedule represents mostly “open times” to ensure that students have a common time during which they can work on their projects, hold team meetings, and engage in other project activities. At the beginning of the fall and winter terms, the lab. periods will also be used for facilitated project brainstorming sessions, team meetings with Dr. Churchill on project economic analysis, and for progress report presentations. These items and their dates are enumerated below in the course schedule and will be posted on A2L. Students are required to keep these times clear on their calendars.

Typically, students in MATLS 4Z06 make use of the analytical facilities located in the MATLS department, the Brockhouse Institute for Materials Research (BIMR), the Centre for Automotive Materials and Corrosion (CAMC), the Canadian Centre for Electron Microscopy (CCEM), and/or facilities associated with their industrial sponsor in order to fulfil their project requirements. Students must pre-book the use of all tools and instruments. Note that student use is not limited to the laboratory period; they are able (and encouraged) to reserve the facilities anytime Monday-to-Friday during working hours to perform their research. For specific details related to laboratory use during COVID-19, please refer to the “Use of Laboratory Facilities” on page two.

Learning Outcomes

By the end of this course, the student should be able to:

1. Apply specialized engineering-based knowledge to identify, formulate, analyse and solve complex open-ended engineering problems related to materials or materials processing design in manufacturing or engineering services;
2. Select and apply appropriate analytical techniques, resources and modern engineering tools to the solution of open-ended problems with an understanding of their associated limitations;
3. Work effectively as a member of a team in terms of the quality of the work produced, the sharing of project responsibilities, and inter-personal relationships;
4. Effectively and efficiently communicate, both orally and in written forms, complex engineering concepts;
5. Apply sustainability principles in the project decision making process;
6. Apply detailed economic analyses to evaluate the viability of an engineering solution.
7. Demonstrate an ability to conduct literature reviews and identify standards relevant to a design project.

Course Website: MATLS 4Z06A/B will use an Avenue to Learn (A2L) site which students can access via their MacID and password. The course A2L site is an important means of communication between the co-ordinators and the class and should be consulted regularly. Course announcements (including important due dates), lecture schedules, lecture notes and other important course information will be posted on the MATLS 4Z06 site. Students are reminded that they are solely responsible for keeping up to date with all course announcements, instructional materials and due dates, including postings on the course A2L site. Students should inform the course co-ordinators if they encounter problems with the course A2L site.

Use of Laboratory Facilities: It is required of each MATLS 4Z06 student that they conform to the safety regulations of and any training requirements associated with their use of laboratory facilities either internal or external to McMaster University. Violations of lab safety or training protocols will not be tolerated and may result in students being excluded from the use of lab facilities, along with an accompanying academic penalty. The training documents for the Undergraduate materials laboratories located in JHE can be found at <http://sop.mcmaster.ca/>. SOPs for other facilities should be requested from the facility contact-person.

COVID-19 “on campus” plan: For the 2021-2022 academic year, please remember the University has instituted strict procedures pertaining to on-campus activities. To that end, please note:

1. The University has developed a short COVID-19 safety course that must be completed prior to any student presence on campus.
2. The Department of Materials Science and Engineering, CAMC, and the CCEM have all developed Standard Operating Procedures and/or videos pertaining to laboratory use during COVID-19 that must be followed by undergraduate students at all times. These SOPs/videos, with links available on A2L, must be reviewed prior to any student presence in these facilities. These SOPs must be followed at all times to ensure that student access continues to be authorized.
3. Your group must sign and return the 4Z06 COVID-19 “checklist” before starting any on-campus activities.

Important Dates: The following are the due dates for major coursework components. Students should note that the below due dates are subject to minor alterations, except in the case of the fall semester progress report, the final project poster presentation and the final project report which will be due on the final day of classes in their respective semesters. All coursework is due by 17:30 on its assigned due date to the appropriate A2L drop box. It is the student’s responsibility to update themselves to any alterations in the due dates for coursework via in-class announcements or the course A2L site.

Item	Date
Project Ballots Due + Ideas Summary	Sunday, Sept. 12, 2021
Project Assignments Provided to Students*	Wednesday, Sept. 15, 2021
Self-Reflection #1**	Wednesday, Sept. 22, 2021
Project Proposal	Wednesday, Sept. 29, 2021
October Progress Presentation	Mon/Wed, Oct. 25 & 27, 2021
Interim Design Brief #1 + Peer Evaluations**	Thursday, Oct. 28 th , 2021
Self-Reflection #2**	Wednesday, Dec. 1, 2021
Interim Design Brief #2 + Peer Evaluations**	Wednesday, Dec. 8, 2021
Group Plan for Winter Term	Friday, Jan. 14, 2022
Group Plan for Winter Term Evaluated*	Monday, Jan. 17, 2022
February Progress Presentation + Peer Evaluations**	Mon/Wed, Feb. 14 & 16, 2022
Self-Reflection #3**	Wednesday, March 23, 2022
Final Project Video Upload	TBD
Final Project Presentations	Mon/Wed, Apr. 4 & 6, 2022
McMaster Engineering Capstone Exposition	Tuesday, April 12, 2022
Final Design Report + Peer Evaluations**	Thursday, April 14, 2022

* The project assignments are a deliverable by the course co-ordinators and this date is included in the above list as it is an important course milestone.

**The Self-reflection and Peer evaluations are mandatory elements. You cannot pass the course without completing these activities.

Texts: There are no required texts for MATLS 4Z06. However, the following resources are recommended for consultation concerning various aspects of MATLS 4Z06:

- H.F. Hoffman, *The Engineering Capstone Course*, Springer, ISBN 978-3-319-05897-9 (this can be rented as an e-book from the Springer website).
- G. Blake and R.W. Bly, *The Elements of Technical Writing*, Pearson, ISBN-13 978-0020130857 (this book is available on amazon.ca for less than \$20).
- D.F. Beer and D.A. McMurrey, *A Guide to Writing as an Engineer*, Wiley, ISBN-13 978-1118300275 (this book is available on amazon.ca as a Kindle edition for less than \$40 with paperback copies being more expensive)

Project Teams

Project teams will normally comprise four (4) students who will form their own project team. Project teams of three (3) students will be allowed under exceptional circumstances after discussion with, and permission from, the course co-ordinators. Teams comprising five (5) or more students will not be permitted. Students who cannot find a project team will be assigned a team by the course co-ordinators.

Each four-person team will assign specific roles to each member as follows:

1. Team Lead – responsible for the general organization and management of the project and will be the primary point of contact between the project team and course co-ordinators;
2. Communications Lead – responsible for ensuring the team communicates its progress effectively, both internally and externally to the team;
3. Safety Lead – responsible for ensuring that all team members are working in a safe and secure manner, including the provision/performance of appropriate training and PPE;
4. Business and Sustainability Lead – ensuring that the team addresses the economic, social and environmental impacts and practical application of its work.

The assignment of team members to each role should be included in both the Ideas Summary and the Project Proposal Document.

Students should note that the assignment of these roles does not mean that other members of the team have no responsibilities in these areas. All team members should be involved in and contribute significantly to all the project activities. However, the assigned lead should exercise leadership in their assigned area and ensure that all team members are aware of the need to address the specific needs of each area. It should be further noted that we have not asked you to assign a technical lead as it is assumed that all team members will contribute equally to the technical content of the project.

Project Selection

Project descriptions will be posted on the MATLS 4Z06 A2L website and will be discussed during one of the course lectures. Student teams will be provided a ballot on A2L to indicate their first, second and third project preference choices, which will be due to the appropriate A2L drop box on the assigned due date. Along with the project ballot, students will also submit a one-page summary of their ideas concerning their first choice project, which may be used to decide on final project allocations at the discretion of the course co-ordinators. *Students should be aware that, if a particular project is in high demand, they may not be assigned to their first project preference.* In such cases, project assignments will be made at the discretion of the course co-ordinators on the basis of their submitted first choice ideas document and their desired second or third project preferences.

Students are also encouraged to develop their own projects for MATLS 4Z06 provided that they have a significant materials-centric design component. Potential projects should be submitted for discussion and approval by the course instructors before September 7th, 2021. In such cases, students will be obligated to develop a project scope and objectives for approval by the course co-ordinators.

Course Lectures and Student Presentations:

Course lectures will be held over the first and second term on a scheduled basis, with the majority of the lectures being held in the first half of the fall semester. Students will be informed of upcoming lectures in-class and on the course A2L website. A tentative schedule is as follows:

Lecture Topic	Date
Introduction to MATLS 4Z06	September 7, 2021
Project Descriptions	September 8, 2021 (lab session)
Project Planning inc. Analytical and Software Tools	September 13, 2021 (lab session)
What is a Reflection?	September 14, 2021
Project Brainstorming Tutorials	September 15, 2021 (lab session)
Library/Thinkspace Overview (Ms. K Harding)	September 21, 2021
Proposal Writing Tutorials	September 22, 2021 (lab session)
Health and Safety Overview (Ms. L. Allan)	September 28, 2021
Report Writing Toolbox Tutorial	October 5, 2021
Fall Progress Report Presentations	October 25 and 27, 2021 (lab session)
Welcome back; Hazards/Risk Assessment Tutorial	January 11, 2022
Economic & Sustainability Analysis Discussions (Prof. C. Churchill)	The Second Week in January
Winter Progress Report Presentations	February 14&16, 2022 (lab sessions)
Final Project Presentation	April 4&6, 2022 (lab sessions)
McMaster Engineering Capstone Exposition	Tuesday, April 12 th – all day event

Course Assessment and Details of Course Elements

The following mark distribution will be used for MATLS 4Z06A/B:

- Sept. Proposal: 5%
- Oct. Design Brief: 15%
- Oct. Presentation: 9%
- Dec. Design Brief: 15%
- Group Plan for Winter: 5%
- Feb. Presentation: 9%
- April Presentation: 5%
- April Mac Eng. Expo: 5%
- April Report: 27.5%
- Self-Reflections: 4.5%

You should note that 50% of the final grade will be assigned in the Fall semester. It is, therefore, essential that project teams get off to a quick start and achieve substantial progress over the term. In assessing the performance of each group, the course instructors and the project mentors will be looking not just at the project team's success in completing the project deliverables but also at their ability to work effectively as a team.

Unless otherwise noted, all written coursework and peer evaluations are due by 17:30 on the designated due date and must be submitted to the appropriate A2L assignment drop box. All coursework will be marked on technical content and quality of analysis, organization, spelling, grammar and clarity of language. Details concerning the requirements for each major course element are provided below. Note that all documents must use 1" margins, line spacing of 1.5, 12 pt Times New Roman font for text, and 14 pt. font for Headings. All text must be black, and all figures/tables must be referenced from within the text.

Oral Presentations

There are three presentations scheduled for this course – October (7 slides, 7 min.), February (10-12 slides, 10-12 min.), and April (12-15 slides, 12-15 min). It is expected that each group member will speak during *at least* two of the three presentations. Any members who are not presenting are still expected to be present and available to answer questions. Groups may opt to have every group member present in all three presentations.

Ideas Summary

The Ideas Summary will comprise a one-page document, inclusive of figures and tables, in which the team will present their ideas for carrying out a specific capstone project, and why they are best-suited to this activity. In this document they will also identify the roles of each team member.

Project Proposal Report

The project proposal report will comprise a four page document, exclusive of figures, tables, and references in which the project team will provide a well-defined project objective statement, identify and describe the major project milestones (within the context of appropriate background research), identify Team Roles, Project Budget and Project Timeline. In addition to the four pages, students must include a Team Charter, and Budget Request Form. The project timeline must be presented in the form of a Gantt chart. We suggest using Trello to make the Gantt chart. In addition to the course deliverables (design briefs, presentations, etc.), major project milestones such as literature survey, first prototype, final design, etc. must be included in the Gantt Chart. However, do not include a week-by-week schedule of lab activities. We also suggest using "Tasks" in MS Teams to plan your work.

October Design Brief and Presentation

This report will comprise of a summary of the first phase of project development. The report is limited to six pages of text, exclusive of tables, figures, and references. The report should not repeat material that was presented in the project proposal report but should elaborate on the methodology and progress to date. Project teams should also outline any changes in strategy or approach considering further development of the project. The focus of this report should be to convince the course instructors and your project mentor that the project team has developed a robust understanding of the project and has the analytical tools and background knowledge to complete it successfully. Additional details about the format of a design brief can be found on the course A2L page.

This report will be accompanied by a presentation in the form of an “elevator pitch”. Project teams will be allowed seven minutes and up to seven PowerPoint slides to make this pitch. Teams should imagine that they are making this presentation to a group of managers at their company and, based on their presentation, the management team will decide whether to continue with the project or cut it. So, a lot depends on these few minutes. The focus of the presentations should be to convey a level of excitement about the project, the confidence the team has that it can be completed successfully (based on evidence, not on hype) and the approach the team will be taking to accomplish their project objectives.

December Design Brief

This report will comprise a summary of project progress since the submission of the October progress report. The report is limited to eight pages of text, exclusive of tables, figures, and references. The December progress report should not contain significant sections of material from previous reports but should refer to them as required. In general, this report will focus on the analysis and interpretation of work conducted by the project group towards their project objectives, presented in a standard engineering report format. It should outline both progress towards your goals as well as any major setbacks or impediments that the team encountered. An updated Gantt chart – assessed versus the Gantt chart provided in the proposal report – is a required report element as is an updated project budget and statement of expenditures-to-date. Any deviations from the previous project schedule and budget should be briefly discussed. It is not expected that project teams provide an economic/sustainability analysis as part of the fall semester report, but it should be noted that teams should give thought to this aspect of their project as it will become a required element during the winter semester.

February Progress Presentation

The February progress presentation will comprise a progress report, delivered orally, focussing on project progress since the fall semester progress report with sufficient background material being available in the presentation for the audience. The winter semester progress presentation will focus on the analysis and interpretation of data acquired by the project group towards their project objectives, as well as a discussion on Risk Assessment. An updated Gantt chart – assessed versus the Gantt chart provided in the fall progress report – is a required element of the mid-year presentation, as is an updated budget and statement of expenditures-to-date. Any deviations from the project schedule or budget presented in the fall semester progress report should be briefly

discussed. It is also expected that project teams will present a preliminary economic and sustainability analysis of their project based on their progress to date.

McMaster Engineering Capstone Exposition

The Faculty of Engineering will be holding a faculty-wide Capstone Exposition, tentatively scheduled for April 12, 2022 for all students participating in a departmental capstone course. All MATLS 4Z06 project teams will participate in this Capstone Exposition, during which time they can interact with fellow students from other departments and discuss their projects with Faculty members – some of whom will be marking their Exhibit and asking questions of students – and their industrial sponsors. Guidelines for the Exhibit and logistics of the day will be communicated to the project teams through A2L. A 3-5 min project video will likely be required. Note that it is not yet certain if this event will be in-person or virtual, given the current COVID-19 situation.

Final Project Report and Presentation

The final project report will discuss the results, present a coherent analysis and provide global conclusions and recommended remedies/designs stemming from the project within the context of the project objective. It is expected that a detailed analysis of the data acquired during the project will be used to support the project conclusions and recommendations. It is also expected that the team will present a rigorous economic and sustainability analysis of their project based on their data. The team must provide their final budget statement with a brief comparison to the initial budget, and a discussion of deviations as compared against the Design Brief #2 budget.

The report must include a max four-page executive summary, exclusive of tables and figures, that should be written at the level of a Department Manager or Company Director. The main report has no set page length; however brevity is appreciated and is part of effective communication. Please note that the executive summary represents approx. 40% of the final report mark.

Although the final report should have sufficient background information to inform the reader of the work previously presented in the fall semester and winter semester progress presentation, it is expected that the report will focus on project deliverables as this is not a progress report.

The April project presentation represents the final project oral report. It should focus on the Project Design, comparing the outcomes against the intended deliverables and screening criteria; analysis and interpretation of acquired data; as well as a presentation on the final costs. It is also expected that project teams will present their project's economic and sustainability analysis as part of the proposed design solution.

Self-Reflections

“The role of reflection is to generate learning through connecting theory to practice; deepen learning by challenging students’ thinking; document learning by producing tangible expressions of new understanding gained through integrating experience and disciplinary knowledge”.
-Ash & Clayton, 2009

As part of the course, students are required to complete three (3) individual self-reflections to articulate and reflect on your application of specialized engineering-based knowledge to your

capstone projects. These are required course elements that must be satisfactorily completed to pass the course. You will be provided with a rubric that will be used to mark each reflection assignment so that you are aware of the criteria that must be met. Each reflection should be 350 – 550 words in length. You are encouraged to do a free write / first draft that includes all your ideas and then edit your writing so that you succinctly address the reflection prompt within the word limit. Your ability to articulate what and how you applied engineering knowledge learning will help you better communicate your skills and competencies to future employers.

Peer Evaluations

All MATLS 4Z06 students must submit an individual confidential peer evaluation form to the appropriate A2L drop box as part of their fall progress presentation and report, fall semester report, winter semester progress presentation and final project report submissions. These are required course elements that must be satisfactorily completed to pass the course. All peer evaluations must be submitted on the due date. Peer evaluation forms will be available from the course A2L website. Anonymous or peer evaluations submitted on behalf of other students will not be accepted.

The peer evaluation form will ask the following question: “You and your team members comprise a small engineering consulting company, whereby the fees charged to the client are split amongst the partners according to the billable hours (effort) a particular partner devotes to a project. Your company has invoiced your client \$100,000 for the work performed on your MATLS 4Z06 project during the present project phase. How would you divide the fee amongst your partners?” The peer evaluations may be used to weigh the marks assigned to an individual group member for particular course elements; however, all mark weighting decisions will be at the discretion of the course co-ordinators. Students who don’t complete a fair share of the work may see their grade reduced by up to 50%

Policy on Late Submission of Coursework

All coursework must be submitted on time or deductions will be made without valid and documented reasons. All late penalties will be assessed by the course co-ordinators. The following penalties will apply:

- Reports and Presentations: a deduction of 50% per day to a minimum of zero credit.

Appeal of Marks:

All queries or appeals of marks received on course work should be directed to Dr. Phillion.

Important Notices to Students from the University Administration

Policy Reminder on Academic Integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. The academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty**

Academic dishonesty is to knowingly acting 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. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>.

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

AUTHENTICITY/PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster’s use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/ software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities.

These expectations are described in the [Code of Student Rights & Responsibilities](#) (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that **interfere** with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact [Student Accessibility Services](#) (SAS) at 905-525-9140 ext. 28652 or sas.mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University’s [Academic Accommodation of Students with Disabilities](#) policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”.

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.