McMaster University | ENGINEERING Materials Science & Engineering

We recognize and acknowledge that McMaster University meets and learns on the traditional territories of the Mississauga and Haudenosaunee nations, and within the lands protected by the "Dish With One Spoon" wampum, an agreement amongst all allied Nations to peaceably share and care for the resources around the Great Lakes.

MATLS 4B03/IBEHS 4M03 & MATLS 6B03/BIOMED 6BB3
BIOMATERIALS AND TISSUE ENGINEERING
2025 Fall Term

Instructor: Dr. Bryan Lee	**e-mail:** leebej@mcmaster.ca	**Office:** ETB 403
T. A.: Blanca Keohan	**e-mail:** keohanb@mcmaster.ca	
T. A.: Erica Anderson	**e-mail:** andere32@mcmaster.ca	
T. A.: Brithney Ortiz Galvis	**e-mail:** ortizgab@mcmaster.ca	

Course Details

Lectures
Tuesday (12:30-2:20): PC 155
Thursday (12:30-1:20): PC 155

Course Description

Introduction to biomaterials. Includes material-tissue interactions, techniques for biomaterials testing, and characterization. Applications of biomaterials and the clinical context of their use will be introduced.

Prerequisite(s): Registration in Level III or above in Materials Engineering; or Registration in Level IV or above in the Integrated Biomedical Engineering and Health Sciences (IBEHS) program.

Antirequisite(s): N/A

Course and Learning Objectives

Learning Objectives

LO.01	Explain the need for targeted biomaterial and/or tissue engineering solutions considering the specific material-tissue interactions that occur in the body.
LO.02	Demonstrate the key considerations in the conceptualization and design of a biomaterial through visual schematics.

LO.03	Develop a characterization and testing plan for a biomaterial-based solution considering the capabilities and limitations of existing materials characterization and biological testing methods.
LO.04	Consider the impact of biomaterials design on different stakeholders considering equity, diversity, & inclusion (EDI) as well as other economic, environmental and social factors.
LO.05	Critically analyze and reflect on biomaterials-related reading and lecture material.

Course Communication

Office hours:

Dr. Lee: Mondays 12:30-1:20 PM and Tuesdays 3:00-4:00 PM (hybrid – in ETB 403 or on the course Teams). If these do not work for you request an appointment via email.

Teaching Assistants: Set-up Appointments via email.

Electronic communication:

If you have a question outside scheduled class hours, email is the best method to contact the instructor or the TAs. Please send all e-mails using your McMaster e-mail address and include "MATLS 4B03" in the subject line. Every attempt will be made to reply within 24 hours (excluding weekends).

Mental Wellness

Your well-being throughout this course and your time at McMaster University is a top priority. If you are struggling, please remember that you are not alone and you can reach out to McMaster's Student Wellness Centre (905-525-9140 ext. 27700; wellness@mcmaster.ca). As your instructor, I am also here to support you and to help you connect to the Student Wellness Centre or other resources if you wish so.

Materials & Fees

Required Materials/Resources

The recommended (but not mandatory) textbook for this course is "Biomaterials Science: An Introduction to Materials in Medicine" by W. Wagner, S. Sakiyama-Elbert, G. Zhang, and M. Yaszemski (Elsevier, 2020). You can borrow a copy or get a PDF version free of charge through the McMaster University Library.

Course Overview and Assessment

Topics

Note: This is a course under development by the instructor; subject matter and evaluation methods are subject to change at the discretion of the instructor. At certain points in the course, the instructor may modify elements of the course and will notify students accordingly (in class and on Avenue).

Week	Topic	Deliverables
September 2 - September 5	Welcome and course overview Introduction to biomaterials & Material Selection	
September 8 - September 12	Material-tissue interactions	Quiz 1
September 15 - September 19	Biomaterials Properties and Characterization	Quiz 2 Groups Finalized
September 22 - September 26	In vitro & in vivo assessments	Quiz 3
September 29 - October 3	Day for Truth and Reconciliation	Consultation #1
October 6 - October 10	Sterilization and How the host affects a biomaterial	Quiz 4 Literature Review
October 13 - October 17	***Reading week – No lecture***	
October 20 - October 24	Scaffolds & Tissue engineering	Quiz 5
October 27 - October 31	Biodegradable Materials & Surface Modification	Quiz 6
November 3 - November 7	3D Printing and Bioprinting	Quiz 7
November 10 - November 14	EDI in Biomaterials	Consultation #2
November 17 - November 21	Bioinspiration & Intersection of Arts	Quiz 8 Biomaterial proposal report
November 24 - November 28	Student presentations	Biomaterial proposal presentations
December 1 - December 4	Student presentations	Biomaterial proposal presentations
December 6 – December 19	Exam Period	Final Exam

Evaluation

Assessment	4B03/4M03	6B03/6BB3
1) Quizzes (Best 5 of 8 Count)	30%	25%
2) Biomaterial proposal	37.5%	35%
Literature Review	7.5%	7.5%
Final Report	15%	15%
Final Presentation	12.5%	12.5%
Peer Evaluation	2.5%	--
3) Final exam	32.5%	20%
4) Analysis and Justification of Experimental Plan	--	20%
Report		10%
Presentation		10%

More detailed information about each assessment will be provided in class and on Avenue, but here below you can find a brief overview for each.

1. Quizzes

These short assessments will occur at the start of each Tuesday lecture starting September 9 (with some exceptions). These quizzes will assess your knowledge from the previous week's lecture material. There will be 8 quizzes throughout the term, and your best 5 out of 8 quizzes will count toward your grade. Quizzes will be in-person or via photographed online submissions in the event of remote learning.

2. Biomaterial Proposal

In this assessment, you will be asked to work in groups of 3-4 to propose a biomaterial for an application. You will have to identify the key interactions between the biomaterial and the body and summarize them through a schematic. You will have to identify the requirements in terms of biocompatibility and other properties important to your specific application, justify your choices, and describe everything in a report.

Summary of deliverables for the Biomaterial Proposal:

- Literature Review
- Written report
- Presentation
- Peer Evaluation (4B03 only)

3. Final Exam

A final exam will be scheduled through the registrar's office at the end of term during the examination period.

4. Analysis and Justification of Experimental Plan

Students at 600-level will complete an extra report and oral presentation called the "Analysis and Justification of Experimental Plan". Students will be asked to identify the rationale for an experimental technique that is used in biomaterials/biomedical research.

Important Notices to Students from the University Administration

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. **It is your responsibility to understand what constitutes academic dishonesty.**

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. 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:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- 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., online 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.

GENERATIVE AI: USE PROHIBITED

Students are not permitted to use generative AI in this course. In alignment with McMaster academic integrity policy, it "shall be an offence knowingly to … submit academic work for assessment that was purchased or acquired from another source". This includes work created by generative AI tools. Also state in the policy is the following, "Contract Cheating is the act of "outsourcing of student work to third parties" (Lancaster & Clarke, 2016, p. 639) with or without payment." Using Generative AI tools is a form of contract cheating. Charges of academic dishonesty will be brought forward to the Office of Academic Integrity.

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.

PEDAGOGICAL STUDY

For the study of engineering education, you may be asked to provide information or feedback about course components. When possible, the instructor will share these results with participants.