



Faculty of Engineering and Applied Science

## CHEE 874 – TISSUE ENGINEERING

### Course Syllabus – Winter 2022

This is your course syllabus. Please download the file and keep it for future reference.

#### LAND ACKNOWLEDGEMENT

Queen's University is situated on traditional Anishinaabe and Haudenosaunee Territory.  
See: <http://www.queensu.ca/encyclopedia/t/traditional-territories>

#### INCLUSIVITY STATEMENT

Queen's students, faculty, and staff come from every imaginable background – small towns and suburbs, urban high rises, Indigenous communities, and from more than 100 countries around the world. You belong here: <https://www.queensu.ca/inclusive/>.

### COURSE INSTRUCTOR

#### Lindsay Fitzpatrick, PhD

Department of Chemical Engineering  
Queen's University

E-mail: [Lindsay.fitzpatrick@queensu.ca](mailto:Lindsay.fitzpatrick@queensu.ca)

Office hours: By appointment



# CHEE 874

## COURSE DESCRIPTION

CHEE 874 is designed as a graduate level introductory course in tissue engineering: the interdisciplinary field that encompasses biology, chemistry, medical sciences and engineering to design and fabricate living systems to replace damaged or diseased tissues and organs. Topics to be discussed include: tissue anatomy, basic cell biology, common methods for generating engineered tissues, tissue engineering scaffolds, cell sources and differentiation, design considerations, diffusion and mass transfer limitations, effects of external stimuli, bioreactors, methods used to evaluate the engineered product(s), and implantation.

## COURSE STRUCTURE AND ACTIVITIES

One three-hour session per week. Sessions will contain a combination of lecture, student presentations, journal club presentations and discussion.

## COURSE EVALUATION

### ASSESSMENT WEIGHTING

Assessment Tool		Weight
Journal Club	Week 3, 5, 7, 9, 11	10%
<b>Peer Teaching Presentations</b>		
Assignment 1: Fields of Tissue Engineering	Week 6	25%
Assignment 2: Advanced Methods in Tissue Engineering	Week 10	25%
Letter of Intent	Week 9	10%
Research Proposal	Week 12	25%
Participation	Ongoing	5%
		100%

### ASSESSMENT DESCRIPTIONS

#### Journal Club

Journal club presentation are intended to teach students to critically read scientific manuscripts and build experience communicating scientific information in a condensed format. Each student will lead one journal club with a 10-minute presentation that provides a critical summary of the paper and then lead the discussion. All students are responsible for reading the journal club papers before the meeting, so they can actively participate in the discussion. Journal articles will be assigned 7 days before the meeting to provide everyone with enough time to critically review the article, and for the presenting student to prepare their slides. Slides for the

presentation should be posted in the OnQ assignment folder by 9am on the day of the journal club. Journal club presentations will be graded according to the rubric posted on OnQ.

### Presentations

There are two peer teaching assignments in this course. These assignments are design to provide students experience in (1) self-directed learning on an specific area of tissue engineering (Assignment #1; e.g. tissue engineering vascular grafts or liver tissue engineering) and advanced methods and strategies in tissue engineering (Assignment #2; 3D bioprinting or RNA-Seq) using a variety of resources, including published literature, manufacturer protocols and/or patents; and (2) peer-to-peer teaching, by preparing lecture slides and teaching a 30 minute lecture on their selected topics.

### Letter of Intent (LOI) and Research Proposal

Students will prepare an original NSERC-style research proposal in field of tissue engineering. To aid in the preparation of the final research proposal, students will submit an LOI (1 page max) in Week 9 to receive preliminary feedback on their proposal. The Research Proposal (5 page max) will be submitted in Week 12 and graded according to the rubric posted on OnQ.

### Participation

Students will receive a score that reflects their preparedness and participation in discussion during journal clubs, student presentations and lectures. This goal of this assessment is to motivate students to be engaged in the course and complete the reading assignments.

## GRADING

All assessments in this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to the established [Grade Point Index](#).

### Feedback on Assessments

The course instructor will provide feedback on graded activities. You can expect feedback on your assessments within two weeks of the due date.

### Accessing Your Final Grade

Your final grades will show on SOLUS. Official transcripts showing final grades will be available on the Official Grade Release Date. Please note that in official transcripts, a mark of IN (incomplete) is considered a grade, and your transcript is released with this grade.

## COURSE MATERIALS

All other course material is accessible via OnQ.

### Suggested Time Commitment

This course represents a study period of one semester spanning 12 weeks. Learners can expect to invest on average 7-9 hours per week in this course. Learners who adhere to a pre-determined study schedule are more likely to successfully complete the course.

## TENTATIVE COURSE SCHEDULE

Week	Topic	Assigned Reading	Deliverables
1	Introduction to Tissue Engineering	Lanza – Chapter 1: Tissue Engineering: Current Status and Future Prospectives	
2	Review of Molecular Biology of the Cell Common Molecular Biology Methods Used in Tissue Engineering	Lanza – Chapter 4: Molecular Biology of the Cell	
3	Cell-Matrix Interactions Organization of Tissues and Organs	Lanza – Chapter 7: Matrix Molecules and Their Ligands	<i>Journal Club #1</i>
4	Cell Sources for Tissue Engineering	Lanza – Chapter 8: Morphogenesis & TE Liu et al. Advances in Pluripotent Stem Cells: History, Mechanisms, Technologies and Applications. <i>Stem Cell Rev and Rep</i> (2020) 16:3-32.	
5	Scaffolds for Tissue Engineering	Lanza – Chapter 18: Biodegradable Polymers Lanza – Chapter 17: Polymer Scaffold Fabrication	<i>Journal Club #2</i>
<b>6</b>	<b><i>Assignment #1: Fields of tissue engineering</i></b>	<b><i>30 min presentations w/ 2-5 min Q&amp;A</i></b>	<i>Assignment #1</i>
7	Bioreactors – In vitro	Lanza – Chapter 10: Engineering functional tissues: in vitro culture parameters Lanza – Chapter 11: Principles of bioreactor design for tissue engineering	<i>Journal Club #3</i>
8	Bioreactors – In vivo	Lanza – Chapter 15: In vivo engineering of organs	
9	Immunology for Tissue Engineering	Lanza – Chapter 20: Targeting Host Immune Response for TE Lanza – Chapter 22: Immunoisolation Devices	<i>Journal Club #4</i> <i>Letter of Intent</i>
<b>10</b>	<b><i>Assignment #2 - Advanced Methods or Strategies in Tissue Engineering</i></b>	<b><i>30 min presentations w/ 2-5 min Q&amp;A</i></b>	<i>Assignment #2</i>
11	Regulation and Commercialization	Lanza – Chapter 84: Regulatory Process Lanza – Chapter 85: Business Issues	<i>Journal Club #5</i>
12	Ethics and Tissue Engineering	Lanza – Chapter 86: Ethical Issues Ethics Case Study	<i>Research Proposal</i>

# COURSE COMMUNICATION

## NETIQUETTE

In this course, you may be expected to communicate with your peers and the teaching team through electronic communication. You are expected to use the utmost respect in your dealings with your colleagues or when participating in activities, discussions, and online communication.

Following is a list of netiquette guidelines. Please read them carefully and use them to guide your online communication in this course and beyond.

1. Make a personal commitment to learn about, understand, and support your peers.
2. Assume the best of others and expect the best of them.
3. Acknowledge the impact of oppression on the lives of other people and make sure your writing is respectful and inclusive.
4. Recognize and value the experiences, abilities, and knowledge each person brings.
5. Pay close attention to what your peers write before you respond. Think through and re-read your writings before you post or send them to others.
6. It's alright to disagree with ideas, but do not make personal attacks.
7. Be open to be challenged or confronted on your ideas and challenge others with the intent of facilitating growth. Do not demean or embarrass others.
8. Encourage others to develop and share their ideas.

## QUESTIONS ABOUT COURSE MATERIAL

Questions or comments regarding the course material that can be of benefit to other students should be posted in the Q&A forum on the class website. The instructor and students are encouraged to answer these questions directly in the discussion forum for the benefit of everyone in the course.

## COURSE ANNOUNCEMENTS

The instructor will routinely post course news in the Announcements section on the main course homepage on OnQ. Please sign up to be automatically notified by email when the instructor posts new information in the Announcements section. Instructions on how to modify your notifications are found in the **Begin Here** section of the onQ course site.

## OFFICE HOURS

In addition to interaction in the Q&A discussion forums, you will have the opportunity to interact with the instructor through office hours, by appointment.

## CONFIDENTIAL MATTERS

If you have a confidential matter you would like to discuss with your instructor, their contact details are on the first page of this document. Expect email replies within 48 hours.

# STANDARD FEAS INFORMATION

## COURSE POLICIES

Please review the following policies concerning copyright, academic integrity, absences and academic accommodations:

### COPYRIGHT

Course materials created by the course instructor, including all slides, presentations, synchronous and asynchronous course recordings, handouts, tests, exams, and other similar course materials, are the intellectual property of the instructor. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate an instructor's course materials or to provide an instructor's course materials to anyone else for distribution, posting, sale or other means of dissemination, without the instructor's **express consent**. A student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face adverse legal consequences for infringement of intellectual property rights and, with respect to recordings, potentially privacy violations of other students.

### ACADEMIC INTEGRITY

As an engineering student, you have made a decision to join us in the profession of engineering, a long-respected profession with high standards of behaviour. As future engineers, we expect you to behave with integrity at all times. Please note that Engineers have a duty to:

- Act at all times with devotion to the high ideals of personal honour and professional integrity.
- Give proper credit for engineering work

The standard of behaviour expected of professional engineers is explained in the [Professional Engineers Ontario Code of Ethics](#). Information on policies concerning academic integrity is available in the [Queen's University Code of Conduct](#), in the [Senate Academic Integrity Policy Statement](#), on the [Faculty of Engineering and Applied Science website](#), and from your instructor.

Departures from academic integrity include plagiarism, use of unauthorized materials or services, facilitation, forgery, falsification, unauthorized use of intellectual property, and collaboration, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the University.

In the case of online or remotely proctored exams, impersonating another student, copying from another student, making information available to another student about the exam questions or possible answers, posting materials to online services, communicating with another person during an exam or about an exam during the exam window, or accessing unauthorized materials, including internet sources and using unauthorized materials, including smart devices, are actions in contravention of academic integrity.

### LATE POLICY

Any applicable late penalties are described in the details for each assessment. In the event of extenuating circumstances, you must follow the policies for requesting an academic consideration (please see below). Note that unacceptable reasons include extra-curricular activities, travel plans, being generally behind on schoolwork,

etc. In the absence of an approved consideration request, the normal late penalty will apply as described in the assignment or any course/departmental policies.

## **ABSENCES (ACADEMIC CONSIDERATIONS) AND ACADEMIC ACCOMMODATIONS**

For absences and academic accommodations please review the information on the [FEAS website](#).

## **ACADEMIC AND STUDENT SUPPORT**

Queen's has a robust set of supports available to you including the [Library](#), [Student Academic Success Services \(Learning Strategies and Writing Centre\)](#), and [Career Services](#). Learners are encouraged to visit the Faculty of Engineering and Applied Science [Current Students](#) web portal for information about various other policies such as academic advisors, registration, student exchanges, awards and scholarships, etc.

### **INDIVIDUAL NEEDS AND SUPPORT**

If you have a disability or health-related condition that may require academic accommodations, please approach the [Queen's Accessibility Services](#). The staff at Accessibility Services are available by appointment to develop individualized accommodation plans, provide referrals, and assist with advocacy. The sooner you let us know your needs, the better we can assist you in achieving your learning goals. For questions or assistance with requesting Academic Consideration or Accommodation, contact the FEAS Academic Accommodation Coordinator at [engineering.aac@queensu.ca](mailto:engineering.aac@queensu.ca)

Every effort has been made to provide course materials that are accessible. For further information on accessibility compliance of the educational technologies used in this course, please consult the links below.

<b>EDUCATIONAL TECHNOLOGY</b> <b>(MODIFY THIS TABLE TO INCLUDE TOOLS USED IN YOUR COURSE)</b>	<b>ACCESSIBILITY COMPLIANCE INFORMATION</b>
onQ (Brightspace Learning Management System by D2L)	<a href="https://www.d2l.com/accessibility/standards/">https://www.d2l.com/accessibility/standards/</a>
MS-Teams	<a href="https://support.microsoft.com/en-us/office/accessibility-support-for-microsoft-teams-d12ee53f-d15f-445e-be8d-f0ba2c5ee68f">https://support.microsoft.com/en-us/office/accessibility-support-for-microsoft-teams-d12ee53f-d15f-445e-be8d-f0ba2c5ee68f</a>
Zoom	<a href="https://zoom.us/accessibility">https://zoom.us/accessibility</a>

If you find any element of this course difficult to access, please contact [engineering.aac@queensu.ca](mailto:engineering.aac@queensu.ca)

### **RELIGIOUS OBSERVANCE**

Students in need of accommodation for religious observance are asked to speak to their professor within a week of receiving their syllabus. Note also that alternative assignments are considered a "reasonable accommodation" under the Ontario Human Rights Code. Students with questions about their rights and responsibilities regarding religious accommodation should contact the Chaplain via [Chaplain@queensu.ca](mailto:Chaplain@queensu.ca).

## **TECHNICAL SUPPORT**

Some basic comfort level with basic hardware and software skills are required for this course. If you require technical assistance, please contact [Technical Support](#).

## **SUPPORTIVE PERSONAL COUNSELLING**

If at any time you find yourself feeling overwhelmed, anxious, sad, lonely, or distressed, consider confidential supportive counselling offered by the [embedded counselors](#) and by Student Wellness Services <https://www.queensu.ca/studentwellness/>



