



Faculty of Engineering and Applied Science

## CHEE 229 – CELL BASED ENGINEERING PRINCIPLES

### Course Syllabus – Fall 2021

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/>.

### TEACHING TEAM

#### COURSE INSTRUCTOR

##### Laura Wells, PhD

Department of Chemical Engineering  
Queen's University

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Office hours: By appointment \*Zoom only



#### TEACHING ASSISTANTS

##### Sumaiya Karim

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# CHEE 229 (F 3-0.75-0.25 4.0)

## COURSE DESCRIPTION<sup>1</sup>

Introduction to the Biological, Biochemical and Life Science principles of cell/enzyme based engineering systems and processes. The emphasis will be placed on microbial cell culture, but comparisons will be drawn to related systems including viral, plant and animal cell culture as it relates to medicine, industrial practice or the environment.)

PREREQUISITES: APSC 131 and APSC 132; or equivalents or permission of the Department.

EXCLUSION: MICR 221

(0/35/0/13/0) (Mathematics/Natural Sciences/Complementary Studies/Engineering Science/Engineering Design)

This engineering course covers cell-based knowledge and principles important in biochemical and biomedical engineering. The knowledge and skills in this course will prepare students for upper year biochemical and biomedical engineering courses, such as CHEE 342, 340, 440, 484.

## OBJECTIVES AND OUTCOMES

The objective of this course is to develop the application of the knowledge of the metabolic and molecular nature of prokaryotes and eukaryotes to solve problems in medicine, industry and the environment

## COURSE LEARNING OUTCOMES (CLO)

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

CLO	DESCRIPTION	INDICATORS
CLO 1	Identify and explain the major cellular processes in prokaryotes and eukaryotes.	KB Bio (a)
CLO 2	Describe the interrelationships between organisms and their environments.	KB Bio (a)
CLO 3	Identify and describe the relationship between structure and function on a molecular, cellular, and organismal level.	KB Bio (a)
CLO 4	Identify a range of fields where biological systems are being applied to solve engineering problems, and discuss the most recent advances in each field, as well as the strengths and limitations of each approach.	KB Bio (a)
CLO 5	Explain a variety of advanced molecular and cellular biology techniques used for the characterization and manipulation of micro-organisms, with applications in medicine, industry, and the environment.	KB Bio (a)
CLO 6	Demonstrate laboratory knowledge and expertise with microbiological techniques.	IN (c)

<sup>1</sup> Course Author(s): Laura Wells. 1st Edition (initial development): Juliana Ramsay; Queen's University holds a license for the use of the Course Author's Intellectual Property for CHEE 229.

This course develops the following attributes at the 2<sup>nd</sup> year level:

**Knowledge base (KB): Bio (a)** Applies knowledge of cellular processes to engineering problems.

**Investigation (IN): (c)** Synthesize information from investigation, considering sources of uncertainty and limitations to reach substantiated conclusions.

## COURSE EVALUATION

Deliverable	Week or Date	Weight
Quizzes (4 @ 3% each)	Alternate weeks	12
Labs/Answers to questions (6 @ 2% each)	Due 2 weeks after each lab	12
Midterm	Tutorial slot in week 6	26
Final Exam	Exam period	50

Students are expected to complete their work in a timely fashion. The course instructor will provide notification (in lecture and on course website) of due dates and any revisions thereof.

Students must pass the exam component (combined mark on midterm+final) to pass the course, as stated by departmental policies (<http://www.chemeng.queensu.ca/undergraduate-studies/Departmental-Undergraduate-Policies.html>). Only a Casio 991 non-programmable, non-communicating calculator will be allowed during tests and exams.

### ASSESSMENT DESCRIPTIONS

**Quizzes:** There are four quizzes in this course. These quizzes are designed to provide learners with immediate feedback on their knowledge. Quizzes will be completed at the beginning of the last lecture on weeks 2, 4, 8, and 10.

**Labs:** There are six labs in this course. Attendance is mandatory as there are no make-up labs. Students must complete all lab exercises. Students are expected to read lab instructions (posted in advance) before coming to the lab and to bring a copy of instructions to the lab. While students perform laboratory exercises in groups, each individual must work on separate and independent answers to the lab questions. Late reports will not be accepted.

To earn 2% for each lab, you must complete the lab and have made a good effort in answering the required questions. In addition, 10% of the material on the quizzes and exams will be based on the laboratory component. Attendance at the labs will be recorded. To miss a lab, a student must follow FEAS protocols for missing deliverables.

**Qlicker:** this software will engage students by asking questions at the end of each lecture with students answering using a cell phone or computer (or similar device). Participation marks for attending lectures and marks for correctly answering questions will be given when questions are answered DURING the lectures. If students have technical difficulty or access issues, they should contact the instructor immediately.

**Midterm:** There is one midterm in this course and it is closed book. It will be in-person and the date will be posted onto onQ.

**Final exam:** The final exam is closed book. Students must write their exam on the day and time scheduled by the University. You should not schedule vacations, travel, etc. during the exam period. The [Term and Session Dates](#) will indicate the final exam period session dates in each term.

## 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 teaching team will provide feedback on graded activities. You can expect feedback on your Quiz within seven days and your labs during the following lab period (14 days).

### 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

Required Textbook: J. Willey, L. Sherwood, C. Woolverton. 2020. Prescott, Harley and Klein's Microbiology. 11th Edition. McGraw-Hill, Boston, MA. (available for purchase at the bookstore, approx. \$99.95)

Qlicker: Qlicker is accessed at: <https://qlicker.github.io/guide/student.html>

### Other Material

All other course material is accessible via OnQ. All course lecture slides, labs, and tutorials will be posted on the CHEE 229 onQ website.

### Required Calculator

A Casio 991 is required. **ONLY** this type of non-programmable, non-communicating calculator will be allowed during tests and exams.

### Suggested Time Commitment

This course represents a study period of one semester spanning 12 weeks. Learners can expect to invest on average 10-12 hours per week in this course. Learners who adhere to a pre-determined study schedule are more likely to successfully complete the course.

### COURSE STRUCTURE AND ACTIVITIES

3 lecture hours per week, 1 tutorial hour in alternative weeks and three lab hours. Times and locations can be found in SOLUS.

### LABORATORY MANUAL AND SCHEDULE

Download the instructions for each lab from the Chee 229 onQ website. You are required to thoroughly read all lab instructions before coming to the lab.

Lab 1	General Microbiological Techniques
Lab 2	Effect of Antibiotics
Lab 3	Titration of Phage/Transduction
Lab 4	Bacteriological Examination of Water
Lab 5	Enumeration of Microorganisms in Soil Recovery and Purification of Plasmid DNA and the Polymerase Chain Reaction
Lab 6	Assay of Lysozyme Recovery and Purification of Plasmid DNA and the Polymerase Chain Reaction (continued)

### EXPECTATIONS FOR LECTURES, LABS, AND TUTORIALS

Lecture slides will be posted in advance on onQ. Some lectures will include content, examples and problem solutions not contained in the posted slides. **Attendance to all lectures, laboratories and tutorial is mandatory.**

### HOW TO DO WELL IN THIS COURSE

This course covers a large amount of material. Attending all lectures as well as reviewing the assigned reading sections of the textbook, lecture slides, labs and tutorial questions should allow you to excel in the quizzes and exams. If you do not understand certain concepts after review, please ask for clarification, especially during lectures.

### CHEE 229 POLICIES

**Attendance:** Attendance in the lectures and laboratories is mandatory. Concerns or conflicts should be discussed with the course instructors at the earliest possible date.

**Email Policy:** The instructor will respond to emails within two business days.

**Communication after lectures:** The instructor will be available to discuss any issues or concerns about course management or course content through Zoom. The instructor will not be available to discuss in-person after lectures.

**Laboratories:** Students **must** complete all lab exercises. While students perform laboratory exercises in pairs, each individual must work on separate and independent answers to the lab questions, **which should be submitted by 2:30 PM on Wednesday two weeks after the completion of the lab**, hand in at the start of the next lab. **Late reports will not be accepted.**

**Quizzes and Exams:** Attendance at the quizzes, midterm exam, and final exam is mandatory. No cell phones are permitted. If a quiz or midterm is missed for a medical reason (with appropriate documentation), the weight of the final exam may be readjusted to reflect the combined total. The quizzes, midterm, and final will be closed book. Slightly more than 20% of the final exam will be based on material from before the midterm.

**Request for Mark Reassessment:** All work must be written in permanent ink in order to be eligible for mark reassessment. All marking concerns must be submitted within 2 weeks of the initial return date. To be considered for re-evaluation, a mark reassessment request form (found on the course website) must be submitted to the course instructor along with the complete original submission.

## COURSE SCHEDULE

<b>CHEE 229    Module overview</b>
<b>Course outcomes (CLO) - The students should be able to:</b>
<ol style="list-style-type: none"><li>1. Identify and explain the major cellular processes in prokaryotes and eukaryotes</li><li>2. Describe the interrelationships between structure and function on a molecular, cellular, and organismal level.</li><li>3. Describe the interrelationships between organisms and their environments.</li><li>4. Identify a range of fields where biological systems are being applied to solve engineering problems, and discuss the most recent advances in each field, as well as the strengths and limitations of each approach.</li><li>5. Explain a variety of advanced molecular and cellular biology techniques used for the characterization and manipulation of micro-organisms, with applications in medicine, industry, and the environment.</li><li>6. Demonstrate laboratory skills and expertise with microbiological techniques</li></ol>
<b>Students are expected to augment lecture material through reading of associated sections of the textbook, and to practice execution of course principles by completing posted questions</b>

<b>Module</b>	<b>Lecture approach and content</b>	<b>Tutorials, labs, and events</b>	<b>Assessment (CLO, and % of course grade)</b>
<b>Week 1</b>	Introduction and Lab 1, Microbial classification, Microscopy	Lab 1: General microbiological techniques Reading assignment Qlicker (during lectures)	Lab 1 ( <b>2%, CLO6</b> )  Material is included in Quiz 1, Qlicker (during lectures), Midterm ( <b>CLO1-2</b> )
<b>Week 2</b>	Biological molecules, Bacterial cell structure and processes	Tutorial 1: review concepts of weeks 1-2, practice problems (unmarked)  Reading assignment  Qlicker (during lectures)	<b>Quiz 1</b> covers lecture and lab material from weeks 1-2 ( <b>3%, CLO1-2</b> )  Material is included in Quiz 2, Qlicker (during lectures), Midterm ( <b>CLO1-2</b> )
<b>Week 3</b>	Bacterial cell structure and processes (part 2)  Introduction to control of microorganisms (Lab 2)	Lab 2: Effect of antibiotics  Reading assignment  Qlicker (during lectures)	Lab 2 ( <b>2%, CLO6</b> )  Material is included in Quiz 2, Learning Catalytics questions (in class), Midterm ( <b>CLO2-3</b> )
<b>Week 4</b>	Eucaryotic cell structure and Archaea cell structure	Tutorial 2: review concepts of weeks 3-4, practice problems (unmarked)  Reading assignment  Qlicker (during lectures)	<b>Quiz 2</b> covers lecture and lab material from weeks 3-4 ( <b>3%, CLO1-3</b> )  Material is included in Quiz 2, Learning Catalytics questions (in class), Midterm ( <b>CLO3</b> )
<b>Week 5</b>	Viruses, Microbial nutrition and growth	Lab 3: Titration of phage/Transduction  Reading assignment  Qlicker (during lectures)	Lab 3 ( <b>2%, CLO6</b> )  Material is included in Qlicker (during lectures), Midterm ( <b>CLO3</b> )
<b>Week 6</b>	Control of microorganisms	Midterm  Reading assignment  Qlicker (during lectures)	<b>Midterm</b> covers lecture and lab material from weeks 1-6 ( <b>25%, CLO1-4, 6</b> )

			Material is included in Qlicker (during lectures), Midterm. <b>(CLO3-4)</b>
<b>Week 7</b>	Water microbiology, Introduction to metabolism	Lab 4: Bacteriological examination of water  Reading assignment  Qlicker (during lectures)	Lab 4 <b>(2%, CLO6)</b>  Material is included in Quiz 3, Qlicker (during lectures), Final Exam <b>(CLO3-4)</b>
<b>Week 8</b>	Catabolism, Soil microbiology	Tutorial 3: review concepts of weeks 7-8, practice problems (unmarked)  Reading assignment  Qlicker (during lectures)	<b>Quiz 3</b> covers lecture and lab material from weeks 7-8 <b>(3%,CLO5)</b>  Material is included in Quiz 3, Qlicker (during lectures), Final Exam <b>(CLO3-4)</b>
<b>Week 9</b>	Genes: Structure, Replication	Lab 5: Enumeration of Microorganisms in Soil & Recovery and Purification of Plasmid DNA and the Polymerase Chain Reaction  Reading assignment  Qlicker (during lectures)	Lab 5 <b>(2%, CLO6)</b>  Material is included in Quiz 4, Qlicker (during lectures), Final Exam <b>(CLO5)</b>
<b>Week 10</b>	Gene expression, Regulation of gene expression	Tutorial 4: review concepts of weeks 9-10, practice problems (unmarked)  Reading assignment  Qlicker (during lectures)	<b>Quiz 4</b> covers material from weeks 9-10 <b>(3%, CLO5)</b>  Material is included in Quiz 4, Qlicker (during lectures), Final Exam. <b>(CLO5)</b>
<b>Week 11</b>	Recombinant DNA Technology, Lysozyme lab	Lab 6: Assay of lysozyme & Recovery and Purification of Plasmid DNA and the Polymerase Chain Reaction (continued)  Reading assignment  Qlicker (during lectures)	Lab 6 <b>(2%, CLO6)</b>  Material is included in Qlicker (during lectures), Final Exam. <b>(CLO5)</b>



<b>Week 12</b>	Microbial Genomics and/or other current topics	Tutorial 6: review concepts of weeks 11-12, practice problems (unmarked)  Reading assignment  Qlicker (during lectures)	Material is included in Qlicker (during lectures), Final Exam. <b>(CLO5)</b>
	Q&A	Review of weeks 1-12	
	<b>Final Exam</b>		<b>Final Exam<sup>2</sup> is worth 45% of Final Grade (CLO1-CLO6).</b>

<sup>1</sup> 10% of the material on the quizzes and exams based on the laboratory component

<sup>2</sup> ~ 20% of the final exam based on material from before the midterm.

## 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 asked in-class or posted in the Q&A forum on the class website. The instructor, TAs, 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 either a TA or the instructor through office hours. **Office hours may be booked through Zoom.**

## 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, 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.

### **INVALID EXAMS**

An exam may be declared invalid in case of an interruption in an in-person examination; if the instructions in a remote or online exam were not followed; if the student uploads wrong materials; or if a situation arises where the integrity of the exam cannot be verified. If an exam is declared invalid, the student may be granted a re-write.

### **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.

EDUCATIONAL TECHNOLOGY	ACCESSIBILITY COMPLIANCE INFORMATION
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>
Qlicker	<a href="https://qlicker.github.io/guide/student.html">https://qlicker.github.io/guide/student.html</a>

If you find any element of this course difficult to access, please discuss with your instructor how you can obtain an accommodation.

## 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](#) at the Student Wellness Service Faculty of Engineering and Applied Science.