



Faculty of Engineering and Applied Science

# CHEE 229 – CELL BASED ENGINEERING PRINCIPLES

## Course Syllabus – Fall 2020

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

### COURSE INSTRUCTOR

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### TEACHING ASSISTANTS

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## COURSE INFORMATION

### COURSE DESCRIPTION

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. (0/35/0/13/0)

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

EXCLUSION: MICR 221

### 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)

Specific course learning outcomes include:

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)

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.

### RELEVANCE TO THE PROGRAM

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.

### COURSE STRUCTURE AND ACTIVITIES

CHEE 229 is an intensive 6-week course in 2020 with 6 lecture hours (asynchronous), 1 tutorial hour and three lab hours per weeks. Times can be found in SOLUS and details on onQ.

### LABORATORY MANUAL AND SCHEDULE

Labster will be used as an online lab platform with a Lab set (1-3 mini labs) required to be done every week. A TA will be available online during the designated lab slot. However, students may choose to complete the lab set at any given time during the designated week. The specific labs for each set are listed on onQ.

Week 1	Lab set 1: General microbiological techniques
Week 2	Lab set 2: Growth curves and mammalian cell culture
Week 3	Lab set 3: Growth and control of microorganisms
Week 4	Lab set 4: TBA
Week 5	Lab set 5: TBA
Week 6	Lab set 6: TBA

### EXPECTATIONS FOR LECTURES, LABS, AND TUTORIALS

Lecture slides and lecture videos will be posted in advance onto onQ. Some lectures will include examples and problem solutions not contained in the posted slides. **It is mandatory for students to watch all lectures, perform all the online laboratories, and attend the live tutorials on Zoom (tutorials will be recorded for exceptions such as those in a different time zone, links will be posted on onQ).**

Students **must** complete all the required online labs the week they are due. Students are expected to read lab instructions and online information provided by Labster. Students will be completing the labs individually and a TA will be available on discussion forums on onQ

should any questions arise. During the lab exercises on Labsters, students will be asked a series of questions which will be in lieu of an official lab report.

## COURSE MATERIALS

Required Textbook J. Willey, L. Sherwood, C. Woolverton. 2020. Prescott, Harley and Klein's Microbiology. 11th Edition. McGraw-Hill, Boston, MA. Print ISBN 9781259281594 (available for purchase at the bookstore, approx. \$99.95)

\*\*Please note that there is also an online version of this textbook with a 1-year license.

All course lecture slides, videos, labs, and tutorials will be posted on the CHEE 229 onQ website.

### Required Hardware/Software

Students must have a reliable [internet connection and hardware](#) that are compatible with online learning and remote proctoring system requirements.

### Course Specific Computer-Related Skills

This course requires computer-related technical skills. For this course, you will also need to use Labster – an online lab platform. Students will learn the software during Week 1 labs, which help introduce the software and lab techniques.

### Suggested Time Commitment

This course represents a study period of one semester spanning **6 weeks and is a 4 unit course**. Learners can expect to invest on average 20+ hours per week in this course. Learners who adhere to a pre-determined study schedule are more likely to successfully complete the course. A recommended schedule is posted on the course website on onQ.

## COURSE EVALUATION

Deliverable	Week or Date	Weight
Tests (6 @ 8% each)	Weekly (Tuesdays)	48
Lab completion and answers on Labster (6 @ 4% each)	Weekly	24
Group project: review paper on a current topic (summary week 3 2%, paper 18%)	Weekly milestones, Summary due Week 3, Final due end of exam period	20
Individual report: advanced techniques on review paper topic	Due end of exam period	5
Forum participation – feedback on project summaries	Week 4	3

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

\*\*To earn 4% for each lab, 2% is for completing the lab and 2% for correctly answering questions during the lab. In addition, up to 10% of the material on the tests will be based on the laboratory component.

Students must pass the test components (combined mark of the 6 tests) 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.

## ASSESSMENT DESCRIPTIONS

**Tests:** There are six tests in this course. These tests are designed to measure students knowledge. These tests are taken from the course onQ website every Tuesday. Once initiated, you will have a limited time to complete the test (time posted in advance) and have one attempt to complete test.

## 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](#).

### 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.

### HOW TO DO WELL IN THIS COURSE

This course covers a large amount of material over a short period (6 weeks) – the equivalent of taking 2 courses. Start completing course material September 8<sup>th</sup> to not fall behind. Watching 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 tests, review paper, and individual report. If you do not understand certain concepts after review, please ask for clarification during the tutorials or over the discussion forums on onQ.

## 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, 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 class website.

## OFFICE HOURS

In addition to interaction in the Q&A discussion forums, you will have the opportunity to interact in a synchronous fashion with either a TA or the instructor through office hours which can be booked as needed (common questions will be addressed on the onQ discussion boards).

## 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.

# COURSE POLICIES

**Attendance:** Watching the recorded lectures, attending the tutorials, and completing the 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.

**Laboratories:** Students **must** complete all lab exercises during their respective week (ie. Lab set one is due by the end of Week 1).

**Tests:** Writing the tests at their allotted time-slot is mandatory. Arrangements can be made for those in far time-zones. No cell phones or internet search engines are permitted. If a test is missed for a medical reason, the final weight of the tests may be readjusted to reflect the combined total. The tests will be closed book with a limited time-frame allowed. Only Faculty-approved calculators are allowed for the tests.

**Request for Mark Reassessment:** All marking concerns must be submitted within 2 weeks of the initial return date. To be considered for re-evaluation, an email with a request including the question (s) and why they should be remarked should be included.

**Cheating:** You are required to adhere to the Queen's Code of Conduct, which specifies the following as constituting an offence against the University: "all forms of academic dishonesty

such as plagiarism, cheating, furnishing false information to the University, forgery, misuse of university documents.” (<http://www.queensu.ca/secretariat/senate/policies/codecond.html>)

## LATE POLICY

Any applicable late penalties are described in the details for each assessment. In the event of extenuating circumstances, you may request an extension to an assignment due date without penalty. Requests must be made to your instructor prior to the original due date of the assignment, and some substantiating documentation is often required (see information below on absences). Note that unacceptable reasons include extra-curricular activities, travel plans, generally behind on schoolwork, etc. In the absence of substantiating documentation, the normal late penalty will apply as described in the assignment or departmental policies.

## ABSENCES (ACADEMIC CONSIDERATIONS) AND ACADEMIC ACCOMMODATIONS

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

## RECORDING SYNCHRONOUS (LIVE) CLASSES

Synchronous (live) tutorials and the introductory lecture will be delivered in this course through a video conferencing platform supported by the University using Zoom. Steps have been taken by the University to configure these platforms in a secure manner. Classes will be recorded with video and audio (and in some cases transcription) and will be made available to students in the course for the duration of the term. The recordings may capture your name, image or voice through the video and audio recordings. By attending these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated coursework. If you are concerned about the collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives.

To learn more about how your personal information is collected, used and disclosed by Queen’s University, please see the general [Notice of Collection, Use and Disclosure of Personal Information](#).

## 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>

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

## ACCOMMODATIONS RELATED TO REMOTE ASSESSMENT

To have your accommodations applied to the tests please follow the instructions for submitting your information, as outlined on the QSAS website. If you are already registered with QSAS and you require additional accommodations related to remote-proctored exams, please consult with your QSAS advisor to update your Letter of accommodation as appropriate.

## RELIGIOUS OBSERVANCE

Students in need of accommodation for religious observance are asked to speak to their professor within a week of receiving their syllabus. Please note that Rosh Hashanah falls on the eve of September 18, 2020 so students in need of accommodation should speak to their professors right away. 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 Chaplain Kate Johnson 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.

## **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 109 countries around the world. You belong here: <https://www.queensu.ca/inclusive/>.

## COURSE SCHEDULE

<b>CHEE 229 Weekly 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 knowledge 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>Week</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>	Microbial classification, Microscopy, Biological molecules	Lecture videos online Test 1 Lab set 1 Book chapter readings Practice assignment Review paper (chose topic, start research) Tutorial 1: review concepts, practice problems (unmarked)	Material is included in Test 1 <b>(8%)</b> and applied in Review paper <b>(CLO1-2)</b>  Lab 1 <b>(4%, CLO6)</b>

<b>Week 2</b>	Bacterial, eukaryotic, and archaea cell structure	<p>Lecture videos online</p> <p>Test 2</p> <p>Lab set 2</p> <p>Book chapter readings</p> <p>Practice assignment</p> <p>Review paper: continue research, develop outline and hand in before tutorial</p> <p>Tutorial 2: review concepts of weeks 2, practice problems (unmarked)</p>	<p>Material is included in Test 2 <b>(8%)</b>, applied in Review paper <b>(CLO1-2)</b></p> <p>Lab 2 <b>(4%, CLO6)</b></p> <p>Review paper outline <b>(for feedback)</b></p>
<b>Week 3</b>	Growth and control of microorganisms	<p>Lecture videos online</p> <p>Test 3</p> <p>Lab set 3</p> <p>Book chapter readings</p> <p>Practice assignment</p> <p>Review paper: continue research, complete summary and post before tutorial period</p> <p>Tutorial 3: review concepts of week 3, practice problems (unmarked)</p>	<p>Material is included in Test 3 <b>(8%)</b>, applied in Review paper <b>(CLO 3-4)</b></p> <p>Lab 3 <b>(4%, CLO6)</b></p> <p>Review paper summary <b>(2%, CLO 5)</b></p>

<b>Week 4</b>	Soil, metabolism, catabolism	<p>Lecture videos online</p> <p>Test 4</p> <p>Lab set 4</p> <p>Book chapter readings</p> <p>Practice assignment</p> <p>Review paper: continue writing, finish rough draft</p> <p>Participation: feedback on 2 other review paper summaries (assigned by TA)</p> <p>Tutorial 4: review concepts of week 4, practice problems (unmarked)</p>	<p>Material is included in Test 4 <b>(8%)</b>, applied in Review paper <b>(CLO 3&amp;4)</b></p> <p>Lab 4 <b>(4%, CLO6)</b></p> <p>Feedback on 2 other review paper summaries <b>(3%, CLO 5)</b></p>
<b>Week 5</b>	Gene replication and expression, and drinking water	<p>Lecture videos online</p> <p>Test 5</p> <p>Lab set 5</p> <p>Book chapter readings</p> <p>Practice assignment</p> <p>Review paper: hand in final draft</p> <p>Tutorial 5: review concepts of week 5, practice problems (unmarked)</p>	<p>Material is included in Test 5 <b>(8%)</b>, applied in Review paper <b>(CLO 4&amp;5)</b></p> <p>Lab 5 <b>(4%, CLO6)</b></p>

<b>Week 6</b>	Gene regulation and advanced technologies	Lecture videos online Test 6 Lab set 6 Book chapter readings Practice assignment Review paper: hand in final draft Tutorial 6: review concepts of week 6, practice problems (unmarked)Midterm	Material is included in Test 6 <b>(8%)</b> , applied in Review paper <b>(CLO 5)</b>  Lab 6 <b>(4%, CLO6)</b>
<b>Exam period</b>	<b>Review paper and Individual report</b>		<b>Review paper (18%) and Individual report (5%) due at end of exam period.</b>

\*\* 10% of the material on the tests based on the laboratory component