



Faculty of Engineering and Applied Science

CHEE 440 – PHARMACEUTICAL TECHNOLOGY

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/>.

TEACHING TEAM

COURSE INSTRUCTOR

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CHEE 440 (W 3-0-0.5 3.5)

COURSE DESCRIPTION

Introduction to pharmaceuticals and the industrial manufacture of pharmaceutical dosage forms. Topics include the design and preparation of a successful dosage form with respect to the route of administration, and large-scale manufacture in a sterile and clean environment. Aspects of chemical kinetics, physical chemistry, physiology, cell biology, mass and heat transfer, and fluid dynamics will be described as they relate to the manufacture of effective dosage forms.

(0/12/0/30/0) (Mathematics/Natural Sciences/Complementary Studies/Engineering Science/Engineering Design)

PRE-REQUISITE KNOWLEDGE

The objective of this course is to provide the students with an understanding of the application of mathematics, physical chemistry and engineering unit operations in the manufacture and assessment of basic dosage forms.

RELEVANCE TO THE PROGRAM

This elective course, offered at the 4th year level, applies foundations of mathematics, science, and engineering in the pharmaceutical setting and provides bio/physiological insight for biomedical engineering applications.

COURSE LEARNING OUTCOMES (CLO)

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

CLO	DESCRIPTION	INDICATOR
CLO 1	Explain the physiological routes of absorption for drugs and the advantages and limitations of each route.	KB-BIO(b)
CLO 2	Describe and mathematically analyze the absorption, distribution, and elimination of drugs from various dosage forms.	KB-BIO(b)
CLO 3	Analyze and solve problems involving unit operations in the context of the design and manufacture of tablets, capsules, solutions, suspensions and emulsions.	KB-BIO(b)
CLO 4	Describe the ethics, safety and regulatory standards around manufacture and regulatory approval of pharmaceutical products.	KB-BIO(b)

This course develops the following attribute:

KB-BIO(b): Applies foundations of science and engineering to analyze and solve biological, physiological, pharmaceutical, and/or environmental problems or processes

COURSE EVALUATION

ASSESSMENT WEIGHTING

Deliverable	Week or Date	Weight
Midterm test 1	Week 5	23
Midterm test 2	Week 9	23
Exam question assignment	Week 11	2
News post assignment	One week throughout term	2
Final Exam	Exam period	50

Students must pass the exam component (combined mark on midterm+final) to pass the course, as stated by departmental policies.

HOW TO DO WELL IN THIS COURSE

This course requires knowledge of engineering concepts, such as mass transfer, unit operations, thermodynamics, and basic chemistry. Students are expected to apply this knowledge and memorize technical information for pharmaceutical applications. It is recommended that students in their 3rd or 4th year take this course.

ASSESSMENT DESCRIPTIONS

Midterms: There are two midterms in this course and they are closed-book. The first midterm will be run through Proctortrack and the second midterm in-person (TBD). Students must write their exam on the day and time scheduled by the Instructor during Week 5 and Week 9. Those in far time-zones should contact the instructor for Midterm 1 (online).

Exam question assignment: You will need to hand in an exam-level problem and solution. These will be anonymously distributed to the class as a study tool. More details about this assignment can be found in onQ.

In-the-News post: One week this term you will be assigned to post a news item related to this course and describe its importance. You are also expected to view others posts and comment on two. More details about this assignment can be found in 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.

Remote Proctoring - Proctortrack

The first midterm in this course will use remote proctoring provided by a third-party, cloud-based service that enables the completion of a proctored exam or test from an off-campus location, through onQ. This online proctoring solution was chosen as part of the approach to maintaining academic integrity in online assessment. Precise details about how remote proctoring will be used in this course can be found in the “Getting Started with Remote Proctoring” content module in onQ or will be provided by the instructor.

When writing tests/exams using remote proctoring, you are connecting to the third-party service. Queen’s has conducted a privacy and security review of the service in accordance with Ontario’s privacy legislation.

You should also take measures yourself to protect your information by keeping your NetID password and challenge questions private, closing all applications prior to starting an exam/test, and ensuring your device is updated and safeguarded against malware.

For more information about remote proctoring, see the Student FAQs on the OUR Exams resource page for [remote proctoring](#).

GRADING

Feedback on Assessments

The teaching team will provide feedback on graded activities. You can expect feedback on your assessments within approximately ten business days 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 STRUCTURE AND ACTIVITIES

For the first 6 weeks, the equivalent of 3 lecture hours of videos will be posted and paired with one live synchronous Question and Answer session (see onQ for details). There will also be 1 tutorial which will often be synchronous. Times are found on SOLUS and the details of the Question and Answer sessions will be posted onto onQ. All live components will also be recorded and posted onto onQ.

EXPECTATIONS FOR LECTURES/TUTORIALS

Lecture slides will be posted. The lectures will include material, examples, and problem solutions not contained in the posted slides. Problem sets are posted biweekly, with the solutions posted the following week. These are not marked. Students are expected to undertake these problems to gain understanding of the course material.

COURSE MATERIALS

Recommended Textbook: The Design and Manufacture of Medicines, Michael E. Aulton & Kevin M.G. Taylor, 5th Edition.

All course lecture slides, videos, problem sets, and tutorials will be posted onto onQ.

Required Calculator

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

Required Hardware/Software

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

Suggested Time Commitment

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

WEEKLY COURSE OUTCOMES

Course learning outcomes (CLO): Students will be able to:			
<ol style="list-style-type: none"> 1. Explain the physiological routes of absorption for drugs and the advantages and limitations of each route. 2. Describe and mathematically analyze the absorption, distribution, and elimination of drugs from various dosage forms. 3. Analyze and solve problems involving unit operations in the context of the design and manufacture of tablets, capsules, solutions, suspensions and emulsions. 4. Describe the ethics, safety and regulatory standards around manufacture and regulatory approval of pharmaceutical products. 			
<p>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 problem sets</p>			
Week	Lecture approach and content	Tutorial approach and content	Assessment (CLO, and % of course grade)
Week 1	<p>Introduction</p> <ul style="list-style-type: none"> •The drug product as a delivery system 	<p>Week 1</p> <ul style="list-style-type: none"> •Tutorial 1 •Practice problem set 1: posted online 	<p>Material is included on midterm 1 and exam (CLO1)</p>
Weeks 1-3	<p>Principals of drug absorption and conventional dosage forms</p> <ul style="list-style-type: none"> •Routes of administration and dosage form design •Physical, chemical, and physiological factors influencing drug absorption •Pharmacokinetics and the concept of bioavailability 	<p>Week 2</p> <ul style="list-style-type: none"> •Tutorial 2: Review on biological systems and routes of administration •Practice problem set 1: solutions posted online <p>Week 3</p> <ul style="list-style-type: none"> •Tutorial 3: Tutorial problem set •Practice problem set 2: posted online 	<p>Material is included on midterm 1 and exam (CLO1 and CLO2)</p> <p>**Starting week 2: In the News assignment due worth 2% of course grade. (CLO 1-4)</p>
Weeks 4-7	<p>Unit operations in pharmaceuticals</p> <ul style="list-style-type: none"> •Powder flow •Granulation •Drying •Tableting •Tablet coating •Capsule preparation 	<p>Week 4</p> <ul style="list-style-type: none"> •Tutorial 4: Tutorial problem set •Practice problem set 2: solutions posted online <p>Week 5</p> <ul style="list-style-type: none"> •Tutorial: Midterm 	<p>Week 5, Midterm exam 1: questions will target CLO1 and CLO2, worth 23% of course grade</p> <p>Material is included on midterm 2 and exam (CLO3)</p>

		<ul style="list-style-type: none"> •Practice problem set 3: posted online <p>Week 6</p> <ul style="list-style-type: none"> •Tutorial 6: Tutorial problem set •Practice problem set 3: solutions posted online <p>Week 7</p> <ul style="list-style-type: none"> •Tutorial 7: Take-up midterm 1 •Practice problem set 4: posted online 	
Weeks 8-12	Parenteral formulations <ul style="list-style-type: none"> •Physical parameters •Sterilization •Suspensions •Emulsions •Emerging technologies (LNP) •Stability 	<p>Week 8</p> <ul style="list-style-type: none"> •Tutorial 8: Tutorial problem set •Practice problem set 4: solutions posted online <p>Week 9</p> <ul style="list-style-type: none"> •Tutorial 9: Midterm •Practice problem set 5: posted online <p>Week 10</p> <ul style="list-style-type: none"> •Tutorial 10: Tutorial problem set •Practice problem set 5: solutions posted online <p>Week 11</p> <ul style="list-style-type: none"> •Tutorial 11: Tutorial problem set •Practice problem set 6: posted online 	<p>Week 9, Midterm exam 2: questions will target CLO1, CLO2, and CLO3, worth 23% of course grade</p> <p>Week 11, Assignment: Exam-level problem and solution, worth 2%</p> <p>Material is included on exam (CLO3)</p>
Week 12	Drug development <ul style="list-style-type: none"> •Clinical trials •GMP 	<p>Week 12</p> <ul style="list-style-type: none"> •Tutorial 12: Take-up midterm 2/Exam review •Practice problem set 6: solutions posted online •Exam problem set: will be posted online 	<p>Material is included on exam (CLO4)</p>
EXAM			<p>Final exam: Questions will target each CLO, with a focus on CLO3 and CLO4, worth 50% of course grade</p>

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 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. The instructor will provide a schedule of availability at the beginning of the term.

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.

RECORDING SYNCHRONOUS (LIVE) CLASSES

Any synchronous (live) classes will be delivered in this course through a video conferencing platform supported by the University, Zoom. Steps have been taken by the University to configure these platforms in a secure manner, and to maintain student privacy while delivering courses remotely. Please note the following:

- Lectures 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. You will be able to turn off your camera and microphone if you would like.
- Tutorials will be recorded with video and audio...

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](#).

COURSE POLICIES

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

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

Request 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. Alternatively, an email outlining the request will also be accepted this term.

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.

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

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)	https://www.d2l.com/accessibility/standards/
Zoom	https://zoom.us/accessibility

If you find any element of this course difficult to access, please contact engineering.aac@queensu.ca

ACCOMMODATIONS RELATED TO REMOTE ASSESSMENT

To have your accommodations applied to a remote-proctored exam please follow the instructions for submitting your information, as outlined on the QSAS website. Your accommodations will be incorporated into your exam session by the Queen's University exam coordinators, on behalf of your course instructor. This information is uploaded automatically to [Proctortrack / Examity](#).

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. 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.

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/>