Faculty of Engineering and Applied Science

CHEE 412 – TRANSPORT PHENOMENA

Course Syllabus – Winter 2021

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

TEACHING TEAM

COURSE INSTRUCTOR

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CHEE 412 (3.5)

Course Description

The course advances the fundamentals of material, momentum and energy transfer. Emphasis is placed on the theory and analysis of diffusion, convection and interphase transport of material in laminar and turbulent streams and their similarities. Applications in engineering and environmental transport processes are presented, and the modelling of complex processes is considered.

Prerequisites: CHEE 223, CHEE 330 (or CHEE 317 and CHEE 318), or permission of the department.

Pre-Requisite Knowledge

Students are expected to be familiar with the concepts of fluid mechanics (laminar and turbulent flow, Bernoulli's equation, boundary layers...), heat transfer (Fourier's law, Newton's law...) and mass transfer (Fick's law), numerical methods (approximation of differential equations), and be competent in the analytical solution of differential equations. It is assumed that students already understand the basics of heat and mass balances and have a working knowledge of spreadsheets and a computer programming language.

Course Learning Outcomes (CLO)

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

CLO	Description
CLO 1	Understand the basic unifying concept behind transport phenomena.
CLO 2	Understand the general form and solution strategy for transport phenomena problems
CLO 3	Through examples develop an understanding of how the general form is converted to a specific solution.

CLO	DESCRIPTION
CLO 4	Review and recall how the basic vector and matrix operators are used in defining Transport Phenomena problems.
CLO 5	Understand the concept of diffusive transport of conserved quantities: Fick's Law, Fourier's Law, Newton's Law.
CLO 6	Become familiar with the general expression for diffusive flux of a conserved quantity

COURSE EVALUATION

ASSESSMENT WEIGHTING

Assessment Tool	Date	Weight
Quizzes		**100% (500 points)**
Quiz 1	Week of 2/8	
Quiz 2	Week of 3/1	
Quiz 3	Week of 4/5	
Two term tests with highest scores (2@200 points)		**400 points**
Other term test with lowest score		**100 point**

ASSESSMENT DESCRIPTIONS

(Quizzes)

ALL TESTS OPEN BOOK. ALL TESTS COMPREHENSIVE. Use hardcopy of textbook, approved calculator, notes on paper, and a watch. The test is to done individually and alone, without consultation. Be organized. Prepare by doing assigned readings, tutorial assignments and problems in text. Everything covered could be on the tests. Subjects emphasized in class or through homework are emphasized on tests. Grading: arithmetic errors penalized lightly, except where they indicate conceptual difficulty. Conceptual errors penalized more heavily. Wrong answers with no analysis given zero. Make your analysis clear. Always give units. This information applies to all tests. Regraded tests will be completely regraded. Resulting regrade may not be as high as initial grade.

(Assignments)

Tutorial assignments are not to be handed in. Instead, for this special online semester, we will credit these following the honour system.

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 assessments within seven 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 MATERIALS

Required Textbook

- Bird, R.B., W.E. Stewart and E.N. Lightfoot, Transport Phenomena , REVISED SECOND EDITION, Wiley, New York (2007).

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.

WEEKLY COURSE OUTCOMES

Week	Learning Outcomes	Book Chapter Readings
1	**Transport, Viscosity**	0,1
2	**Equations of Change: Isothermal**	3
3	**Equations of Change: Isothermal**	3
4	**Unsteady (time-dependent) flow**	3, §4.1
5	**Polymeric Liquids**	8
6	**Thermal Conductivity**	9
7	**Equations of Change: Nonisothermal**	11
8	**Equations of Change: Nonisothermal**	11
9	**Unsteady Heat Conduction**	11, §12.1, Ex. 12.1-1
10	**Diffusivity**	17
11	**Equations of Change: Mixtures**	19
12	**Equations of Change: Mixtures**	19, §20.1

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 or via email. 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. 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.

COURSE POLICIES

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

Copyright

The material presented in this course is intended for use as part of the course at Queen's University and is the property of the instructor unless otherwise stated. Copying this material for distribution (e.g. uploading material to a commercial third-party website) can lead to a violation of Copyright law and constitutes a violation of Academic Integrity.

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 exams, impersonating another student, copying from another student, making information available to another student about the exam questions or possible answers, communicating with another person during an exam or about an exam during the exam window, or accessing 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 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

(STANDARD TEXT): 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/
RocScience	https://www.rocscience.com/
Google Spreadsheets	https://www.google.com/accessibility/products-features/

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 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 Examity/ Proctortrack. Please note that exam accommodations that are uploaded for a specific exam are not visible to students. For example, extra time is calculated and added automatically to the exam duration but is only visible to students once they begin their exam in the Exam Portal.

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.

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/.