MEC E 636 Environmental Fluid Mechanics

Fall 2019 - September 03 to December 06

Class time: Monday, Wednesday, Friday 13:00-13:50 Location: MEC 4 1

Instructor:

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Donadeo Innovation Centre for Engineering 10-226
Office Hours: By appointment

Course Description:

*3 (fi 6) (either term, 3-0-0) Transport of passive and active scalars. Plumes and environmental convection with applications to air pollution. Gravity currents and intrusions. Surface gravity waves. Flow in porous media. Darcy's law with applications to groundwater flow and oil recovery. Turbulent boundary layers in the natural environment.

Course Objectives & General Content:

The overall objective of this (survey) course is to provide students with a foundational understanding of key environmental flows as related e.g. to pollution transport, dispersion. Specific course topics include

1. Review of fluid mechanics
2. Passive scalar transport; turbulent flows and the Reynolds decomposition
3. A first look at buoyancy effects: plumes and environmental convection
4. A second look at buoyancy effects: gravity currents and intrusions
5. Surface gravity waves
6. Flow in porous media with applications to oil and groundwater flow
7. Turbulent boundary layers (time-permitting)

Marking Scheme:

Activity	Due/Scheduled	Weight
Problem sets	Various dates throughout the term	20%
Midterm examination	Friday, Oct. 25, in-class	35%
Final project presentation	Last 2 weeks of classes	20%
Final project report	Monday, Dec. 2	25%

The Faculty recommended grade point average for a 600 level course is 3.3. Instructors have the leeway to deviate from this average and can assign grades based on their own scheme. All grades are approved by the department chair (or delegate). The office of the Dean has final oversight on all grades.

Term Work

All term work solutions will be posted no later than the last day of classes. All term work will be returned to students by the final day of classes, with the exception of major term work due in the last week of classes. The latter will be returned by the day of the final examination or the last day of the examination period if there is no final examination in the course as per university policy; instructors will make accommodations to return these term work. It is the responsibility of the student to pick up all their term work at the specified time and place. Any unreturned term work, shall be retained and then shredded six months after the deadline for reappraisal and grade appeals. Final examinations will be kept for one year as required by university guidelines and the Government of Alberta's Freedom of Information and Protection of Privacy Act.

Additional Notes

1. For the midterm exam, students are permitted an 8.5-by-11 single-sided formula sheet.

2. There is no class on Sept. 13 to allow new graduate students to attend the Dept. of Mechanical Engineering orientation session.

3. On or before Nov. 8, students will be assigned a collection of similarly-themed papers from the open-literature. Drawing on additional resources as necessary, students will be required to write a five page review of the topics discussed, the associated technological, industrial or environmental impacts and possible directions for future research. Students will also be required to make a presentation that addresses the ideas described in their reports. Presentations will be held during the final 2 weeks of classes for the Fall Term.

Calculator Policy

No calculators are permitted in examinations.

Text and References (Mandatory):

None.

Website:

https://sites.ualberta.ca/~mrflynn/teach.html and eClass

Previous Examples of Evaluative Materials:

Will be posted at https://sites.ualberta.ca/~mrflynn/teach.html

University Policies:

Policy about course outlines can be found in Course Requirements, Evaluation Procedures and Grading of the University Calendar.

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at www.governance.ualberta.ca) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan. Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study, and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

Only those items specifically authorized by the instructor may be brought into the exam facility. The use of unauthorized personal listening, communication, recording, photographic and/or computational devices is strictly prohibited. Students should refrain from bringing any unauthorized electronic device into an examination room, including cell phones, high tech watches, high tech glasses or other such devices.

Faculty of Engineering Statement on Safety During Learning Activities:

In all Faculty of Engineering courses, labs, seminars or other learning activities, safety is of paramount importance. In some cases, laboratory work in a program requires high standards for risk management to keep potential hazards safely under control. Anyone found to be unable to function safely, due to intoxication, behavior, or other reasons, in the class, lab, seminar or other learning activity may be asked to leave or be removed for their and the safety of other participants and instructors. As members, or prospective members, of the engineering profession, it is your responsibility to identify and inform the proper authorities of an unsafe work/learning environment.

Learning Outcomes:

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

1. Enhance students' abilities to communicate technical material to a broad audience (verbally and in writing).

2. Develop or enhance students' research skills by considering the application of textbook knowledge to a particular problem relevant to environmental flows.

3. Enhance students' appreciation for the connection between classical and environmental fluid mechanics. Have students understand the key differences between internal flows and environmental flows.

4. Have students understand the significance of the following phenomena in the environmental flow context: buoyancy (or density differences), turbulence, drift and dispersion.

Did you know that the University of Alberta has various low-to-no-cost services to help students succeed? Visit http://www.deanofstudents.ualberta.ca/ for information about the academic, wellness, and various other support services available to U of A students. It's never too early or too late to seek help!

From the Office of the Dean, Faculty of Engineering

Students PLEASE READ. It is **your responsibility** to be aware of and understand the implications of contravening the University of Alberta's Code of Student Behaviour.

All suspected infractions identified by Faculty, TAs, Markers and Exam Invigilators will be:

1) Investigated by the responsible Faculty member delivering the course including an interview with the student.
   a) A second Faculty member will be present at the time of the interview.
   b) The student is entitled to an advisor sourced from the Office of the Student Ombuds during such an interview.
2) If the outcome of (1) warrants, then it will be referred to the Office of the Dean for investigation and possible disciplinary sanction.
   a) The student will be invited to meet with the Associate Dean, Dr. Joseph for an interview.
   b) The student is entitled to an advisor sourced from the Office of the Student Ombuds during such an interview.
   c) The Associate Dean will decide on a sanction weighing the evidence "**on the balance of probabilities**".
3) The student has the right to appeal any sanction imposed through the University Appeals Board.

The following is selected content from the Code of Student Behaviour that students should be particularly aware of, ref: **"CODE OF STUDENT BEHAVIOUR"**, updated July 1, 2018

"30.3.2 Inappropriate Academic Behaviour

30.3.2(1) **Plagiarism**

No Student shall submit the words, ideas, images or data of another person as the Student's own **in any academic writing, essay, thesis, project, assignment, presentation** or poster in a course or program of study."

Dispelling some of the myths that lead to plagiarism

*a) It is **not OK** to use someone else's words or work without appropriate citation and referencing but claim that you are 'honouring them' by using their words.*
*b) It is **not OK** to put references at the end of a piece of work but not cite the reference at the end of the specific section of paraphrased text or vice-versa.*
*c) It is **not OK** to use a figure, table or graph from someone else's work without appropriate citation.*
*d) It is **not OK** to put a verbatim quote in quotation marks or italics and not to cite the reference at the end of the quote, or vice-versa.*
*e) It **is OK** for you to work with a person or group on an assignment, lab report or project as long as your solution or submission for grading was worked and written **independently** of the person or group.*
*f) **No** assignment, lab report or project submission from one student should show strong similarity in written style or calculation layout to another student.*
*g) It is **not OK** to work with someone else on an assignment or lab report or paper **and** submit an identical or highly similar document for grading.*
*h) A momentary lapse in judgment **is not** an excuse.*

"30.3.2 Inappropriate Academic Behaviour

30.3.2(2) **Cheating**

30.3.2(2)a No Student shall in the course of an examination or other similar activity, obtain **or attempt to obtain** information from another Student or other unauthorized source, give or attempt to give information to another Student, or use, attempt to use or possess for the purposes of use any unauthorized material.
30.3.2(2)b No Student shall represent or attempt to represent themself as another or have or attempt to have themself represented by another in the taking of an examination, preparation of a paper or other similar activity. See also misrepresentation in 30.3.6(4).
30.3.2(2)c No Student shall represent another's substantial editorial or compositional assistance on an assignment as the Student's own work.
30.3.2(2)d No Student shall submit in any course or program of study, without the written approval of the course Instructor, all or a substantial portion of any academic writing, essay, thesis, research report, project, assignment, presentation or poster for which credit has previously been obtained by the Student or which has been or is being submitted by the Student in another course or program of study in the University or elsewhere.
30.3.2(2)e No Student shall submit in any course or program of study any academic writing, essay, thesis, report, project, assignment, presentation or poster containing a statement of fact known by the Student to be false or a reference to a source the Student knows to contain fabricated claims (unless acknowledged by the Student), or a fabricated reference to a source."

Plagiarism can also be cheating (two counts in one)

Plagiarizing within the context of assignments, papers, lab reports, tests and examinations is also an attempt to take academic advantage over others in the same class; such that a better grade may be achieved, and hence may also be subject to a charge of cheating.

"30.3.6(5) Participation in an Offence

No Student shall counsel or encourage or knowingly aid or assist, directly or indirectly, another person in the commission of any offence under this Code."

"30.3.4 Inappropriate Behaviour towards Individuals or Groups

30.3.4(1) **Disruption**

30.3.4(1)a No Student shall disrupt a Class in such a way that interferes with the normal process of the session or the learning of other Students." **Comment: *This includes use of laptops, phones and working on assignments distracting others***

"30.3.4(6) Violations of Safety or Dignity

30.3.4(6)a No Student shall have sexual or physical contact with another person without that person's consent.
30.3.4(6)b No Student shall physically abuse another person, threaten any other person with physical abuse or cause any other person to fear physical abuse.
30.3.4(6)c No Student shall create a condition which endangers or potentially endangers or threatens the health, safety or wellbeing of other persons.

30.3.4(6)d No Student shall harass another person. Harassment is defined in the Discrimination, Harassment and Duty to Accommodate Policy in UAPPOL, and includes Harassment, Bullying, Sexual Harassment and Racial Harassment.
30.3.4(6)e No Student shall use words which threaten violence or physical abuse to any group or individual whether or not the group or individual thus threatened knows of such threatening words and whether or not the words are employed with a demonstration, rally or picketing."

"30.3.6 Other Offences

"30.3.6(4) **Misrepresentation of Facts**

No Student shall misrepresent pertinent facts to any member of the University community for the purpose of obtaining academic or other advantage..." **Comment: *This includes falsely claiming ill health to defer examinations or gain extensions***

"30.3.3 Inappropriate Behaviour in Professional Programs

30.3.3(1) A Student enrolled in Professional Programs is bound by and shall comply with the Professional Code of Ethics governing that profession and the practice of its discipline.
30.3.3(2) It shall be the responsibility of each student in a Professional Program to obtain, and be familiar with, the Professional Code of Ethics relevant to the discipline and all amendments thereto as may be made from time to time."

Association of Professional Engineers & Geoscientists of Alberta - APEGA CODE OF ETHICS

1. Professional engineers and geoscientists shall, in their areas of practice, hold paramount the health, safety and welfare of the public and have regard for the environment.
2. Professional engineers and geoscientists shall undertake only work that they are competent to perform by virtue of their training and experience.
3. Professional engineers and geoscientists shall conduct themselves with **integrity, honesty**, fairness and objectivity in their professional activities.
4. Professional engineers and geoscientists shall comply with applicable statutes, regulations and bylaws in their professional practices.
5. Professional engineers and geoscientists shall **uphold and enhance the honour, dignity and reputation of their professions** and thus the ability of the professions to serve the public interest.

Unauthorized use of devices & resources

On-line resources such as **"Course-Hero"** are considered inappropriate resources that **students should avoid accessing**. Such resources are the subject of concern by the Office of the Dean and University Legal Counsel, as content has previously been identified as unauthorized use of Faculty of Engineering Professors' intellectual property, including notes & solutions. To use such resources is both **Cheating** and **Plagiarism**.

Students identified to have used **unauthorized devices**; such as **smart phones, watches and glasses**; to access E-class or communicate with others via email or social media during an **examination** have received **Cheating** sanctions which can include the loss of the full exam grade value as a minimum, up to a suspension or expulsion from University recommendation.

In many instances, cheating in examinations occurred when students were using washrooms, although some students access resources in exams in front of invigilators. Students need to be aware that the Office of the Dean uses all available technology and services to **monitor use of unauthorized devices and resources**, including IP logs specific to device traffic during examination periods. Instructors are encouraged to monitor E-class logs and 'electronic material sharing' sites during exam periods.

Faculty of Engineering rules related to unauthorized electronic devices in examinations

1. Section 23.5.1(1) Permitted References and Aids, of the University Calendar states: "Only those items specifically authorized by the instructor may be brought into the exam facility. The use of unauthorized personal listening, communication, recording, photographic and/or computational devices is strictly prohibited". Any violation of this is a violation of the Code of Student Behaviour.
2. On entering an examination, students must turn off all unauthorized electronic devices including but not limited to cell phones, laptops, tablets, watches with internet/storage capability, or other audio-visual devices. Invigilators should remind students to do this before the examination is started.
3. Such devices should be placed in a carrying bag or backpack, and placed behind or underneath the student's chair; or if the room is deemed capable, invigilators may ask all bags and backpacks be placed in a designated area and only retrieved once the examination is completed.
4. Any student in possession of an unauthorized electronic device, regardless of perceived action, will be reported by the invigilator and/or instructor for investigation under the Code of Student Behaviour. All such reports will be referred to the Office of the Dean.
5. Students requiring a washroom break must present their ONEcard to the invigilator prior to leaving the examination room. Invigilators will be responsible for noting such students' names and exact time of departure and return.
6. Calculators with storage capability other than approved programmable calculators are prohibited in examinations.

General rule for unauthorized devices in examinations

Students should refrain from bringing any unauthorized electronic device into an examination room. At the very least **no unauthorized device should be on your person** during an examination, but should be secured in your backpack or bag out of reach for the duration of the examination.

Study and assignment tips for students

1. Study in groups, but only to discuss concepts and principles, **NOT** to complete assignments.
2. Perform assignment calculations and written solutions on your own – you are only competing with yourself.
3. Take advantage of using the TA scheduled office time to ask additional questions – if in doubt ask.
4. If colleagues are getting higher grades in assignments, labs, exams, remember you are not competing with other students only with yourself.
5. If you are tempted to take a shortcut think about this: What is the value of the assignment or lab or test that I am tempted to cheat or plagiarize to get credit?

Comments on grading

Summarized below is a generic grading scheme for a representative long-answer problem as might appear on a problem set, a midterm examination or a final examination. Note that in order to adequately distinguish between mediocre and superlative students, the average mark on the midterm and/or final will typically fall between 60% and 70%.

Table 1: Generic grading scheme (quiz(zes)/midterm/final).

% of marks obtained	Material presented
20	Limited material presented. Equations irrelevant to the problem at hand OR correct equations presented but with little or no subsequent calculations.
40	Correct equations presented with incomplete or badly misguided follow-up calculations.
60	Correct approach marred by a major conceptual flaw or multiple algebraic mistakes OR right answer obtained using an incorrect approach.
80	Correct approach with a single algebraic mistake.
100	Correct answer obtained using a correct (and well laid-out) methodology.