

Faculty of Science Course Syllabus Department of Earth & Environmental Sciences ERTH 4153 Petroleum Geoscience Fall 2020

Instructor: Grant Wach

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"Office" Hours: Contact by email to make a virtual appointment Lectures: Tuesdays & Thursdays, 10:05-11:25 Atlantic Time (AST), synchronous delivery Laboratories: Tuesdays, 2:35-5:25 Atlantic Time (AST), synchronous delivery

Course Description

The course is an introduction to petroleum geoscience (gas, oil and unconventional) with discussion of alternative and renewable energy sources including geothermal, hydrogen, wind and CCS (Carbon Capture and Storage) as the World economies experience a fundamental change- the Energy Transition.

We examine the elements of the petroleum system- source, migration, reservoir, trap and seal through integrated study of basin analysis, source rock evaluation, seismic and well log sequence stratigraphy, biostratigraphy, core and outcrop description, depositional facies analysis, nonconventional resources and oil sands, drilling and completions, petrophysics and well log analysis in addition to other topics. Practical work includes laboratory and class exercises including core and cuttings descriptions and a term paper. Field excursions will discuss basin evolution and study evidence from outcrops to discern past paleoclimates, depositional systems and the elements of a petroleum system.

Course Prerequisites: ERTH 2270—Intro to applied geophysics, ERTH 3140—Structural geology, ERTH 3303—Stratigraphy

Course Objectives/Learning Outcomes

Successful completion of the course will equip students to:

- 1. Demonstrate knowledge and understanding of the concepts of petroleum geology and the elements of an effective petroleum system.
- 2. Gain "hands-on" laboratory techniques and field experience.
- 3. Organize ideas, summarize teachings, and describe findings appropriate for academic writing in the Earth Sciences.
- 4. Evaluate petroleum basins and fields and present technical analysis and interpretation.
- 5. Learn the value of integrated data sets to deciphering petroleum systems.

Course Materials

These materials have been selected to expand your understanding of petroleum geoscience

MANDATORY

1) Petroleum class reader (available on BrightSpace)



Recommended Textbooks:

- Last Billion Years, Atlantic Geoscience Society (2001)
- Petroleum Geoscience: From Sedimentary Environments to Rock Physics Knut Bjorylkke (2010)
 - [In Killam Library: TN 870.5 B56 2010]
- N.P. James & R.W. Dalrymple (2010) "Facies Models 4"

Course Assessment

Component	Weight (% of final	Date Due
	grade)	
Labs	40%	Labs are due at the beginning of the following
		week's lab unless stated otherwise
Participation	15%	Attendance, in-class assignments & quizzes
Field Trip Reports	20%	Field trip reports/exercise material are due 2
		weeks after the field trip date
Term Paper	25%	Sept 15 – Topic submission
		Oct 6 – Essay outlines due for feedback
		Nov 19 – Finished Term Paper

Other course requirements

Students are required to attend the following sessions:

TBD

Course Policies

Attendance: Attendance is mandatory. This includes all lectures, labs, and field trips. There are no make-up sessions. **Attendance at departmental guest lectures is expected** – as material from guest lectures will be included on exams.

Late penalty for <u>all assignments</u>, <u>labs</u>, <u>in-class exercises</u>, <u>papers</u>, etc. <u>will 5% per day after the due date</u>.

Professional Conduct: All work will be done on a professional level of presentation in both laboratory and class. All written work and data will be your own work. Ask questions of both your classmates, TA, and the instructor **but do not copy**. Plagiarism will result in direct referral to the University Senate Committee on Academic Discipline & Integrity.

This course will prepare you for your professional career and future professional accreditation. As such, students are expected to maintain a high ethical and professional standard in their work and behaviour.

Term Assignments (see assignment handout for further guidelines)

- Term Assignments are due as an electronic file.
- 50% of your references must come from books or journals.
- Option 1: Term papers must be double spaced paper of 10 pages plus figures.



- Option 2: Term Powerpoint presentations must be 15 slides with extensive notes
- Use the <u>Canadian Journal of Earth Sciences</u> referencing style
- Include a: title page, page numbers, and references. The format and style for the Honours thesis is a good model to follow. See assignment handout for further guidelines.
- You must choose your topic by SEPT 15.
- I am willing to review the outline of your paper and provide feedback as long as it is submitted to me by **Oct 6**.
- The final term assignment is due at the beginning of lecture on NOV 17.
- THERE WILL BE A 5% REDUCTION EACH DAY OR PART OF A DAY THAT ANY ASSIGNMENT IS LATE.

Participation

In order to participate fully in the online environment, students are expected to contribute during lecture and/or make a minimum of two (2) posts per week on BrightSpace's discussion boards, and to respond to a minimum of two (2) other posts. Students may either address the discussion prompt provided each week, or address the week's content, ask and/or answer questions, share their own background knowledge, or post relevant news articles.

Conversion of numerical grades to Final Letter Grades follows the <u>Dalhousie Common Grade</u> <u>Scale</u>

A+ A A-	90-100 85-89 80-84	4.30 4.00 3.70	Considerable evidence of original thinking; demonstrated outstanding capacity to analyse and synthesize; outstanding grasp of subject matter; evidence of extensive knowledge base.	
B+	77-79	3.30	Evidence of grasp of subject matter, some evidence of critical capacity	
В	73-76	3.00	and analytical ability; reasonable understanding of relevant issues;	
B-	70-72	2.70	evidence of familiarity with the literature.	
C+	65-69	2.30	Evidence of some understanding of the subject matter; ability to	
С	60-64	2.00	develop solutions to simple problems; benefitting from his/her	
C-	55-59	1.70	university experience.	
D	50-54	1.00	Evidence of minimally acceptable familiarity with subject matter, critical and analytical skills (except in programs where a "C" is required).	
F	<50	0.00	Insufficient evidence of understanding of the subject matter; weakness in critical and analytical skills; limited or irrelevant use of the literature.	



Related courses offered at Dalhousie University:

ERTH 4157 -- Petroleum Geoscience Field Methods ERTH 4131 -- Advanced Petroleum Geoscience (Imperial Barrel Award / EAGE FIELD Challenge)

Related Student Societies

AAPG – American Association of Petroleum Geologists
CSPG – Canadian Society of Petroleum Geologists
SEG – Society of Economic Geologists
CSEG / SEG – Canadian Society of Exploration Geophysicists
SPE – Society of Petroleum Engineers
EAGE – European Association of Geoscientist and Engineers

Course content

The online delivery of this course is new and unique to how it has been taught previously, and so is subject to changes as material is delivered. Lab and field-based learning is essential in the Earth Sciences, and we still want to provide that experience for the students, as best we can through this new medium.

Many lectures will also feature in-class assignments, as well as a series of vignettes from guest lecturers.



Date	Lecture	Lab/Activity
Tuesday, September 8	Introduction to Petroleum	None
	Geology and Course	
	Overview	
Thursday, September 10	Petroleum Systems of the	Petroleum Systems & Risk
	Scotian Margin	Analysis (In-class exercise)
Tuesday, September 15	Source Rocks I	Source Rocks II
	*Term paper topics	
	submitted today	
Thursday, September 17	Sequence Stratigraphy	None
Tuesday, September 22	Field Trip 1	Field trip
Thursday, September 24	Atlantic Canada Energy	None
	Snapshot	
Tuesday, September 29	Reservoir Characterization,	Wilson cycles and turbidites
	Diagenesis, Porosity and	Point Pleasant Park exercise
	Permeability, Net- to-Gross	
	Sand, Fractured Reservoirs	
Thursday, October 1	Seismic Stratigraphy	None
Tuesday, October 6	Introduction to Well Log	Miocene well correlation
	Correlation	
	Lab	
	*Field trip report due	
Thursday, October 8	Oil Sands	None
Tuesday, October 13	Petrophysics	Petrophysics & Well Log
		Analysis (Neil Watson—
		Petrophysics)
Thursday, October 15	The Geology of Mi'kma'ki	None
	(the Mi'kmag nation)	
Tuesday, October 20	Geophysics—Data	Seismic reflection
	acquisition	
Thursday, October 22	Geophysics—Data analysis	None
Tuesday, October 27	Overview of Seismic	Seismic interpretation
	Stratigraphy and	_
	Interpretation	
	Lab	
Thursday, October 29	Field Trip	TBD
Tuesday, November 3	Offshore Nova Scotia	Offshore NS Seismic
	Geology & Petroleum	Stratigraphy
	Exploration	
	Lab	



Thursday, November 5	Carbon Sequestration (CCUS)	None
Fall Break	Fall Break	Fall Break
Tuesday, November 17	Nova Scotia Carbonates &	Carbonate & Chalk Core
	Chalk	Description
	Lab	
	*Term paper due	
Thursday, November 19	Provost Field—Cuttings	None
	*Field trip report due	
Tuesday, November 24	Provost Field – Core	Northern Alberta Core Lab
	Lab	
Thursday, November 26	Geothermal Energy	None
Tuesday, December 1	Linked Depositional Systems	Fluvial to Deepwater RQ
	-South Africa Talk	
Thursday, December 3	Course review	None

UNIVERSITY POLICIES AND STATEMENTS

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.



Code: <u>https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html</u>

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: <u>http://www.dal.ca/cultureofrespect.html</u>)

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

https://www.dal.ca/academics/important_dates.html

University Grading Practices

<u>https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html</u>

STUDENT RESOURCES AND SUPPORT

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: <u>https://www.dal.ca/faculty/science/current-students/academic-advising.html</u>

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Advising Centre: <u>https://www.dal.ca/campus_life/communities/black-student-advising.html</u>

International Centre: <u>https://www.dal.ca/campus_life/international-centre/current-students.html</u>

Academic supports

Library: <u>https://libraries.dal.ca/</u>

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Writing Centre: <u>https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html</u>

Studying for Success: <u>https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html</u>

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health & Wellness Centre: <u>https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html</u>

Student Advocacy: https://dsu.ca/dsas

Ombudsperson: <u>https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html</u>

Safety

 Research Lab Safety

 https://www.dal.ca/content/dam/dalhousie/pdf/dept/safety/lab_policy_manual_2007.pdf

 Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

 Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

 Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: <u>https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html</u>