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University of Manitoba
CHR Faculty of Environment, Earth and Resources
Department of Environment and Geography

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COURSE DETAILS

Course Title & Number:	Physical Oceanography of High Latitude Oceans (Short title – Polar Oceanography), GEOG-4670-T12 & GEOG-7010-T63
Number of Credit Hours:	3
Class Times & Days of Week:	14:30-15:45 Tuesday and Thursday
Location for classes/labs/tutorials:	125 St. John's College
Pre-Requisites:	Prearranged written consent of an individual instructor and permission of department head.

Instructor Contact Information

Instructor(s) Name:	Jens Ehn
Preferred Form of Address:	First name
Office Location:	580 Wallace Building
Office Hours or Availability:	16:00 – 17:00 Tues. and Thurs. (also by appointment)
Office Phone No.	(204) 228-5689
Email:	jens.ehn@umanitoba.ca
Contact:	For any questions please contact me by either email, phone, or in person. I will respond as soon as possible.

General Course Information

This course aims to introduce graduate students as well as advanced undergraduate students to the basic ideas and main concepts of physical oceanography of Polar and High Latitude regions, and how processes there are connected to the World Oceans and Earth's climate system. The methods will be more observational than mathematical or theoretical, however, key dynamical concepts will be derived since modern oceanography is a highly quantitative subject. In addition to the broad overview, the graduate students will have a chance to research in depth a suitable topic of their choosing and then prepare a lecture and research paper on that topic.

Topics covered include:

- Circulation and water properties of Arctic Ocean, sub-Arctic seas.
- Circulation and water properties of the Southern Ocean
- Importance of a stratified ocean
- Transfer of heat across the ocean surface
- Conservation equations
- Small-scale physical processes
- Equations of motion
- The effect of the Earth's rotation
- Sea ice and climate
- Polynyas
- Fresh water cycle of Arctic Ocean
- Wind-generated waves
- Tides (+ under ice tides)
- The marginal ice zone (MIZ)
- The coastal ocean and shelf circulation
- Shelf-basin exchange
- Ice sheets, ice shelves, tidal outlet glaciers

Textbook, Readings, Materials

Readings for the various lectures will be based on scientific papers available through the UM Libraries. Lectures will be provided to students in PPT or PDF format.

Using Copyrighted Material

Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the *Copyright Act* applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact um_copyright@umanitoba.ca.

Recording Class Lectures

Jens Ehn and the University of Manitoba hold copyright over the course materials, presentations and lectures, which form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission by Jens Ehn. Course materials (both paper and digital) are for the participant's private study and research.

Course Technology

It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. The student can use all technology in classroom setting only for educational purposes approved by instructor and/or the University of Manitoba Disability Services. Student should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline "gaming" during scheduled class time. If student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it. (@S Kondrashov. Used with permission)

Class Communication

The University requires all students to activate an official University email account. For full details of the Electronic Communication with Students please visit:

[http://umanitoba.ca/admin/governance/media/Electronic Communication with Students Policy - 2014 06 05.pdf](http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy_-_2014_06_05.pdf)

Please note that all communication between myself and you as a student must comply with the electronic communication with student policy

(http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html). You are required to obtain and use your U of M email account for all communication between yourself and the university.

Expectations: I Expect You To

I will make every attempt to be on time for class, and will stay after class as long as required to answer or discuss any questions. You may also interrupt me to ask questions or for clarifications any time during the lectures. If you miss a class or classes, you will be expected to independently read the course material. Powerpoint slides of the lectures will be provided. I will treat you with respect and would appreciate the same courtesy in return. See [Respectful Work and Learning Environment Policy](#).

Students Accessibility Services

If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services <http://umanitoba.ca/student/saa/accessibility/>

520 University Centre

204 474 7423

Student_accessibility@umanitoba.ca

Class Schedule

This schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students but such changes are subject to Section 2.8 of the – [ROASS](#)-Procedure.

LECTURE	TOPIC
0	Course introduction
1	Circulation + water properties of Arctic Ocean
2	Circulation + water properties of Arctic Ocean
3	Circulation + water properties of Southern Ocean
4	Ocean stratification and the equation of state
5	Conservation equations (mass, S, heat)
6	Small-scale physical processes
7	Exam 1 for 4670, no class for 7010
8	The effect of the Earth's rotation - Geostrophic
9	The effect of the Earth's rotation - Ekman
10	Freshwater budget of Arctic Ocean
11	Freshwater budget of Arctic Ocean
12	Sea ice and polynyas; Ice sheets, ice shelves, tidal outlet glaciers
13	Sea ice and polynyas; Ice sheets, ice shelves, tidal outlet glaciers
14	Exam 2 for 4670, no class for 7010
15	Lecture by grad students (slot 1)
16	Lecture by grad students (slot 2)
17	Wind-generated waves
18	Tides (+under ice tides) and other long waves
19	The coastal ocean and shelf circulation

20	Exam 3 for 4670, no class for 7010
21	Oral presentations for 4670 & 7010
22	Oral presentations for 4670 & 7010

** Voluntary withdrawal date is 31 March.

GEOG 4670 Assignment Descriptions

Research paper instructions

- Due in last quarter of course (~20 November).
- Length: ~1000 words for 4000-level.
- Presentation: ~10-15 minutes.
- Chose a topic that falls in the broad range of class topics. I will help you decide on the topic and its details. For example find two papers: (1) A seminal ("classic") paper (journal or book chapter) for the topic; it should be highly cited and now part of our basic understanding of the ocean. (2) A recent paper can be something more specific that builds on or solves a problem remaining from the first paper. Review both papers with special attention to what was learned about the ocean (or an instrument if that is your choice) in the earlier paper that set the stage for the new findings in the 2nd. Use more than two papers if convenient. Include them in a reference section.
- Presentation given after handing in research paper.
- The assignment should use the APA reference style as outlined in the text. See e.g. <http://www.bibme.org/citation-guide/apa/> for examples.

GEOG 7010 Assignment Descriptions

Lecture instructions

- Given in late October.
- Discuss with instructor to select a topic that falls in the broad range of class topics. If it helps student's research, then all the better.
- Prepare presentation (powerpoint) in advance so instructor can review and comment on it.
- Length of presentation has to be evaluated based on class size. About 45 minutes is preferable because this is what is typical during a defence.
- If topic is not physical oceanography, e.g. chemistry or biology etc., then try to relate it to physical processes in the ocean.

Research paper instructions

- Due in last quarter of course (~20 November).
- Length: ~2000 words for 7000-level.
- Presentation: ~10-15 minutes.
- Chose a topic that falls in the broad range of class topics. For example find two papers: (1) A seminal ("classic") paper (journal or book chapter) for the topic; it should be highly cited

and now part of our basic understanding of the ocean. (2) A recent paper can be something more specific that builds on or solves a problem remaining from the first paper. Review both papers with special attention to what was learned about the ocean (or an instrument if that is your choice) in the earlier paper that set the stage for the new findings in the 2nd. Use more than two papers if convenient. Include them in reference section.

- Presentation given after handing in research paper.
- The assignment should use the APA reference style as outlined in the text. See e.g. <http://www.bibme.org/citation-guide/apa/> for examples.

Laboratory Expectations

This course includes no labs.

GEOG 4670 Course Evaluation Methods

This course is evaluated with three exams and a research paper/presentation. There is no final exam.

	<u>Value Contributing to Final Grade:</u>
Exam 1	20%
Exam 2	20%
Exam 3	20%
Research paper + presentation	40%
Presentation (20%)	
Final submission (20%)	

GEOG 7010 Course Evaluation Methods

This course has no exams at the GEOG 7010 level. Instead graduate students are expected to be active participants in class activities by asking questions, giving a lecture, and writing a research paper with short presentation.

	<u>Value Contributing to Final Grade:</u>
Handout for lecture	25%
Lecture on course topic	25%
Research paper + presentation	50%
Presentation (20%)	
Final submission (30%)	

Grading

The Grading Standard for this course is as follows:

Letter Grade	Percentage out of 100	Final Grade Point
A+	90-100	4.5
A	80-89	4.0
B+	75-79	3.5
B	70-74	3.0
C+	65-69	2.5
C	60-64	2.0
D	50-59	1.0
F	Less than 50	0