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**Instructions:**

This is a sample syllabus template/workbook.

Content can be re-organized to meet the preferred styles of individual instructors.

Tables are used in the document to preserve formatting.

An automatic table of content is included. In order to update the table:

- Choose the references tab in the ribbon above

- Choose "update table"

- Choose "update entire table"

Content order can be re-ordered to best suit your course needs



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

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## COURSE DETAILS

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<b>Course Title &amp; Number:</b>	<b>Physical Oceanography of High Latitude Oceans (Short title – Polar Oceanography), GEOG 4670 T12</b>
<b>Number of Credit Hours:</b>	3
<b>Class Times &amp; Days of Week:</b>	14:30-15:45 Tuesday and Thursday
<b>Location for classes/labs/tutorials:</b>	217 Wallace Building
<b>Pre-Requisites:</b>	Prearranged written consent of an individual instructor and permission of department head.

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## Instructor Contact Information

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<b>Instructor(s) Name:</b>	Jens Ehn
<b>Preferred Form of Address:</b>	First name
<b>Office Location:</b>	580 Wallace Building
<b>Office Hours or Availability:</b>	16:00 – 17:00 Tues. and Thurs. (also by appointment)
<b>Office Phone No.</b>	(204) 480-1493
<b>Email:</b>	jens.ehn@umanitoba.ca
<b>Contact:</b>	For any questions please contact me by either email, phone, or in person. I will respond as soon as possible.

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## General Course Information

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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

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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

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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](mailto:um_copyright@umanitoba.ca).

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## Recording Class Lectures

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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.

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## Course Technology

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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)

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## Class Communication

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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](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.

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## Expectations: I Expect You To

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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

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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](mailto:Student_accessibility@umanitoba.ca)

## Class Schedule

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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.

MONTH	DAY	LECTURE	TOPIC
September	7		Course introduction
	12	1	Circulation + water properties of Arctic Ocean
	14	2	Circulation + water properties of Arctic Ocean
	19	3	Circulation + water properties of Southern Ocean
	21	4	Ocean stratification and the equation of state
	26	5	Conservation equations (mass, S, heat)
	28	6	Small-scale physical processes
October	3	7	Exam 1 for 4670, no class for 7010
	5		no lecture (fall term break)
	10		no class (thanksgiving Oct 9)
	12		Review exam 1 + Equations of motion
	17	8	The effect of the Earth's rotation - Geostrophic
	19	9	The effect of the Earth's rotation - Ekman
	24	10	Freshwater budget of Arctic Ocean
	26	11	Freshwater budget of Arctic Ocean
	31	12	Sea ice and polynyas; Ice sheets, ice shelves, tidal outlet glaciers
	31	12	Sea ice and polynyas; Ice sheets, ice shelves, tidal outlet glaciers
November	2	13	glaciers
	7	14	Exam 2 for 4670, no class for 7010
	9	15	Lecture by grad students (slot 1)
	14		no class (remembrance day Oct 13)
	16		Lecture by grad students (slot 2)



	21	16	Wind-generated waves + SEEQ
	23	17	Tides (+under ice tides) and other long waves
	28	18	The coastal ocean and shelf circulation
	30	19	Exam 3 for 4670, no class for 7010
December	5	20	Oral presentations for 4670 & 7010
	7	21	Oral presentations for 4670 & 7010

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\*\* Voluntary withdrawal date is November 17.

## Assignment Descriptions

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### 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 2<sup>nd</sup>. 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.

## Laboratory Expectations

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This course includes no labs.

## Course Evaluation Methods

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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%)

## Grading

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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