

Course Outline: ENSC 454/654

Snow and Ice

Instructor: Stephen J. Déry, Office: 8-414

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Office hours: M 1:00-2:00 pm, W 10:00-11:00 am

Lecture: MW 2:30-3:50 p.m. in room 5-159

Objectives:

This course will focus on the physical processes involving snow and ice that greatly influence the hydrometeorology of northern B.C. and the remainder of Canada. Some of the goals of this course are: 1) to gain a better understanding of snowpack, permafrost, lake ice, and glacier formation and ablation processes, 2) to learn about the characteristics of snow and ice and how they will evolve with climate change, 3) to conduct an extensive snow survey in the field that will form the basis of a research project and in-class presentation.

Instruction is through two 80 minute classes per week on Mondays and Wednesdays at 2:30-3:50 p.m. in 5-159.

If you, because of a disability, may have a need for special academic accommodations, please come and discuss this with me, or contact the Disability Services Centre located in room 1048 in the Teaching and Learning Centre.

Students are responsible for informing themselves of the risks associated with field work. By participating in such studies they shall be deemed to have accepted personal responsibility for all such risks, to have agreed to abide by the safety rules and procedures established by the instructors, and to have waived the liability of UNBC and its instructors in respect of such activities.

Resources:

The required course textbook is:

Marshall, S. J., 2012: **The Cryosphere**, Princeton University Press, 288 pp.

Other related books that are not necessarily available at the library are:

Armstrong, R. L. and E. Brun, 2008: **Snow and Climate**, Cambridge, 222 pp.

DeWalle, R. and A. Rango, 2008: **Principles of Snow Hydrology**, Cambridge, 410 pp.

French, H. M., and O. Slaymaker, 1993: **Canada's Cold Environments**, McGill-Queen's University Press, 340 pp.

Gray, D. M., and D. H. Male, 1981: **Handbook of Snow**, Blackburn Press, 776 pp.

Paterson, W. S. B., 1994: **The Physics of Glaciers**, Butterworth Heine-
mann, 3rd ed., 481 pp.

Slaymaker, O., and R. E. J. Kelly, 2007: **The Cryosphere and Global
Environmental Change**, Blackwell Publishing, 261 pp.

Resources related to ENSC 454 can also be found in the course homepage located
at <http://cirrus.unbc.ca/454>

Evaluation:

There will be a mid-term exam, final exam, a snow survey report and presentation. The report requires a formal, typed or word-processed write-up, the format of which will be discussed in class. The mid-term exam is scheduled for **Monday, 5 February 2018** during the lecture period. The final exam will occur sometime during the April exam period, so no travel or employment plans should be made during this time. Reports handed in late will have marks deducted, except for medical or other extraordinary circumstances. In any case, the instructor must be notified of late assignments prior to the due date. Missed exams cannot be made up except on documented grounds **and** notification prior to exam date. Plagiarism and other forms of cheating will not be tolerated and will be strictly dealt with according to university policy (see the "Academic Offenses" section of the UNBC Calendar). Plagiarism is the "act of passing off as one's own, the ideas or writings of another" (The American Heritage College Dictionary 1044). It includes submitting the work of another, in whole or in part, including copying material from web pages or another student. Any material directly or indirectly originating from another source must be properly cited.

Snow survey report and presentation*	40%
Mid term Exam*	20%
Final Exam*	40%
Total	100%

***Note:** Graduate students taking this course will be required to perform additional analyses for the snow survey report and respond to supplemental questions on the exams.

Topics:

The following topics will be covered in the course, as time permits. The dates listed are the Mondays and Wednesdays of each week for the winter 2018 semester.

Week	Date	Topic
1	Jan. 3	Introduction and scheduling of field trip. Introduction to the cryosphere, properties and characteristics of snow and ice (density, thermal conductivity, albedo, etc.). Surface radiation, energy and water budgets.
2	Jan. 8/10	Snowfall formation and distribution (atmospheric processes, formation and properties of snow crystals and snow flakes).
3	Jan. 15/17	Snowcover formation and distribution (factors controlling snowpack evolution: precipitation, wind, terrain, vegetation). Global distribution and climatology of snowcover.
4	Jan. 22/24	Snowpack ablation processes (sublimation, melt, liquid water infiltration and runoff).
5	Jan. 29/31	Description of research project and preparation for snow survey in the field. Snow survey in the field on the afternoon of Wednesday, 31 January 2018
6	Feb. 5/7	Mid-term exam on Monday, 5 February 2018 ; Remote sensing of snow (guest lecture)
	Feb. 12/14	Family Day and mid-semester break, no lectures
7	Feb. 19/21	Introduction to glaciers: Glacier distribution in Canada, glacier formation and ablation processes, mass balance of glaciers, sea level rise. (guest lectures)
8	Feb. 26/28	Greenland and Antarctic ice sheets, sea level rise.
9	Mar. 5/7	Arctic and Antarctic sea ice.
10	Mar. 12/14	Lake ice and river ice.
11	Mar. 19/21	Arctic and alpine permafrost.
12	Mar. 26/28	In class presentations of the snow survey reports. Climate change impacts on the cryosphere.
13	Apr. 2/4	No classes on Easter Monday, 2 April 2018 ; Climate change impacts on the cryosphere (continued); Review.