1-Core (sigs)

v10-day
#20?

FORMAT 6

Submit originals and one copy and electronic copy to **Governance/Faculty Senate Office**
(email electronic copy to fysenat@uaf.edu)

Geology majors current have only two choices for Oral Intensive courses within the department, and one of those is only taught every other year. Adding Oral Designation to Ice in the Climate System will expand these offerings.

Furthermore, as a new course, *the course design integrates the oral component completely* – rather than the oral component being an add-on to a course that has been taught previously.

- This course will be required for Geology students [illegible]

ADDITIONAL SIGNATURES: ***(As needed for cross-listing and/or stacking)***

	Date	
Signature, Chair, Program/Department of:		
	Date	
Signature, Chair, College/School Curriculum Council for:		
	Date	
Signature, Dean, College/School of:		

CATALOG DESCRIPTION

GEOS F377 O Ice in the Climate System

3 Credits
Offered Spring Odd-numbered Years

Earth's cryosphere includes seasonal snow, permafrost, sea ice, mountain glaciers, and ice sheets. This course will cover the formation of each of these forms of snow and ice and their response to

Ice in the Climate System
GEOS F377 O Syllabus

Erin Pettit

email: pettit@gi.alaska.edu (email is best way to contact me)

INSTRUCTOR: Offices: 338 Reichardt and 410 B Elvey (GI)
Office hours: by appointment
you are welcome to drop by my office anytime after noon, I am glad to help if I have time.

COURSE LOGISTICS:

Time: We will meet Wednesday and Friday from 1 to 2pm and Thursdays from 2 to 5 pm.

Place: Reichardt 229

PREREQUISITES:
PHYS F103X AND MATH F200X; permission of instructor

COURSE MATERIALS:

Book: There will be one required textbook:

The Global Cryosphere: Past, Present and Future by Barry and Gan, 2011, Cambridge University Press.

Course Packet There will be a course reading packet that contains selected required readings and worksheets for activities. This will be available on Blackboard at the beginning of the semester. A list of required readings included in the course packet is at the end

4. *On Sea Ice* by Weeks
5. *Dynamics of Snow and Ice Masses* by Colbeck
6. *Glaciers* by Hambrey and Alean
7. *The Little Ice Age* by
8. *Physics of Glaciers* by Cuffey and Paterson
9. *Earth's Climate: Past and Future* by Ruddiman
10. *Glaciers of North America* by Ferguson
11. *Avalanche Handbook* by McClung and Schaerer
12. *Glacier Science and Environmental Change* by Knight
13. *Sea Ice* by Thomas and Dieckmann

COURSE DESCRIPTION:

Snow, permafrost, sea ice, glaciers, and ice sheets (the cryosphere) play a major role in both local and global climate an ocean system. In this course will will use an interdisciplinary perspective to study how snow, permafrost, sea ice, glaciers, ice sheets respond to changes in climate climate and environmental conditions and how the local environment responds to changes in snow and ice. We will emphasize Alaska and the Arctic, but also study the global interactions between ice and the climate system. As a geophysics course, we will emphasizes the physical processes involved; however, we will also emphasize the interdisciplinary nature of this subject through course assignments which will allow students from other disciplines (such as oceanography, chemistry, biology, or math) to highlight those connections. The course will combine readings, discussions, in-class activities, hands on data collection and analysis, homework assignments, exams, and weekly oral presentations.

After taking this course, you will be able to:

1. describe the formation processes and evolution of snow, sea ice, permafrost, glaciers, and ice sheets
2. recognize the importance of these forms of ice in the Arctic system, particularly with respect to their interactions with climate, weather, ecosystems, ocean, and landscapes.
3. apply basic concepts in physics to processes in the natural world, such as heat flow and mass conservation
4. confidently express concepts, ideas, and conclusions in an oral format with a varying amount of preparation and visual aids.

In order to succeed in this course you will need to have

1. some background in physics and calculus and be willing to try applying those concepts to natural processes

biological and physical processes. During most activities, you will work on interdisciplinary [illegible]

teams.

COURSE GOALS: The goal of this course is to build students foundational knowledge in the cryospheric components of the global climate system, with a particular emphasis on the Arctic. After this course, the students will be able to discuss knowledgeably many aspects of Alaskan [illegible]

learning environment that builds their confidence in making observations, framing questions, and designing experiments in order to understand physical processes.

STUDENT LEARNING OUTCOMES:

Content

Students will be able to:

1. Classify ice masses (land and sea ice) based on their formation, morphology, temperature,
2. [illegible]

[redacted]

at microscopic and macroscopic scales)

Time and Changes Through Time (rate):

1. discuss and visualize a specific earth process occurring on a variety of timescales (for [redacted]

Prezi: We will use spatial presentation software Prezi (prezi.org) for concept maps as well

email account to create a FREE prezi educational account for yourself. Please take time to familiarize yourself with prezi.

Website: The course website is `http://ice.gi.alaska.edu/education/iceandclimate` I will post the syllabus, additional information, and links to interesting online material here.

COURSE CALENDAR:

Please see attached detailed course schedule.

COURSE POLICIES:

I make the course policies regarding late assignments or missed classes flexible enough to accommodate reasonable amount absence for illness, emergencies, or required university spon-

ASSESSMENT:	Attendance (5 pts per week)	70
	Written Assignments (40 pts each)	360
	Oral Assignments (40 pts each)	480
	Completion of Outline/Notes from Readings	100
	Written Final	120
	Oral Final	120
	Contributions to Activities and Discussions (5 pts per week)	70
	Total Possible	**1320**

[redacted]

Block Class you attend and participate. As written above, you may miss two Wed/Fri Classes and one Thur Block without penalty.

[redacted]

Minimum Points Required:

A+ (97-100%)	=1280
A (93-96.9%)	=1228
A- (90-92.9%)	=1188
B+ (87-89.9%)	=1148
B (83-86.9%)	=1096
B- (80-82.9%)	=1056
C+ (77-79.9%)	=1016
C (73-76.9%)	=964
C- (70-72.9%)	=924
D+ (67-69.9%)	=884
D (63-66.9%)	=831
D- (60-62.9%)	=792
F (0-59.9%)	=0

DISABILITY ACCOMMODATION: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. UAF is committed to equal opportunity for all students. If

you have a documented disability, please let us know AS SOON AS POSSIBLE, and we will work with the Office of Disabilities Services to make the appropriate accommodation(s). If you have a specific undocumented physical, psychiatric or learning disability, you will benefit greatly by providing documentation of your disability to Disability Services in the Center for Health and Counseling 474-7043, TTY 474-7045. (For example: procrastination issues

If you are the first in your family to attempt a four-year college degree, and/or eligible for Pell grants, you have opportunities for tutorial and other forms of support from the office of Student Support Services. We will collaborate with the Office of Disabilities and/or the Office of Student Support Services to make your educational experience in our class as positive as

Ice in the Climate System
GEOS F377 O Schedule

Wednesday: 1-2pm ("W Class")
Thursday 2-5pm ("Block")
Friday 1-2pm ("F Class")

Typical weekly content:

Wednesday (W Class): one hour of introduction to concepts for the week.

- Students arrive having read the material and taken notes or answered questions based on an outline I provide(with incentives such as random checking of outline/notes or initial activity that requires using some basic concepts from reading).
- Question Time: Discussion regarding questions emailed to me the night before or asked at this point to clear up questions from reading.
- 1-2 activities such as small group discussions, gallery walks, think/pair/shar, jigsaws that require them to work alone and together to solve problems/answer questions/practice using material from the reading.

Thursday (Block): three hour block of time for deeper hands on problem solving, experiential [illegible]

Selected Readings the following Books:

Barry and Gan *The Global Cryosphere Past Present and Future* : Your Textbook

[redacted]

Marchand *Life in the Cold*

Archer and Rahmstorf *The Climate Crisis*

Colbeck *Dynamics of Snow and Ice Masses*

Cuffey and Paterson *Physics of Glaciers*

[redacted]

Ferguson *Glaciers of North America*

[redacted]

Knight *Glacier Science and Environmental Change*

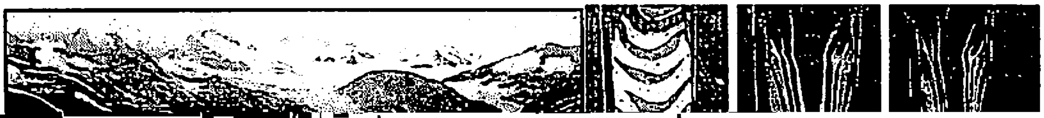
Thomas and Dieckmann *Sea Ice*

	Readings/Assignments	Topics	In-Class Activities

eek 6	**W Class:** *Written #4 due* Barry and Gan Ch 7 Thomas and Dieckmann 5 **Block:** No reading	Sea Ice • formation • growth	**W Class:** Sea Ice Growth Activity **F Class:** Sea Ice group question/problem solving activity as *Written #5*

Week 9	**W Class:** Selections from Cuffey and Paterson Ch 8 Post and Others (2011)	Mountain Glaciers • movement and flow • erosion • tidewater glaciers	**W Class:** Designing Experiments using Scientific Method Activity and Discussion **F Class:** Special types of Mountain Glaciers

13	**W Class:** Barry and Gan Ch 9.5-9.6, Ch 10	Cryosphere-Climate • Feedbacks	**W Class:** Questions/Problem solving turned in as *Written #9*



1. Content and Concepts of Glacier Flow

    - how temperature affects flow
    - spatial patterns of flow,
    - how slope and bed conditions affect flow,
    - [illegible]

[illegible]

    - techniques for making field observations

2. Higher Order Concepts

    - recognizing the difference between observations and inferences

[illegible]

    - framing a scientific question,
    - formulating a hypothesis,
    - designing a method for measuring flow.

3. Other Skills Goals

    - [illegible]

conclusions with data directly supporting those conclusion. A rubric will be provided to the students describing the assessment in detail. Individual students will additionally be assessed on their contributions to the group effort.

6 Materials

1. Flubber Ice (make multiple colors)
   Mix 1 = 3/4 cup warm water, 1 cup Elmer's glue, food coloring

   Mix 2 [illegible]

learn about glacier flow. This activity is designed to help you learn both concepts regarding glacier flow as well as concepts in how the scientific method works.

This is based on Dr. Pettit's version of the scientific method (which has some slight variations from the "standard" scientific method).

Step 1: Explore.

on how you can use flubber-ice to simulate glacier flow. A brainstorm idea can be a question

Step 2: Questions.

Now that you have some ideas you need to narrow down your ideas to focus on a few questions that you want to pursue in an experiment. Please focus on three questions that

are better than general questions. For example:

Bad: What affects flubber ice flow speed? *This question is too general.*

Good: How is flubber ice flow speed affected by the temperature of the flubber ice? *This*

3. Be aware that some experiments may go quickly, some slowly. If your experiment goes slowly in the beginning, it is ok to alter your design to make the experiment run faster.

4. List the materials that are necessary. For example, are toothpicks useful? If so, how will you use them? What measuring device will you use?

5. Write the detailed steps you need to take to make each measurement.

conclusions as they relate directly to your questions and hypotheses. These conclusions will

[redacted]

be as specific as possible. If the flubber ice at -5° C flows 10 times faster than flubber ice at -10° C, then write this down as your conclusion (not just that warm flubber ice flows faster).

Step 7: Uncertainty and Error Analysis.

As you write out your conclusions and compare them with other groups running similar experiments it is critical for you to think through what factors might have led to small differences in your measurements. Did you do multiple runs with the same exact conditions? This will help you understand the uncertainties caused by your experimental design. How well were you able to make each measurement with the tools that you have? For example, is your ruler for measuring distances ticked off in mm or cm? Make a list of possible sources of errors

[redacted]

- Question. Are you questions clearly written, specific, and feasible?
- Experimental Design. Did [illegible]

things that need to be kept constant? Did you come up with good methods for making the [illegible]

GEOS 377 O Ice and Climate

Snow Exploration

[redacted]

University of Alaska Fairbanks

1 Brief Description

This activity is intended to get students engaged and thinking about the role that snow plays

[redacted]

knowledge can do. The students dig shallow snow pits on campus make observations of texture

[redacted]

2. Higher Order Concepts

   (a) recognizing the difference between observations and inference,

   (b) framing a scientific question,

   (c) formulating a hypothesis,

   (d) designing a method for measuring density.

3. Other Skills Goals

   (a) [illegible]

   (b) synthesizing results toward making an oral presentation

4 Description

The students will come into this activity with no or very little knowledge of snow. They will divide into groups, each group receiving the first list of questions (on Rite-in-Rain paper). The questions help guide them through their inquiry and are divided into groups: A) initial observations, B) mea

5 Evaluation

The activity involves the students answering 3 series of questions, some of which have more

that they identify the number/type of ideas they should right down. The final task is

Discovering Snow: Part A

1. Find a site that has not been trampled by footsteps, dig a square pit down to the ground *keeping one side of the pit free of footsteps!.*

2. Sketch the wall of your pit that is on the non-trampled side (all persons in the group should be on one side of the pit facing the "clean" wall. What colors do you see? What textures? [illegible]

Discovering Snow: Part C

[illegible]

relate to these questions. You may do this in the classroom or outside, or both. *This is a brain-storming session, write down all ideas, you can discuss them, but do not judge them critically yet*

1. How does the ground underneath the snow affect the snowpack? What if the snow fell on top of a picnic table? Would it look different?

2. [illegible]

Good: "The snow is darker brown in the top layer, greenish in the middle layer and white in the bottom layer."

1. What observations did you make that relate to this overarching question?

2. What other background knowledge (from coursework, personal experience) does your group have that you feel might contributes to answering the question?

3. What are several ideas (2-4) that might be answers to your overarching question?

4. [illegible]