FORMAT 1

Submit original with signatures + 1 copy + electronic copy to Faculty Senate (Box 7500).
See http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/ for a complete description of the rules governing curriculum & course changes.

TRIAL COURSE OR NEW COURSE PROPOSAL

SUBMITTED BY:

Department	Geology/Geophysics	**College/School**	CMSM
Prepared by	Matthew Sturm / Sarah Fowell	**Phone**	907-474-5257
Email Contact	Matthew.Sturm@gi.alaska.edu	**Faculty Contact**	Matthew Sturm

1. ACTION DESIRED (CHECK ONE):	**Trial Course**	X	**New Course**		
2. COURSE IDENTIFICATION:	**Dept**	GEOS	**Course #**	692	**No. of Credits**	3
Justify upper/lower division status & number of credits:	Graduate standing is a course prerequisite. Students will spend an average of 2.5 hours total in class and 1.5 hours on lab exercises and field trips each week. Therefore they will receive 2.5 credits for coursework and 0.5 credits for labs.				
3. PROPOSED COURSE TITLE:	Snow and Snow Cover				
4. To be CROSS LISTED? YES/NO	No	**If yes, Dept:**		**Course #**	

(Requires approval of both departments and deans involved. Add lines at end of form for additional required signatures.)

5. To be STACKED? YES/NO	No	**If yes, Dept.**		**Course #**

Stacked course applications are reviewed by the (Undergraduate) Curricular Review Committee and by the Graduate Academic and Advising Committee. Creating two different syllabi—undergraduate and graduate versions—will help emphasize the different qualities of what are supposed to be two different courses. The committees will determine: 1) whether the two versions are sufficiently different (i.e. is there undergraduate and graduate level content being offered); 2) are undergraduates being overtaxed?; 3) are graduate students being undertaxed? In this context, the committees are looking out for the interests of the students taking the course. Typically, if either committee has qualms, they both do. More info online – see URL at top of this page.

6. FREQUENCY OF OFFERING:	Fall, odd numbered years
	Fall, Spring, Summer (Every, or Even-numbered Years, or Odd-numbered Years) — or As Demand Warrants
7. SEMESTER & YEAR OF FIRST OFFERING **(AY2013-14 if approved by 3/1/2013; otherwise AY2014-15)**	2013

8. COURSE FORMAT:

NOTE: Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, any core course compressed to less than six weeks must be approved by the core review committee.

COURSE FORMAT: **(check all that apply)**		***1***		***2***		***3***		***4***		***5***	XX	***6 weeks to full semester***
OTHER FORMAT (specify)												
Mode of delivery (specify lecture, field trips, labs, etc)	Lecture, labs and field trips											

9. CONTACT HOURS PER WEEK:	2.5	LECTURE hours/weeks	1.5	LAB hours /week		PRACTICUM hours /week

Note: # of credits are based on contact hours. 800 minutes of lecture=1 credit. 2400 minutes of lab in a science course=1 credit. 1600 minutes in non-science lab=1 credit. 2400-4800 minutes of practicum=1 credit. 2400-8000 minutes of internship=1 credit. This must match with the syllabus. See http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/guidelines-for-computing-/ for more information on number of credits.

OTHER HOURS (specify type)	

10. COMPLETE CATALOG DESCRIPTION including dept., number, title, credits, credit distribution, cross-listings and/or stacking (50 words or less if possible):

Example of a complete description:

FISH F487 W, O Fisheries Management
3 Credits Offered Spring
Theory and practice of fisheries management, with an emphasis on strategies utilized for the management of freshwater and marine fisheries. *Prerequisites: COMM F131X or COMM F141X; ENGL F111X; ENGL F211X or ENGL F213X; ENGL F414; FISH F425; or permission of instructor.* Cross-listed with NRM F487. (3+0)

GEOS 692 Snow and Snow Cover
3 Credits Offered Fall 2013
Snow cover properties condition the sub-nivean environment for plants, animals and winter biogeochemical processing, while the snow cover distribution and surface radiative properties affect energy balance and the climate. This course will examine the ramifications of these properties at local- to regional-scales, review the current state of the art for snow remote sensing and explore the role snow and snow cover play in Arctic ecosystems and human society. Lectures and labs will emphasize description, interpretation and analysis of snow and snow in the environment, including precipitation processes, snow redistribution, energy balance, snow stratigraphy, slope stability and avalanches. Field trips provide opportunities to examine how a snow cover builds up through a sequence of weather events, track the internal grain-scale metamorphic processes that alter the snow layers (wet and dry metamorphism) and examine the resulting physical, mechanical and thermal characteristics of snow layers and snow covers.

11. COURSE CLASSIFICATIONS: Undergraduate courses only. Consult with CLA Curriculum Council to apply S or H classification appropriately; otherwise leave fields blank.

H = Humanities		S = Social Sciences	

Will this course be used to fulfill a requirement for the baccalaureate core? If YES, attach form.	YES:		NO:	XX

IF YES, check which core requirements it could be used to fulfill:

O = Oral Intensive, Format 6		W = Writing Intensive, Format 7		Natural Science,("X" for Core) Format 8	

11.A Is course content related to northern, arctic or circumpolar studies? If yes, a "snowflake" symbol will be added in the printed Catalog, and flagged in Banner.

YES	X	NO	

12. COURSE REPEATABILITY:

Is this course repeatable for credit?	YES		NO	X

Justification: Indicate why the course can be repeated (for example, the course follows a different theme each time).	

How many times may the course be repeated for credit?		TIMES

If the course can be repeated for credit, what is the maximum number of credit hours that may be earned for this course?		**CREDITS**
If the course can be repeated with <u>variable</u> credit, what is the maximum number of credit hours that may be earned for this course?		**CREDITS**

13. GRADING SYSTEM: ***Specify only one. Note: Later changing the grading system for a course constitutes a Major Course Change.***

LETTER: XX **PASS/FAIL:**

RESTRICTIONS ON ENROLLMENT (if any)

14. PREREQUISITES Graduate standing or permission of instructor.

These will be *required* before the student is allowed to enroll in the course.

15. SPECIAL RESTRICTIONS, CONDITIONS None

16. PROPOSED COURSE FEES $50

Has a memo been submitted through your dean to the Provost for fee approval? No

Yes/No

17. PREVIOUS HISTORY

Has the course been offered as special topics or trial course previously? No

Yes/No

If yes, give semester, year, course #, etc.:

18. ESTIMATED IMPACT

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

The instructor, Sturm, is a member of the Geophysical Institute's research faculty. As part of his GI appointment he has requested to teach a course for the Dept. of Geology & Geophysics in the Snow-Ice_Permafrost cycle. The GI Director has approved this request. Therefore, the course will have a positive impact on the Geology & Geophysics budget, as the instructor will be paid by the GI. The department agrees to cover the cost of vehicles for 4 course field trips. A course fee of $50 is proposed to help cover costs of vehicle rentals.

The course will require a small classroom with space for up to 12 students. Suitable rooms are available at the GI and in the Reichardt Building.

19. LIBRARY COLLECTIONS

Have you contacted the library collection development officer (kljensen@alaska.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No	**XX**	**Yes**		**I have established that the journals needed for this course are available electronically through the library collections.**

20. IMPACTS ON PROGRAMS/DEPTS

What programs/departments will be affected by this proposed action?

Include information on the Programs/Departments contacted (e.g., email, memo)

The MS and PhD programs in the Dept. of Geology & Geophysics will be affected by the proposed course.

21. POSITIVE AND NEGATIVE IMPACTS

Please specify positive and negative impacts on other courses, programs and departments resulting from the proposed action.

This trial course represents a widely requested and long-sought addition to our course offerings at little

cost to the department.

JUSTIFICATION FOR ACTION REQUESTED

The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. Use as much space as needed to fully justify the proposed course.

The Dept. of Geology & Geophysics attracts students who wish to pursue MS and PhD degrees in glaciology or snow/ice/permafrost. It has been more than a decade since a snow course has been part of the graduate curriculum. We anticipate that the course will be very popular with graduate students pursuing MS or PhD degrees in Geophysics with a concentration in Snow, Ice and Permafrost. While we currently offer courses on permafrost, ice physics and glaciology, but not snow. In proposing this course, Dr. Sturm provides a welcome addition to our graduate curriculum at little cost to the department.

APPROVALS: Add additional signature lines as needed. SEE ATTACHED SIGNATURES

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

Offerings above the level of approved programs must be approved in advance by the Provost.

		Date	
Signature of Provost (if above level of approved programs)			

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE

		Date	

Signature, Chair
Faculty Senate Review Committee: ___Curriculum Review ___GAAC

___Core Review ___SADAC

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

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

***APPROVALS:** Add additional signature lines as needed.*

Signature, Chair, Program/Department of: Geology + Geophysics	Date	1/22/13
Signature, Chair, College/School Curriculum Council for: CNSM	Date	1/25/13
Signature, Dean, College/School of: CNSM	Date	1/28/13

Offerings above the level of approved programs must be approved in advance by the Provost.

Signature of Provost (if above level of approved programs)	Date	

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE

Signature, Chair Faculty Senate Review Committee: ___Curriculum Review ___GAAC ___Core Review ___SADAC	Date	

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

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

ATTACH COMPLETE SYLLABUS (as part of this application). The guidelines are online:
http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/uaf-syllabus-requirements/
The Faculty Senate curriculum committees will review the syllabus to ensure that each of the items listed below are included. If items are missing or unclear, the proposed course (or changes to it) may be denied.

SYLLABUS CHECKLIST FOR ALL UAF COURSES

During the first week of class, instructors will distribute a course syllabus. Although modifications may be made throughout the semester, this document will contain the following information (as applicable to the discipline):

1. **Course information:**
   ❑Title, ❑ number, ❑credits, ❑prerequisites, ❑ location, ❑ meeting time
   (make sure that contact hours are in line with credits).
2. **Instructor (and if applicable, Teaching Assistant) information:**
   ❑ Name, ❑ office location, ❑ office hours, ❑ telephone, ❑ email address.
3. **Course readings/materials:**
   ❑ Course textbook title, ❑ author, ❑ edition/publisher.
   ❑ Supplementary readings (indicate whether ❑ required or ❑ recommended) and
   ❑ any supplies required.
4. **Course description:**
   ❑ Content of the course and how it fits into the broader curriculum;
   ❑ Expected proficiencies required to undertake the course, if applicable.
   ❑ Inclusion of catalog description is ***strongly*** recommended, and
   ❑ Description in syllabus must be consistent with catalog course description.
5. ❑ **Course Goals (general), and (see #6)**
6. ❑ **Student Learning Outcomes (more specific)**
7. **Instructional methods:**
   ❑ Describe the teaching techniques (eg: lecture, case study, small group discussion, private instruction, studio instruction, values clarification, games, journal writing, use of Blackboard, audio/video conferencing, etc.).
8. **Course calendar:**
   ❑ A schedule of class topics and assignments must be included. Be specific so that it is clear that the instructor has thought this through and will not be making it up on the fly (e.g. it is not adequate to say "lab". Instead, give each lab a title that describes its content). You may call the outline Tentative or Work in Progress to allow for modifications during the semester.
9. **Course policies:**
   ❑ Specify course rules, including your policies on attendance, tardiness, class participation, make-up exams, and plagiarism/academic integrity.
10. **Evaluation:**
    ❑ Specify how students will be evaluated, ❑ what factors will be included, ❑ their relative value, and ❑ how they will be tabulated into grades (on a curve, absolute scores, etc.) ❑ Publicize UAF regulations with regard to the grades of "C" and below as applicable to this course. (Not required in the syllabus, but may be a convenient way to publicize this.) Faculty Senate Meeting #171: http://www.uaf.edu/uafgov/faculty-senate/meetings/2010-2011-meetings/#171
11. **Support Services:**
    ❑ Describe the student support services such as tutoring (local and/or regional) appropriate for the course.
12. **Disabilities Services: Note that the phone# and location have been updated.**
    The Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials.
    ❑ State that you will work with the Office of Disabilities Services (208 WHITAKER BLDG, 474-5655)to provide reasonable accommodation to students with disabilities.

8/1/2012

Syllabus for SNOW & SNOW COVER - GEOS 692 (3 credits)

Prerequisites: Graduate standing or permission of instructor

Time: Fall 2013, Lecture: 2.5 hours/week Tues.-Thursday: Lab: 1.5 hours/week Friday PM
Location: TBA
Instructor: Dr. Matthew Sturm, Geophysical Institute, WRRB 104C
Matthew.Sturm@gi.alaska.edu
phone: 474-5257. In urgent cases you can also reach me at my home
telephone number: 457-1898.
Office hours: ad hoc / by appointment

Course content
The course deals with snow and snow in the environment. We begin by looking at precipitation processes and snowfall, examine how a snow cover builds up through a sequence of weather events, track the internal grain-scale metamorphic processes that alter the snow layers (wet and dry metamorphism) and examine the resulting physical, mechanical and thermal characteristics of snow layers and snow covers. Next we will look at medium-scale processes of the snow cover, including snow redistribution by wind, energy balance, snow stratigraphy, slope stability, and avalanches. The snow cover properties condition the sub-nivean environment for plants, animals and winter biogeochemical processing, while the snow cover distribution and surface radiative properties affect energy balance and the climate. We will examine the ramification these properties at local to regional-scales, reviewing the current state of the art for snow remote sensing. We will pay particular attention to heterogeneous snow distributions and how they arise. We will end by exploring the role snow and snow cover play in Arctic ecosystems and human society.

Student learning outcomes
By the end of the course, students will

- have *gained* an understanding of the critical role snow plays in high latitude/high altitude natural systems,
- *understand* how the physical and thermal properties of a snow arise through a combination of weather and metamorphic processes,
- be able to *describe the* major causes of spatial variability in snowpack properties
- be able to *analyze* and *interpret* snow cover data,
- *know* where to find relevant snow information and be able to *critically evaluate* scientific papers related to snow.
- be able to dig a snow pit and *interpret* the layers in terms of processes and implications.

- **Instructional methods**
- Lectures, student presentations, literature seminars, and
- Field excursions with snow measurements.

Lectures will be interactive and will involve use of power point presentations, group discussions, and smaller computational exercises. Each student will be required to prepare and present a seminar on a topic in snow research, with a written summary of the seminar required. In addition, we will observe the build-up the Fairbanks snow cover with periodic field trips and field and laboratory measurements. In addition, material presented in the lectures will be consolidated by homework problem sets on
selected topics. Class attendance is mandatory and participation encouraged.

Course readings/materials
There is no single textbook for this class since most of the relevant literature appears in journal papers. The first text book on the list will be required and is relatively inexpensive (<$21). Some other useful, but expensive, textbooks from which material will be taken also appear below and will be available through the instructor.

1.) McClung, D. and P. Schaerer, 2006. ***The Avalanche Handbook***. The Mountaineers
2.) Pomeroy, J. W. and D. M. Gray (1995). ***Snow Cover Accumulation, Relocation and Management***, National Hydrology Research Institute.
3.) ***Handbook of Snow: Principles, Processes, Management and Use*** (1981). Edited by D. M. Gray and D.H. Male.
4.) ***Snow Ecology-An Interdisciplinary Examination of Snow-Covered Ecosystems***. Edited by H. G. Jones, J. W. Pomeroy, D. Walker and R. Hoham. Cambridge, Cambridge University Press: 266-324.

Recommended journals wherein snow literature is found:
- *Journal of Glaciology*
- *Arctic, Antarctic, and Alpine Research*
- *Journal of Geophysical Research (Earth Surface)*
- *Hydro-Meteorology*
- *Journal of Climate*

An overview compendium including some seminal papers will be distributed in class. Additional readings (scientific papers) will be made available during the courseof the class. Note that all course material will be posted on blackboard, http://classes.uaf.edu. Students are expected to make extensive use of UAF's electronic journals.

Prerequisites
Graduate standing or permission of the instructor.

Grading policy

Problem sets 30%	Mid-term 10%	Attendance 10%
Student presentations 20%	Final exam 30%	

Problem Sets: There will be a homework set of problems approximately every two weeks, which will be weighted equally. You can work in groups with a maximum of three students. Everyone must turn in their own write-up, as well as any code or spreadsheets you used to solve problems. Late homework will be accepted, however you will loose 5% per day.

Term Projects: These will involve applying concepts from class to your research, or investigating a topic on a deeper level through a literature study. The term project will involve a 5-10 page report, and a 5-10 minute class presentation at the end of the semester.

Field Trips: We will make use of the abundant availability of snow around the campus to look at snow metamorphism, layered snow, wind and snow (Murphy Dome field trip) and snow and surface energy balance. Students will need good snow footwear and warm clothing to participate.

Grade Scale: Problem sets, presentations, exams, and participation/attendance will be graded according to the following scale: 100-91% = A, 90% = A-, 89% = B+, 88-81% = B, 80% = B-, 79% = C+, 78-71% = C, 70% = C-, 69% = D+, 68-61% = D, 60% = D-, <60% = F.

Disabilities Services*:* The Office of Disability Services implements the Americans with Disabilities Act (ADA) and ensures that UAF students have equal access to the campus and course materials. I will work with the Office of Disability Services (474-5655) to provide reasonable accommodation to students with disabilities. Please let me know at the beginning of the course if accommodations should be provided.

Conduct: The **Student Code of Conduct** (p. 52 in the UAF Catalog) outlines your rights and responsibilities, as well as prohibited forms of conduct. Please be aware of the contents of the code.

Course Schedule

Part I: Snow Precipitation & Micro-Scale Physics of Snow

- Week 1: Course overview: Water/ice physics
- Week 2: Formation of snow in the atmosphere
- Week 3: Weather and snow deposition
- Week 4: Dry snow metamorphisms & densification
- Week 5: Snow melt, wet snow metamorphism transition to firn

Part II: Layered Snow Covers and Snow Redistribution

- Week 6: Wind and snow: physics
- Week 7: Wind and snow: redistribution
- Week 8: Avalanches

Part III: Special Topics in Snow Science

- Week 9: Snow Remote Sensing
- Week 10: Snow and Living Things (Plants and Animals)

Part IV: Large Scale Snow Processes & Ramifications

- Week 11: Snow instrumentation & modeling
- Week 12: Snow in the climate system
- Week 13: Snow in human society
- Week 14: Arctic snow
- Week 15: Term project presentations

Laboratories & Field Trips
Lab 1: Snow flakes: Capturing, preserving & photographing them (wherever/whenever it snows)
Lab 2: Destructive metamorphism (West Ridge/Arboretum)
Lab 3: Kinetic growth & depth hoar development (Goldstream Valley)
Lab 4: Wind-drifting, saltation, and suspension. (Murphy Dome)
Lab 5: Sintering and snow hardness (Cold Rooms @ GI or CRREL)
Lab 6: Viscosity & densification (Glen Creek, Fox)
Lab 7: Wet snow processes (Tanana or Chena River)

Some Provisional Reading Assignments

Snow Cover Introduction: Chapters 1-3: McClung, D. and P. Schaerer (2006). The Avalanche Handbook, The Mountaineers.

Snowflakes: Nakaya, U. (1954). Snow Crystals, Natural and Artificial. Cambridge, Harvard University Press.

*Snowflake*s: Magono, C. and C. W. Lee (1966). "Meteorological classification of natural snow crystals." Journal of the Faculty of Science, Hokkaido University 2(4): 321-335.

Destructive Metamorphism: Bader, H., et al. (1954). Snow and its Metamorphism, USA-SIPRE 14.

Kinetic Crystal Growth 1: Frank, F. C. (1982). "Snow Crystals." Contemporary Physics 23(1): 3-22.

Kinetic Crystal Growth 2: Colbeck, S. C. (1986). "Classification of seasonal snow cover crystals." Water Resources Research 22(9): 59S-70S.

Remote Sensing 1:Konig, M., et al. (2001). "Measuring snow and glacier ice properties from satellite." Reviews of Geophysics 39 (1): 1-27.

Remote Sensing 2:Nolin, A. (2010). "Recent advances in remote sensing of seasonal snow." Journal of Glaciology 56(200): 1141-1149.

Wet Snow Process: Marsh, P. and M. K. Woo (1985). "Meltwater movement in natural heterogeneous snow covers." Water Resources Res. 21(11): 1710-1716.

Wind and Snow 1: Bagnold, R. A. (1937). "The transport of snad by wind." The Geographical Journal 89(5): 409-438.

Wind and Snow 2: Doumani, G. A. (1966). Surface Structures in Snow. International Conference on Low Temperature Science: I. Physics of Snow and Ice, Sapporo, Japan.

Wind and Snow 3: Kobayashi, D. (1972). "Studies of snow transport in low-level drifting snow." Contributions from the Institute of Low Temperature Science A24: 1-58.

Pruitt, W. O. J. (1984). Snow and Living Things. Northern Ecology and Resource Management. Rod Olson. Edmonton, Univ. of Alberta Press: 51-77.

Snow and Society 1: Mergen, B. Snow in America