

Submit originals (including syllabus) and one copy and electronic copy to the **Faculty Senate Office**  
 See <http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures/> for a complete description of the rules governing curriculum & course changes.

**CHANGE COURSE (MAJOR) and DROP COURSE PROPOSAL**  
 Attach a syllabus, except if dropping a course.

**SUBMITTED BY:**

Department	<b>Civil and Environmental Engineering</b>	College/School	<b>CEM</b>
Prepared by	<b>Yuri Shur</b>	Phone	<b>474-7067</b>
Email Contact	<b>yshur@alaska.edu</b>	Faculty Contact	<b>Yuri Shur</b>

**1. COURSE IDENTIFICATION: As the course now exists.**

Dept	<b>CEE</b>	Course #	<b>CE F 424</b>	No. of Credits	<b>3</b>
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<b>COURSE TITLE</b>	<b>Introduction to permafrost engineering</b>
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**2. ACTION DESIRED:**  Check the changes to be made to the existing course.

Change Course	<input checked="" type="checkbox"/>	If Change, indicate below what is changing.	Drop Course	<input type="checkbox"/>
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<b>NUMBER</b>	<input checked="" type="checkbox"/>	<b>TITLE</b>	<input type="checkbox"/>	<b>DESCRIPTION</b>	<input type="checkbox"/>
<b>PREREQUISITES*</b>	<input type="checkbox"/>	<b>FREQUENCY OF OFFERING</b>	<input checked="" type="checkbox"/>		

\*Prerequisites will be required before a student is allowed to enroll in the course.

<b>CREDITS (including credit distribution)</b>	<input type="checkbox"/>	<b>3</b>	<b>COURSE CLASSIFICATION</b>	<input type="checkbox"/>
<b>ADD A STACKED LEVEL (400/600) Include syllabi.</b>	<input checked="" type="checkbox"/>	Dept. <b>CEE</b>	Course # <b>624</b>	<input type="checkbox"/>

How will the two course levels differ from each other? How will each be taught at the appropriate level?:

The 424 course will be stacked with the course 624 Frozen ground engineering. Both levels will include fundamental information on permafrost and frozen ground engineering. 624 graduate level course will require extra work in the area of graduate studies (civil, petroleum, geological engineering) including extra work in the permafrost tunnel including testing of samples from the tunnel, additional homework, case studies with review of professional papers, a project with presentation to the class and extra exam questions.

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.

<b>ADD NEW CROSS-LISTING</b>	<input type="checkbox"/>	Dept. & No.	<input type="checkbox"/>	Requires approval of both departments and deans involved. Add lines at end of form for additional signatures.
<b>STOP EXISTING CROSS-LISTING</b>	<input type="checkbox"/>	Dept. & No.	<input type="checkbox"/>	Requires notification of other department(s) and mutual agreement. Attach copy of email or memo.
<b>OTHER (specify)</b>	<input type="checkbox"/>			



**3. 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 and the appropriate Faculty Senate curriculum committee. Furthermore, any core course compressed to less than six weeks must be approved by the Core Review Committee.

COURSE FORMAT:  1  2  3  4  5  6 weeks to full semester

OTHER FORMAT (specify all that apply)

Mode of delivery (specify lecture, field trips, labs, etc.) **Lecture and work in the permafrost tunnel**

**4. COURSE CLASSIFICATIONS:** (undergraduate courses only. Use approved criteria found in Chapter 12 of the curriculum manual. If justification is needed, attach separate sheet.)

H = Humanities  S = Social Sciences

Will this course be used to fulfill a requirement for the baccalaureate core? YES  NO

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

O = Oral Intensive, \*Format 6 also submitted  W = Writing Intensive, \*Format 7 submitted  X = Baccalaureate Core

**4.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   NO

**5. COURSE REPEATABILITY:**

Is this course repeatable for credit? YES  NO

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 with variable credit, what is the maximum number of credit hours that may be earned for this course?  CREDITS

**6. COMPLETE CATALOG DESCRIPTION including dept., number, title, credits, credit distribution, cross-listings and/or stacking, clearly showing the changes you want made. (Underline new wording strike through old wording and use complete catalog format including dept., number, title, credits and cross-listed and stacked.)**

CE F424 Introduction to Permafrost Engineering (a)  
 3 Credits  
~~Offered Spring Odd-numbered Years~~  
Offered Fall  
 Introduction to permafrost and frozen ground engineering, types of permafrost and ways of its formations, factors important for permafrost existence, hazards related to permafrost, index, thermal, and mechanical properties of frozen and thawing soils, methods of thermal analysis of soil freezing and thawing, foundations design alternatives, pipelines, roads and airfields in the permafrost region. Prerequisites: CE F326; or permission of instructor.  
 Recommended: CE F422; GE F384. Stacked with CE F624  
 CE F 624 Frozen ground engineering  
 3 Credits  
Offered Fall ~~Odd-numbered Years~~  
 Nature of frozen ground, thermal properties of frozen soils, classification, physical and mechanical properties of frozen soils, subsurface investigation of frozen ground and hazards, thaw settlement and thaw consolidation, slope stability and principles of foundation design in frozen ground. Prerequisites: Training or experience in soil mechanics. (3+0). Stacked with CE F424

**7. COMPLETE CATALOG DESCRIPTION AS IT SHOULD APPEAR AFTER ALL CHANGES ARE MADE:**

CE F424 Introduction to Permafrost Engineering (a)



3 Credits

Offered Fall

Introduction to permafrost and frozen ground engineering, types of permafrost and ways of its formations, factors important for permafrost existence, hazards related to permafrost, index, thermal, and mechanical properties of frozen and thawing soils, methods of thermal analysis of soil freezing and thawing, foundations design alternatives, pipelines, roads and airfields in the permafrost region. Prerequisites: CE F326; or permission of instructor.

Recommended: CE F422; GE F384. Stacked with CE F62424

CE F 624 Frozen ground engineering

3 Credits

Offered Fall

Nature of frozen ground, thermal properties of frozen soils, classification, physical and mechanical properties of frozen soils, subsurface investigation of frozen ground and hazards, thaw settlement and thaw consolidation, slope stability and principles of foundation design in frozen ground. Prerequisites: Training or experience in soil mechanics. (3+0). Stacked with CE F424

8. **GRADING SYSTEM:** Specify only one.

LETTER:

PASS/FAIL:

9. **ESTIMATED IMPACT**

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

There will be no impact. Both courses have been taught in past with existing resources.

10. **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

Yes

Available library resources are sufficient for the course.

11. **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)

No change in programs

12. **POSITIVE AND NEGATIVE IMPACTS**

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

The 424/624 course will provide students with a thorough understanding of permafrost properties, permafrost related hazards, and permafrost engineering design and construction. They will know main Alaska's engineering problems and means of their solution. No negative impact is expected

13. **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. If you ask for a change in # of credits, explain why; are you increasing the amount of material covered in the class? If you drop a prerequisite, is it because the material is covered elsewhere? If course is changing to stacked (400/600), explain higher level of effort and performance required on part of students earning graduate credit. Use as much space as needed to fully justify the proposed change and explain what has been done to ensure that the quality of the course is not compromised as a result.





Both courses are elective and the enrollment fluctuates. As separate they cannot be taught every year and it is a big disadvantage for undergraduate students who have opportunity to take only in the last year their studies. For those who are going to stay and professionally work in Alaska knowledge of permafrost and frozen ground engineering is essential. The stacked course can be provided every year. Sharing the class with graduate students will be beneficial to undergrads because they will see the higher standards applied to graduates and will become familiar with initial stages of research.

The graduate level will require extra work in the area specific to students graduate studies (civil, petroleum, geological engineering) including additional homework, review of professional papers, a project with presentation to the class, and extra exam questions.

**APPROVALS:** (Forms with missing signatures will be returned. Additional signature blocks may be added as necessary.)

	Date	<del>9/21/14</del> 9/21/14
Signature, Chair, Program/Department of: CEG		

	Date	9-26-14
Signature, Chair, College/School Curriculum Council for: CEM		

	Date	10/6/14
Signature, Dean, College/School of: CEM		

Offerings above the level of approved programs must be approved in advance by the Provost (e.g., non-graduate level program offering of a 600-level course):

Signature of Provost (if applicable)	Date	
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**ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE.**

Signature, Chair	Date	
Faculty Senate Review Committee: <input type="checkbox"/> Curriculum Review <input type="checkbox"/> GAAC		
<input type="checkbox"/> Core Review <input type="checkbox"/> SADAC		

**ADDITIONAL SIGNATURES:** (As needed for cross-listing and/or stacking; add more blocks as necessary.)

Signature, Chair, Program/Department of:	Date	
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Signature, Chair, College/School Curriculum Council for:	Date	
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Signature, Dean, College/School of:	Date	
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Note: If removing a cross-listing, you may attach copy of email or memo to indicate mutual agreement of this action by the affected department(s).

**Frozen ground engineering**  
CE- 624 (3 credits)

**Instructor:** Yuri Shur  
Office: Duckering 237  
Email: [yshur@alaska.edu](mailto:yshur@alaska.edu)  
Phone 474-7067

**Prerequisites:** CE 326 Introduction to geotechnical engineering or similar, or permission of instructor

**Lectures:** Monday and Wednesday 3:30-5:00 PM at Duckering 342. Office Hours: Tue/Fri: 1:00-2:00 pm, Th: 11:00 am to 12:30 pm, or by appointment  
Work in the CRREL Permafrost tunnel

**Course materials**

Instructors' notes. Chapters as assigned from Johnson, GH (edit), 1981 Permafrost engineering design and construction John Wiley and Sons. Pewe, TL, 1981 Geologic hazards of the Fairbanks. . Andersland and Ladanyi 2004. Frozen ground engineering, John Wiley & Sons.

Ferrians, O.J., Jr., and Kachadoorian, R., and Green, G.W., 1969, Permafrost and related engineering problems in Alaska: U .S. Geological Survey Professional Paper 678

Technical manual, 2004. Foundations for structures: Arctic and subarctic construction. U.S. Army Corps of Engineers

Goodman, MA, 1978 World oil's handbook of arctic well completions, World oil Professional papers on permafrost science and engineering (will be specified depending on student's research goals). Specified handouts. Assigned papers available on Blackboard.

**Course description:**

Frozen ground engineering solve problems related to design, construction, and maintenance building and other structure on freezing, frozen and thawing soils. It's the most important area of applications is the permafrost region. The first part of the course provides information on to types of permafrost and ways of its formations, factors important for permafrost existence. In the permafrost tunnel you will describe and test permafrost soils. Then you will study index, thermal, and mechanical properties of frozen and thawing soils, methods of thermal analysis of soil freezing and thawing. The third part of the course integrates the previous information for evaluation of foundations design alternatives and methods of design of buildings, roads and airfields, and pipelines in the permafrost region. You will also study problems related to drilling of wells in permafrost and problems related to their integrity. Also lectures is an essential part of the course your assignments will include intensive reviews of case studies related to the field of your MS studies (civil or petroleum engineering or geological engineering). You will work individually or in a small group on a project preferably related to the area of your discipline and will present it to the class.



## **.Course calendar**

- Week 1: Overview of problems and ideas related to permafrost engineering. Permafrost distribution and factors of permafrost existence.
- Week 2: ways of permafrost formation; active layer
- Week 3: Ground ice, soil cryogenic structure, description of frozen soil. Practice with assorted photos of frozen cores from different permafrost sites.
- Week 4: Ground water and icings. Soil description, coring and testing in the permafrost tunnel.
- Week 5 index and thermal properties of frozen ground
- Week 6: Quantitative methods of evaluation of soil thawing and freezing, including work with evaluation of equations based on quasi-state conditions.
- Week 7 Course review, midterm and post-exam review
- Week 8: Thermal interaction of buildings, wells and pipelines with permafrost. Case studies with written review.
- Week 9: Foundations design alternatives. Beginning of the project.
- Week 10: Means of permafrost protection under buildings. Case studies with written review
- Week 11: Bearing capacity of shallow and pile foundations. Case studies with written review
- Week 12: Roads and airfields. Case studies with written review. Project presentation
- Week 13: Permafrost related hazards case studies with written review. Case studies with written review. Project presentation
- Week 14: Course review and final exam

## **Course goal**

The goal of this course is to prepare you for solving practical related to frozen ground engineering and to increase your knowledge and interest in the area of permafrost and frozen ground engineering

## **Learning outcomes:**

After this course, you will be able to work as an engineer proficient in the area of frozen ground engineering. You will be able to evaluate design alternatives, chose a foundation best matched to permafrost conditions and thermal and mechanical interaction of a structure and frozen or thawing soil. You will understand interaction of wells and pipelines with permafrost and principal and methods providing their integrity. You will understand contemporary scientific issues in frozen ground engineering including combine impacts of climate change and development on permafrost.

## **Format of the class:**

- I. Work with instructor:

1. Lectures
  2. Problems solving and quizzes
  3. Fieldwork in the permafrost tunnel and field sampling of frozen soil
- II. Home assignments
1. Homework is due in the beginning of class on date stated unless permission given ahead of deadline to do otherwise.
  2. Review of at least five scientific and engineering papers
  3. Project with presentation to the class.

### **Instructional methods:**

#### **Lectures and class participation:**

Class attendance is strongly recommended. Work in the field is mandatory. I expect your active participation in the class. We will discuss a previously given handout and case studies you learned and you will be asked \ questions from me and the class. Do not be afraid of wrong answers to my questions when we discuss a new topic. Your active participation is more important than the correct answer to a specific question. Ask questions at any time. Be ready for problem solving activities and quizzes at the class and always bring a calculator. You will present your project to the class.

#### **Work in the Permafrost Tunnel**

Prior to the work in the tunnel, you will study a comprehensive manual. In the tunnel I check your work with the manual by asking about ground ice, soil cryogenic structure, permafrost properties. You will core permafrost in the tunnel and test it on water content and thaw strain.

#### **Quizzes and Exams**

Quizzes will be frequently given in class to check your understanding of the studied material. Two exams (midterm and a final) will be given during the semester. Exams will consist of questions to answer and problems, which have to be solved. Each will be designed to test your understanding of critical concepts and your ability to solve problems. Typically, the exams will consist of a closed book/closed note portion of fill in the blank/multiple choice/short essay questions followed by an open book portion consisting of problems that must be solved.

#### **Review of professional papers and case studies**

You will review professional papers in the field of your MS or Ph.D. studies (civil, geological engineering, petroleum engineering, and mechanical engineering. Case studies are preferred.

#### **Project**

Individually or in a small group you will work on a project related to the field of your study. The project can be based on your review of professional papers and reports closely related to the topic of the project. It can be also based on your research.

**Grading policy**

Homework 10%.

Quizzes 20%.

Review of professional papers and case studies 15%

Project and presentation to the class 15%

Midterm exam 20%,

Final exam 20%

**Grade evaluation**

Your grade will be assessed as:

score  $\geq$  93%: A

score  $\geq$  89%: A-

score  $\geq$  84%: B+

score  $\geq$  79%: B

score  $\geq$  75%: C+

score  $\geq$  70%: C

score  $\geq$  65%: D

Otherwise F

**Student code of conduct:**

As a UAF student, you are subject to UAF's Honor Code:

*"Students will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations.*

*Violations of the Honor Code will result in a failing grade for the assignment and, ordinarily, for the course in which the violation occurred. Moreover, violation of the Honor Code may result in suspension or expulsion."*

**Disability Services:**

The office of disability services, UAF, implements the Americans with Disability Act (ADA) and insures that UAF students have equal access to the campus and course materials. If you feel that you have a disability, please contact the office of disability services (Room 203 WHIT, Phone: 474-7043). I will provide reasonable accommodation as recommended by the office of disability services.



## **Introduction to Permafrost Engineering** CE- 424 (3 credits)

**Instructor:** Yuri Shur  
Office: Duckering 237  
Email: [yshur@alaska.edu](mailto:yshur@alaska.edu)  
Phone 474-7067

Prerequisites: CE 326 Introduction to geotechnical Engineering or permission of instructor

**Lectures:** Monday and Wednesday 3:30-5:00 PM at Duckering 342. . Office hours: Tue/Fri: 1:00-2:00 pm, Th: 11:00 am to 12:30 pm, or by appointment

Tour to the CRREL Permafrost tunnel

### **Course materials**

Instructors' notes. Chapters as assigned from Johnson, GH (edit), 1981 Permafrost engineering design and construction John Wiley and Sons. Pewe, TL, 1981 Geologic hazards of the Fairbanks area and other specified handouts. Assigned papers available on Blackboard.

### **Course description:**

Permafrost engineering is the engineering discipline which provide knowledge in permafrost and approaches to design building and structures for permafrost conditions. The first part of the course provides information on to types of permafrost and ways of its formations, factors important for permafrost existence. Then you will study index, thermal, and mechanical properties of frozen and thawing soils, methods of thermal analysis of soil freezing and thawing. The third part of the course integrates the previous information for evaluation of foundations design alternatives and methods of design of buildings, roads and airfields in the permafrost region.

### **Course Calendar**

1. Week 1: Overview of problems and ideas related to permafrost engineering. Permafrost distribution and factors of permafrost existence.
2. Week 2: ways of permafrost formation; active layer
3. Week 3: Ground ice, soil cryogenic structure, description of frozen soil
4. Week 4: Ground water and icings. Tour to the permafrost tunnel.
5. Week 5 index and thermal properties of frozen ground
6. Week 6: Quantitative methods of evaluation of soil thawing and freezing
7. Week 7 Course review, midterm and post-exam review
8. Week 8: Thermal interaction of buildings, wells, and pipelines with permafrost
9. Week 9: Foundations design alternatives
10. Week 10: Means of permafrost protection under buildings
11. Week 11: Bearing capacity of shallow and pile foundations

12. Week 12: Roads and airfields
13. Week 13: Permafrost related hazards
14. Week 14: Course review and final exam

### **Course goal**

The goal of this course is to prepare your ability to professionally design, built and support structure in the permafrost region and in areas of freezing soil.

### **Learning outcomes, ABET Criteria**

After this course, you will know nature and properties of permafrost and will be able to design buildings and other structure for frozen, freezing and thawing soils. You will understand impacts of development and climate change on permafrost and know means which can prevent permafrost degradation.

This course helps to meet following ABET's criteria :

- an ability to apply knowledge of mathematics, science, and engineering;
- an ability to identify, formulate, and solve engineering problems;
- an ability to communicate effectively;
- the broad education necessary to understand the impact of engineering solutions in a global and societal context;
- a knowledge of contemporary issues;
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
- an appreciation of significant engineering issues in the North.

### **Format of the class:**

- I. Work with instructor:
  1. Lectures
  2. Problems solving and quizzes
  3. Fieldwork in the permafrost tunnel and field sampling of frozen soil
- II. Home assignments
  1. Homework. It is due in the beginning of class on date stated unless permission given ahead of deadline to do otherwise.

### **Instructional method**

#### **Lecture and Class participation:**

Class attendance is required. I expect your active participation in the class. During lectures you will be asked numerous questions and we will solve problems. Your active participation is more important than the correct answer to a specific question. Ask questions at any time. Be ready for problem solving activities and quizzes at the class and always bring a calculator.



## **Quizzes and Exams**

Quizzes will be frequently given in class to check your understanding of the studied material. Two exams will be given during the semester. Exams will consist of questions to answer and problems, which have to be solved. Each will be designed to test your understanding of critical concepts and your ability to solve problems. Typically, the exams will consist of a closed book/closed note portion of fill in the blank/multiple choice/short essay questions followed by an open book portion consisting of problems that must be solved.

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Homework 20%.

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Final exam 30%

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Your grade will be assessed as:

score  $\geq 93\%$ : A

score  $\geq 89\%$ : A-

score  $\geq 84\%$ : B+

score  $\geq 79\%$ : B

score  $\geq 75\%$ : C+

score  $\geq 70\%$ : C

score  $\geq 65\%$ : D

Otherwise F

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