Submit original with signatures + 1 copy + electronic copy to UAF Governance. See [http://www.uaf.edu/ufagen Faculty/CD](http://www.uaf.edu/ufagen Faculty/CD) for a complete description of the rules governing curriculum & course changes.

**TRIAL COURSE OR NEW COURSE PROPOSAL**

**SUBMITTED BY:**

Department: Mining and Geological Engineering
Prepared by: Dr. Debamita Misra
Email Contact: debu.misra@alaska.edu

**College/School**

CEM

**Phone**

907-474-5339

**Faculty Contact**

Dr. Debamita Misra

1. **ACTION DESIRED**

   (CHECK ONE):

   Trial Course [ ] New Course [X]

2. **COURSE IDENTIFICATION**:

   Dept [ ] GE Course # [ ] 622 No. of Credits [ ] 3

   Justify upper/lower division status & number of credits:

   [Blank space for justification]

3. **PROPOSED COURSE TITLE**:

   Unsaturated Soil Geoengineering

4. **CROSS LISTED?**

   YES/NO

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

   [Blank space for approval]

5. **STACKED?**

   YES/NO

   If yes, Dept: [ ]

6. **FREQUENCY OF OFFERING**:

   (Every or Alternate) Fall, Spring, Summer – or As Demand Warrants

   As Demand Warrants

7. **SEMESTER & YEAR OF FIRST OFFERING**

   (if approved)

   Spring 2010

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 one)

   [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [X] 6 weeks to full semester

   OTHER FORMAT (specify)

   Mode of delivery (specify lecture, field trips, labs, etc)

   Lecture

9. **CONTACT HOURS PER WEEK**:

   [ ] 3 LECTURE hours/week [ ] 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/ufagen Faculty/CD/credits.html](http://www.uaf.edu/ufagen Faculty/CD/credits.html) for more information on number of credits.

   OTHER HOURS (specify type)

10. **COMPLETE CATALOG DESCRIPTION including dept., number, title and credits (50 words or less, if possible):**

   GE F622 Unsaturated Soil Geoengineering
Fundamentals of soil physical processes, multiphase flow and transport in unsaturated porous media such as soils. Application of principles of unsaturated flow to geoenvironmental and geotechnical systems. Methods for characterization of hydraulic properties in relation to soil physical parameters in the context of geengineering problems of flow and stability. Non-isothermal flow in unsaturated soils and its impact on subsurface environment. Biogeochemical processes affecting soil and groundwater contamination. Unsaturated flow and transport modeling including heat transfer relevant to active layer dynamics and permafrost underlain soils in Alaska and other similar cold regions. Prerequisites: GE F620 or equivalent and Graduate standing in Engineering or permission of instructor. (Stacked with GE F422) (3+0)

11. COURSE CLASSIFICATIONS: (undergraduate courses only. Use approved criteria found on Page 10 & 17 of the manual. If justification is needed, attach on separate sheet.)
   H = Humanities  N = Natural Science  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,  W = Writing Intensive,
       Format 6  Format 7  Natural Science, Format 8

12. COURSE REPEATABILITY:
   Is this course repeatable for credit?  YES  X  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

13. GRADING SYSTEM:
   LETTER: X  PASS/FAIL: 

14. PREREQUISITES
   GE F620 or equivalent and Graduate standing in Engineering or permission of instructor
   These will be required before the student is allowed to enroll in the course.
   RECOMMENDED
   Classes, etc. that student is strongly encouraged to complete prior to this course.

15. SPECIAL RESTRICTIONS,
   CONDITIONS

16. PROPOSED COURSE FEES
   $  
   Has a memo been submitted through your dean to the Provost & VCAS for

17. PREVIOUS HISTORY
   Has the course been offered as special topics or trial course previously? Yes/No  No
   If yes, give semester, year, course #, etc.: This course has been offered as Independent Study in 2006 and 2007
18. ESTIMATED IMPACT
WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

None

19. LIBRARY COLLECTIONS
Have you contacted the library collection development officer (ffklj@uaf.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 [X] Yes [ ] Library has adequate collection for this course

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)

This course proposal and the stacking has been discussed with Prof. Dave Barnes of the Civil and Environmental Engineering Department of CEM. This change will not affect the CEE program.

21. POSITIVE AND NEGATIVE IMPACTS
Please specify positive and negative impacts on other courses, programs and departments resulting from the proposed action.

This course will have a positive impact on the MS and Ph.D. programs of the Geological Engineering program. The graduate students who would like to focus on Groundwater Hydrology and Geoenvironmental engineering will have a sequence of courses that they can enroll in to complete their desired degree. This course is also quite applicable to Alaskan active layer hydrologic analysis.

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.

This course will be the second in sequence (GE620-GE622-GE624) of graduate level courses to be offered in the focus area of Geohydrology and Geoenvironmental Engineering in the Geological Engineering program. This course will support the base of the existing MS program in GE and the newly developed Ph.D. program. The course will be stacked with the existing undergraduate course GE 422 to make the delivery efficient and to draw a larger pool of students to the course. The content of this course is very critical for the Active Layer Hydrodynamics, Geoenvironmental, Geotechnical issues of Alaska and their engineering applications.
APPROVALS:

Signature, Chair, Program/Department of: MIN/GE
Date 3/18/09

Signature, Chair, College/School Curriculum Council for: CEM
Date 3/3/09

Signature, Dean, College/School of: CEM
Date 3/4/09

Signature of Provost (if applicable)
Offerings above the level of approved programs must be approved in advance by the Provost.

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

Signature, Chair, UAF Faculty Senate Curriculum Review Committee
Date

ADDITIONAL SIGNATURES: (If required)

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).
Note: syllabus must follow the guidelines discussed in the Faculty Senate Guide
http://www.uaf.edu/uafgov/faculty/cd/syllabus.html.
The department and campus wide 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 change will 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 □ Student Learning Outcomes (more specific)

6. 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.).

7. 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.

8. Course policies:
   □ Specify course rules, including your policies on attendance, tardiness,
     class participation, make-up exams, and plagiarism/academic integrity.

9. 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.)

10. Support Services:
    □ Describe the student support services such as tutoring (local and/or
        regional) appropriate for the course.

11. Disabilities Services:
    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.
    □ State that you will work with the Office of Disabilities Services (203
      WHIT, 474-7043) to provide reasonable accommodation to students with
      disabilities.”
Department of Mining and Geological Engineering
Geological Engineering Program

Unsaturated Soil Geoengineering
(GE 422/622)

Catalog Description:
GE F422 Offered As Demand Warrants
3 Credits Fundamentals of soil physical processes, multiphase flow and transport in unsaturated porous media such as soils. Application of principles of unsaturated flow to geoenvironmental and geotechnical systems. Methods for characterization of hydraulic properties in relation to soil physical parameters in the context of geoengineering problems of flow and stability. Non-isothermal flow in unsaturated soils and its impact on subsurface environment. Biogeochemical processes affecting soil and groundwater contamination. Unsaturated flow and transport modeling including heat transfer relevant to active layer dynamics and permafrost underlain soils in Alaska and other similar cold regions. Prerequisites: GE F420 or equivalent course or permission of instructor. (Stacked with GE622) (3+0).

Catalog Description:
GE F622 Offered As Demand Warrants
3 Credits Fundamentals of soil physical processes, multiphase flow and transport in unsaturated porous media such as soils. Application of principles of unsaturated flow to geoenvironmental and geotechnical systems. Methods for characterization of hydraulic properties in relation to soil physical parameters in the context of geoengineering problems of flow and stability. Non-isothermal flow in unsaturated soils and its impact on subsurface environment. Biogeochemical processes affecting soil and groundwater contamination. Unsaturated flow and transport modeling including heat transfer relevant to active layer dynamics and permafrost underlain soils in Alaska and other similar cold regions. Prerequisites: GE F620 or equivalent and Graduate standing in Engineering or permission of instructor. (Stacked with GE F422) (3+0)


Other Recommended Study:
Contaminant Hydrology: Cold Regions Modeling, Grant and Iskandar, 2000. Lewis.

Course Objectives: The objective of this course is to introduce students with the theory and applications of non-isothermal fluid flow and contaminant transport in variably saturated porous media, such as the active layer in Alaska or the vadose zone of the soil, including soil physical properties that govern such processes, and numerical simulation of fluid flow and reactive transport of contaminants.

Tentative Schedule:
Lecture: Tuesdays, Thursdays, 9:45 am – 11:15 am (Meeting Place TBD)

Instructor: Debasmita Misra (Office: 307 DUCK), 907.474.5339, debu.misra@uaf.edu

Office Hours: As posted or by appointment
TOPICS COVERED:

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture (Weekly Reading)</th>
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</table>
| 1    | Introduction and Brief History (Ch. 1)  
     | Physical Properties and Characteristics of Soils (Ch. 2) |
| 2    | Physical Properties and Characteristics of Soils (Ch. 2)  
     | Behavior of Clay-Water Systems (Ch. 3) |
| 3    | Behavior of Clay-Water Systems (Ch. 3)  
     | Potential and Thermodynamics of Soil Water (Ch. 4) |
| 4    | Potential and Thermodynamics of Soil Water (Ch. 4)  
     | Chemical Properties and Principles of Soil Water (Ch. 5) |
| 5    | Principles of Water Flow in Soil (Ch. 6)  
     | Saturated/Unsaturated Water Flow in Soil (Ch. 7 & 8) |
| 6    | Unsaturated Water Flow in Soil (Ch. 8) |
| 7    | Transport of Heat and Gas in Soil and at the Surface (Ch. 9) |
| 8    | Contaminant Transport (Ch. 10) |
| 9    | Contaminant Transport (Ch. 10)  
     | Effects of Infiltration and Drainage on Soil-Water Distribution (Ch. 11) |
| 10   | Effects of Infiltration and Drainage on Soil-Water Distribution (Ch. 11)  
     | Water- and Energy Balance (Ch. 12) |
| 11   | Modeling Water, Solute and Vapor Movement in Soils (Ch. 13)  
     | Simulation of Variably Saturated Flow and Transport using Hydrus-2D (Hydrus Users Manual to be Downloaded from the USDA site) |
| 12   | Simulation of Variably Saturated Flow and Transport using Hydrus-2D (Examples of Flow and Transport in Non-isothermal Conditions) |
| 13   | Unsaturated Soil Mechanics (Ch. 1, Fredlund & Rahardjo, to be handed out)  
     | Stress State Variables, Stress Analysis, and Measurement of Shear Strength Parameters (Chs. 3 & 10, Fredlund & Rahardjo, to be handed out) |
| 14   | Physical and Thermal Properties of Frozen Ground & Heat Flow in Soils (Chs. 2, 3, & 4, Andersland and Ladanyi, to be handed out)  
     | Mechanical Properties of Frozen Soils and Frozen Soil Stability (Chs. 5 & 8, Andersland and Ladanyi, to be handed out) |
| 15   | **FINAL EXAM**  
     | Submission of Final Portfolio(GE 422) or Final Review Paper (GE 622) |

COURSE POLICIES:

- Students are expected to read the material assigned each week prior to attending the lecture.
- Homework will be assigned after a week’s lecture. For GE 422 students, the homework will comprise of solution of problems using simple analytical models or equations used for practical applications in engineering design or assessment. For GE 622 students, the homework will comprise of conceptual analyses that may require additional reading and preparation. Homework is due a week from the date of assignment.
- Pop-quizzes based on the concepts covered in the lecture or the lab will be offered periodically. A minimum of 5 and a maximum of 8 quizzes will be offered over the semester. The quizzes will be the same for the GE 422 and the GE 622 students.
- The final project will be accomplished in groups of 2-3 students for GE 422 and will be based on a simple but practical component of an engineering application. GE 622 students need to work independently in accomplishing a comprehensive assessment of a typical problem supported by alternative approaches to address such a problem.
• GE 622 students need to submit a final review paper on a specific research topic at
the end of the semester. GE 422 students would submit a portfolio of their semester
worth of information assimilated in this course.
• Besides a common set of questions and problems, both the Midterm and the Final
exam will have challenge questions for GE 622 students. These questions may be
attempted by GE 422 students for extra credits.
• Late submission of deliverables will not be accepted unless the student was sick and
can produce proof of sickness, had loss of immediate family members, or was
traveling on university business (e.g., athletes, professional presentations in
conferences, etc.).
• Students are expected to be ethical in conduct, professional in demeanor and
expected to adhere to the University of Alaska Honor Code.

**GRADING:**

Grading will be based on the cumulative performance over the semester. The weighting
scheme of each assignment will be as follows:

- **Quizzes** 10%
- **Homework** 15%
- **Midterm Exam** 15%
- **Final Project** 25% (Report 15% and Presentation 10%)
- **Final Exam** 25% (GE422)
- **Final Exam** 20% (GE622)
- **Final Portfolio** 10% (GE 422)
- **Final Review Paper** 15% (GE622)

An absolute grading policy will be followed for your final grades:

- 85% < A < 100%
- 75% < B < 85%
- 65% < C < 75%
- 50% < D < 65%
- F < 50%

**STUDENT SUPPORT SERVICES:**

CEM computer technicians are located in the Duckering building room 153 (contact phone: 474-6146).
They can help with issues related to software and hardware problems in the computer lab (310 Duckering).
Blackboard support is available through UAF OIT helpdesk. The instructor is available for any other
support required during the offering of this course. Ms. Jessica Potriskus, Office Manager of Mining and
Geological Engineering Department is available for departmental support in Room 301 Duckering (474-
7338).

**DISABILITIES SERVICES:**

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. The instructor and the office manager
of Mining and Geological Engineering program will work with the Office of Disabilities Services (203
WHIT, 474-7043) to provide reasonable accommodation to students with disabilities.

**Contribution to Professional Component:** The instructor introduces the fundamental theories of soil
physics, flow and transport, and numerical modeling of non-isothermal variably saturated flow in porous
media. The students are exposed to real world examples through assignments and homework as well as in-
class discussion. They utilize such principles of engineering, mathematics, soil mechanics, physics,
numerical methods and computer techniques and design a practical problem relevant to Alaska.
**Course Outcomes for ABET:** This course is arranged towards meeting the educational outcomes set forth by the Department of Mining and Geological Engineering.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Role of GE 422</th>
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<tbody>
<tr>
<td>(a) An ability to apply knowledge of mathematics, science, and engineering.</td>
<td>Each chapter in the textbook or class handout is accompanied by a set of problems at the end that are analytical in nature. The chapters also include examples that are reflective of the real world geohydrological problems encountered.</td>
</tr>
<tr>
<td>(e) An ability to identify, formulate, and solve engineering problems.</td>
<td>The lectures &amp; examples will provide ample opportunity to analyze, design, and solve real world examples of engineering issues related to variably saturated and frozen soils.</td>
</tr>
<tr>
<td>(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.</td>
<td>Subsurface contamination and remediation issues, soil conservation and assessment, interaction of soil with groundwater and other natural and artificial sources of contamination and its prevention are introduced through the course.</td>
</tr>
<tr>
<td>(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>Students are introduced to design, analysis and solving various problems utilizing the analytical and numerical modeling, nomographs, charts and tables.</td>
</tr>
<tr>
<td>(l) An ability to practice engineering in Alaska and arctic-related projects.</td>
<td>Students are introduced to Alaskan and arctic-related projects through their term projects.</td>
</tr>
</tbody>
</table>