Submit original with signatures + 1 copy + electronic copy to UAF Governance. See http://www.uaf.edu/uafigov/faculty/cd for a complete description of the rules governing curriculum & course changes.

TRIAL COURSE OR NEW COURSE PROPOSAL

<table>
<thead>
<tr>
<th>SUBMITTED BY:</th>
<th>Mining and Geological Engineering</th>
<th>College/School</th>
<th>CEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department</td>
<td>Mining and Geological Engineering</td>
<td></td>
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<tr>
<td>Prepared by</td>
<td>Dr. Debasmita Misra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email Contact</td>
<td><a href="mailto:debu.misra@alaska.edu">debu.misra@alaska.edu</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action Desired</td>
<td>Trial Course</td>
<td>New Course</td>
<td>X</td>
</tr>
</tbody>
</table>

1. ACTION DESIRED (CHECK ONE):

2. COURSE IDENTIFICATION:

<table>
<thead>
<tr>
<th>Dept</th>
<th>GE</th>
<th>Course #</th>
<th>No. of Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>620</td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

   Justify upper/lower division status & number of credits:

3. PROPOSED COURSE TITLE:

   Subsurface Hydrology

4. CROSS LISTED?

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>If yes, Dept:</th>
<th>Course #</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td></td>
<td></td>
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</tbody>
</table>

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

5. STACKED?

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>If yes, Dept.</th>
<th>Course #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>GE</td>
<td>420</td>
</tr>
</tbody>
</table>

6. FREQUENCY OF OFFERING:

   Fall Odd-Numbered Years or As Demand Warrants
   (Every or Alternate) Fall, Spring, Summer - or As Demand Warrants

7. SEMESTER & YEAR OF FIRST OFFERING (if approved)

   Fall 2009

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)
   - (X) 6 weeks to full semester
   
   OTHER FORMAT (specify)
   Mode of delivery
   (specify lecture, field trips, labs, etc)

   Lecture and Labs

9. CONTACT HOURS PER WEEK:

   | LECTURE hours/week | 2 |
   | LAB hours/week     | 3 |
   | 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/uafigov/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 F620 Subsurface Hydrology
3 Credits Offered Fall Odd-numbered Years or As Demand Warrants

Hydrologic, geologic and other factors controlling groundwater flow, occurrence, development, chemistry and contamination. Elementary groundwater flow theory. Interactions between surface-subsurface hydrologic systems. Hydraulic characteristics of earth materials, engineering problems and models related to subsurface fluids, and properties of water. Prerequisites: Graduate standing in Engineering or permission of instructor. (Stacked with GE F420) (2+3)

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, □ Natural Science, □ Format 6 □ Format 7 □ Format 8 □

12. COURSE REPEATABILITY:  
□ 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 □ CREDITS

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

14. PREREQUISITES  
□ Graduate standing in Engineering or permission of instructor

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 □  
If yes, give semester, year, course #, etc.: This course has been offered as Independent Study in 2007 and 2008
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.

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.

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 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 being the first one in the sequence.

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

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.

GE 620 was offered as an advanced course in Groundwater Hydrology. However, the instructor realized that some of the graduate students enrolled previously did not have adequate basic background to be able to successfully complete an advanced course. Some graduate students were also reluctant to enroll in GE 420 to obtain the fundamental knowledge due to limitations in the number of 4xx level courses that are approved for graduate studies. Hence, the instructor has proposed this stacked GE420 and GE620 to overcome the aforementioned concerns. Besides, with the newly developed Ph.D. program and to expand the existing MS program in GE, this course would serve as the first course of a sequence of courses that a graduate student with focus in Geohydrology and Geoenvironmental Engineering could enroll in.
APPROVALS:

Signature, Chair, Program/Department of: MIN/GE
Date 3/8/09

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/ufgov/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

Subsurface Hydrology
(GE 420/620)

RATIONALE: This course will present an overview of the methods and principles of geohydrology. The first third of the course will review basic processes and principles associated with the movement of water in the subsurface. The second third will focus on concepts and methods for analyzing porous media flow and well hydraulics. The course will conclude with presentations on conceptual models of regional geohydrology and issues related to water quality and remediation.

2008-09 Catalog Description:
GE F420
3 Credits Offered Every Fall
Hydrologic, geologic and other factors controlling groundwater flow, occurrence, development, chemistry and contamination. Elementary groundwater flow theory. Interactions between surface-subsurface hydrologic systems. Hydraulic characteristics of earth materials, engineering problems and models related to subsurface fluids, and properties of water. Prerequisites: GE F365 or permission of instructor; MATH F302; PHYS F211X. (Stacked with GE F620) (2+3)

Description:
GE F620
3 Credits Offered Fall Odd-numbered Years or As Demand Warrants
Hydrologic, geologic and other factors controlling groundwater flow, occurrence, development, chemistry and contamination. Elementary groundwater flow theory. Interactions between surface-subsurface hydrologic systems. Hydraulic characteristics of earth materials, engineering problems and models related to subsurface fluids, and properties of water. Prerequisites: Graduate standing in Engineering or permission of instructor. (Stacked with GE F420) (2+3)

Recommended Textbook:

Other Recommended Study:

Course Objectives: To educate students in basic processes and principles associated with the movement of water in the subsurface and its effect on the environment, soils and related engineering issues, concepts and methods for analyzing porous media flow and well hydraulics, and development and application of conceptual models of regional geohydrology and issues related to water quality and remediation.

My objective for this course is that by the end of the semester you should be able to:

> Develop a basic understanding of ground water hydrology and the mechanics of fluid flow in porous media.
> Develop an understanding of the various processes that govern ground water movement.
> Develop and understand a conceptual model of how fluids flow through porous media subject to different boundary conditions.
➤ Understand Darcy’s law and how it applies to flow through porous media.
➤ Develop a thorough understanding of the various methods utilized to measure aquifer parameters
➤ Develop thorough understanding of the contamination and water quality issues in ground water aquifers.
➤ Solve basic mathematical issues pertinent to hydrogeology.
➤ Additionally, the graduate students are expected to –
  o be able to apply the principles of groundwater dynamics in the design of hydrogeologic experiments and investigations;
  o be able to use the hydrogeologic literature to do research, including being able to synthesize information that appear in the literature; and
  o be conversant in areas of contemporary research development in the field.
➤ Present yourself as an independent subsurface hydrologist upon graduation.

Tentative Schedule:
Lecture: Mondays, Wednesdays, 9:45 am – 10:45 pm (Meeting Place TBD)
Lab: Fridays, 2:00 pm – 5:00 pm (416 DUCK)

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>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction &amp; Hydrologic Balance (Ch. 1)</td>
<td>GE 420: Water Budget: Precipitation and Evaporation&lt;br&gt;GE 620: Analysis of a selected basin’s water budget for a resource development application (Precipitation and Evaporation estimation and mapping)</td>
</tr>
<tr>
<td>2</td>
<td>Physical Properties (Ch. 2)</td>
<td>GE 420: Water Budget: Runoff, Storage, and Groundwater Flow&lt;br&gt;GE 620: Analysis of a selected basin’s water budget for a resource development application (Runoff, Storage, and Groundwater Flow component assessment with respect to overall usage of the basin)</td>
</tr>
<tr>
<td>3</td>
<td>Principles of Flow (Ch. 3)</td>
<td>GE 420: Bulk Density, Porosity, Specific yield and Specific retention measurements for a typical soil&lt;br&gt;GE 620: Assessment of impact of Bulk Density, Porosity, Specific Yield and Specific Retention on Porous Media hydraulic properties</td>
</tr>
<tr>
<td>4</td>
<td>Geology and Groundwater (Ch. 4)</td>
<td>GE 420: Field and Laboratory Estimation of point Hydraulic Conductivity&lt;br&gt;GE 620: Generation of Hydraulic Conductivity variations from point data measurements and geophysical analog information</td>
</tr>
<tr>
<td>5</td>
<td>Deformation Storage and General Flow Equations (Ch. 5)</td>
<td>GE 420: Modeling Groundwater Flow with Flownets</td>
</tr>
<tr>
<td>Week</td>
<td>Topic</td>
<td>Assignments</td>
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<tr>
<td>6</td>
<td>Steady Groundwater Hydraulics (Ch. 6)</td>
<td>GE 620: Analysis of errors and limitations of modeling groundwater flow with Flownets</td>
</tr>
<tr>
<td></td>
<td><strong>MID TERM EXAM</strong></td>
<td>GE420/GE620: Visual Modflow Exercise 1 (INTRO)</td>
</tr>
<tr>
<td>7</td>
<td>Steady Groundwater Hydraulics (Ch. 6)</td>
<td>GE420/GE620: Visual Modflow Exercise 2 (Mine Dewatering Example Setup)</td>
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<tr>
<td></td>
<td></td>
<td>Proposal and Initiation of Final Project</td>
</tr>
<tr>
<td>8</td>
<td>Unsteady Groundwater Hydraulics (Ch. 7)</td>
<td>GE420/GE620: Visual Modflow Exercise 3 (Zone Budget Application and Particle Tracking)</td>
</tr>
<tr>
<td>9</td>
<td>Unsteady Groundwater Hydraulics (Ch. 7)</td>
<td>GE420/GE620: Visual Modflow Exercise 4 (Aquifer Stress Variability and Reactive Transport)</td>
</tr>
<tr>
<td>11</td>
<td>Groundwater Chemistry (Ch. 9)</td>
<td>GE 420: Interpret Water Chemistry and Water Quality Data</td>
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<td></td>
<td></td>
<td>GE 620: Relate Water Chemistry to Geology</td>
</tr>
<tr>
<td>12</td>
<td>Groundwater Contamination (Ch. 10)</td>
<td>GE 420/GE620: Contaminant Transport using Breakthrough Curve Analysis with Review of an Example of a Field Tracer Test</td>
</tr>
<tr>
<td>13</td>
<td>Groundwater Contamination (Ch. 10)</td>
<td>Final Project</td>
</tr>
<tr>
<td>14</td>
<td>Groundwater Development and Management</td>
<td>Final Project (Report and Presentation)</td>
</tr>
<tr>
<td></td>
<td>(Handouts to be provided in week 13)</td>
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<tr>
<td>15</td>
<td><strong>FINAL EXAM</strong></td>
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<tr>
<td></td>
<td>Submission of Final Portfolio (GE 420) or Final Review Paper (GE 620)</td>
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</tbody>
</table>

**COURSE POLICIES:**

- Students are expected to read the material assigned each week prior to attending the lecture.
- Lab exercise will be provided via Bb at least two days prior to the lab class. Students are expected to review the exercise and be conversant with the expectations of each lab vis-à-vis the associated lecture prior to the lab session. Each exercise may contain either information to be filled out from experiments, analyses or questions to be answered and reported. A lab report is due (preferably as a word document) a week after each lab period.
- Homework will be assigned after a week’s lecture. For GE 420 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 620 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 420 and the GE 620 students.
- The final project will be accomplished in groups of 2-3 students for GE 420 and will be based on a simple but practical component of an engineering application. GE 620 students need to work independently in accomplishing a comprehensive assessment of a typical problem supported by alternative approaches to address such a problem.
GE 620 students need to submit a final review paper on a specific research topic at the end of the semester. GE 420 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 620 students. These questions may be attempted by GE 420 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:

- Laboratory 10%
- Quizzes 10%
- Homework 10%
- Midterm Exam 15%
- Final Project 25% (Report 15% and Presentation 10%)
- Final Exam 20% (GE420)
- Final Exam 15% (GE620)
- Final Portfolio 10% (GE 420)
- Final Review Paper 15% (GE620)

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 Potrikus, 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 groundwater assessment, flow and transport, and exploration techniques. The students are exposed to real world examples in the field and the laboratory and they utilize 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 420</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) An ability to apply knowledge of mathematics, science, and engineering.</td>
<td>Each chapter in the textbook 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>(b) An ability to design and conduct experiments, as well as to analyze and interpret data.</td>
<td>The laboratory experiments and modeling will provide first hand experience in designing of experiments and analysis of the data.</td>
</tr>
<tr>
<td>(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.</td>
<td>The modeling and analysis of hydrogeological problems will be accomplished by designing the fluid flow system from the basics and formulating a numerical model to solve problems related to characterization, design, and monitoring of subsurface hydrological processes.</td>
</tr>
<tr>
<td>(d) An ability to function on multi-disciplinary teams.</td>
<td>Group assignments and group projects are assigned through the course such that the students are introduced to teams that are multi-disciplinary in nature. Besides working with agencies on the term project involves multi-disciplinary functioning.</td>
</tr>
<tr>
<td>(e) An ability to identify, formulate, and solve engineering problems.</td>
<td>The lectures and laboratory components of the course will provide ample opportunity to solve real world examples of subsurface hydrological design and analysis.</td>
</tr>
<tr>
<td>(f) An understanding of professional and ethical responsibility.</td>
<td>The course being targeted to the senior students, professionalism and work ethics are inherently introduced through the several assignments in the course as well as through the group project assignments.</td>
</tr>
<tr>
<td>(g) An ability to communicate effectively</td>
<td>The course has components wherein students are required to present their term projects and assignments in an effective manner.</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, groundwater conservation and assessment, evaluation of subsurface water resources and its development, groundwater interaction with natural and artificial sources of contamination and its prevention are introduced throughout 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, and through laboratory assignments.</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 laboratory assignments, field studies, and term projects.</td>
</tr>
</tbody>
</table>