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

TRIAL COURSE OR NEW COURSE PROPOSAL

SUBMITTED BY:

Department	Geology and Geophysics	**College/School**	CNSM
Prepared by	Jeff Freymueller	**Phone**	X7286
Email Contact	Jeff.freymueller@gi.alaska.edu	**Faculty Contact**	

**1. ACTION DESIRED
(CHECK ONE):**   Trial Course [ ]   New Course [X]

2. COURSE IDENTIFICATION: Dept **GEOS**   Course # **636**   No. of Credits **2**

Justify upper/lower division status & number of credits: The course is intended for beginning graduate students or experienced undergraduates.

3. PROPOSED COURSE TITLE: Beyond the Mouse: Computer Programming and Automation for Geoscientists

**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 such signatures.)

**5. To be STACKED?
YES/NO**   **YES**   If yes, Dept. **GEOS**   Course # **436**

6. FREQUENCY OF OFFERING: Every Fall

Fall, Spring, Summer (Every, or Even-numbered Years, or Odd-numbered Years) — or As Demand Warrants

RECEIVED

7. SEMESTER & YEAR OF FIRST OFFERING (if approved)   **Fall 2012**

SEP 2 6 2011

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 into fewer than six weeks must be approved by the core review committee.

Dean's Office
College of Natural Science & Mathematics

COURSE FORMAT:
(check all that apply)   [ ] 1   [ ] 2   [ ] 3   [ ] 4   [ ] 5   [X] 6 weeks to full semester

OTHER FORMAT (specify)

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

9. CONTACT HOURS PER WEEK: **1** LECTURE hours/weeks   **3** 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/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):

GEOS 436 Beyond the Mouse: Computer Programming and Automation for Geoscientists

Basic concepts of computer programming and effective automation of tasks using a computer, with an emphasis on tools and problems common to the geosciences and other physical sciences. Use of MATLAB, shell scripting and various command line tools for data analysis, making scientific figures, maps and visualizations.

Governance
10/7/11 K.Q.

GEOS 636 Beyond the Mouse: Computer Programming and Automation for Geoscientists

Basic concepts of computer programming and effective automation of tasks using a computer, with an emphasis on tools and problems common to the geosciences and other physical sciences. Use of MATLAB, shell scripting and various command line tools for data analysis, making scientific figures, maps and visualizations.

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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 ☐   S = Social Sciences ☐

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

IF YES, check which core requirements it could be used to fulfill:
O = Oral Intensive, Format 6 ☐   W = Writing Intensive, Format 7 ☐   Natural Science, Format 8 ☐

12. 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

13. GRADING SYSTEM: *Specify only one.*
LETTER: ☐   PASS/FAIL: ☒

RESTRICTIONS ON ENROLLMENT (if any)

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

15. SPECIAL RESTRICTIONS, CONDITIONS ☐

16. PROPOSED COURSE FEES $

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

17. PREVIOUS HISTORY
Has the course been offered as special topics or trial course previously?   **YES**
Yes/No

If yes, give semester, year, course #, etc.:   Fall 2009, 2010 and Fall 2011, as GEOS 692

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

The course makes use of the existing departmental computer lab. The number of students who can be supported in the course is limited by the size of the lab. There will be no significant budgetary impact unless there is a future need to expand the lab. The course normally should have a TA, which can be half of a TA's typical load.

The course will become a regular part of Freymueller's workload, which is being reconfigured in the revamped graduate Geophysics curriculum. The course may be shared or taught by another professor from time to time to keep workloads in balance.

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 [X] Yes [ ] Library resources are not required for the 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)

The trial course has had 2 students from the Biology and Wildlife department each of the last two years. Other past versions of the trial course have included students from Atmospheric Sciences and from Chemistry. It may draw students from other departments, but the primary impact will be within the Geology and Geophysics department.

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

This course assumes no prior experience and gives students the basic skills they will need to work computational or numerical problems in other courses, and to get them beyond the steepest part of the learning curve so they can move forward on their own to refine their skills for their own research. For students without this base of knowledge, this course will prepare them to succeed in the numerical/computational part of Foundations of Geophysics, and in similar material in other graduate classes. Undergraduates taking the course will be better prepared for graduate school, an important factor given that a graduate degree is required for many entry-level jobs in geosciences. The course is heavily project-oriented to give students the opportunity to integrate knowledge into their daily routine.

No negative impacts are anticipated. The emphasis of this class is on tools and problem solving for the geosciences, a very different objective from computer science courses. Certainly students could learn computer programming by taking courses in computer science, but in practice very few of our students take those courses because the intended audience and emphasis are very different.

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.

An increasing fraction of our incoming graduate students, now a majority, are arriving without any prior exposure to computer programming, and with no experience with a computer outside of today's highly interactive, graphical operating systems. Yet more and more of today's geophysical research demands computationally intensive exploitation of large data sets, which cannot be done by pointing and clicking. Other graduate courses have been trying to incorporate numerical or computational problems among their assignments, but this then forces every professor either to spend significant time teaching students the basics of programming or to leave much of the class unable to do the assignment.

This course assumes no prior experience and gives students the basic skills they will need to work computational or numerical problems in other courses, and to get them beyond the steepest part of the learning curve so they can move forward on their own to refine their skills for their own research. It will teach basic skills required for success in modern geophysical research. It will allow us to increase the number of computational or numerical problems assigned in other graduate classes. Finally, it will leave students better prepared to do the tasks they will need to do in their own research, because it will have taken them up the steepest part of the learning curve. This is justified by the experience from the three trial runs so far, and the way students who took the course are now approaching their research.

The course focuses on specific tools and kinds of problems that appear commonly in the geosciences, including dealing with time series of data, reformatting/preprocessing of data, scientific visualization, and so on. It introduces tools that many students can use in their own research, and stresses the use of self-documenting scripts and programs as a tool to document and replicate work.

APPROVALS:

	Date	9/26/11
Sarah Fowell		

Signature, Chair, Program/Department of: Geology & Geophysics

	Date	10/6/11

Signature, Chair, College/School Curriculum Council for: CNSM

	Date	Oct 7, 2011

Signature, Dean, College/School of: CNSM

	Date	

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

	Date	

Signature, Chair, UAF Faculty Senate Curriculum Review Committee

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

	Date	

Signature, Chair, Program/Department of:

	Date	

Signature, Chair, College/School Curriculum Council for:

	Date	

Signature, Dean, College/School of:

Sample Syllabus for GEOS 436/636

The remainder of this file is the actual syllabus for the current trial version of the course, which is being offered as GEOS 692. The trial course was developed collaboratively by Freymueller and graduate student Ronni Grapenthin – in fact, the course was Grapenthin's brainchild. The results of the trial courses have been significant enough that we aim to integrate it into the curriculum as a formal course with a permanent instructor. More information about the course is available online:

http://www.gps.alaska.edu/programming/

The 2010 version of the trial course is also online:

http://www.gps.alaska.edu/programming_2010/

That version includes the lecture presentations in PDF format for the entire semester, as they were delivered in Fall 2010. A 2009 version is also available.

The trial course was not stacked and was offered pass/fail. The homework exercises and labs are all equally appropriate for senior level undergraduates and for graduate students, and will be graded in the same way. The expectations and grading for the final project, however, will be different. Graduate students are expected to carry out a complete project within their own field of specialization (this can and should be something that helps them in their own research). The instructor and TA will help undergraduates develop a simpler project, which will be graded accordingly. Undergraduates who are involved in undergraduate research will be encouraged to define a project that will assist them with or advance their research project.

GEOS 692: Beyond the Mouse 2011 – Programming and Automation for Geoscientists (2 Cr.)

"Programming is legitimate and necessary academic endeavor."

Donald E. Knuth

Instructors:

Ronni Grapenthin
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Overview:

In the (geo)sciences -as in many other disciplines- we collect data which need to be analyzed in ways that depend on the problem posed. The ability to modify your environment according to your needs instead of having it dictate how you approach a problem is invaluable. This is especially true in a setting that is supposed to generate fresh knowledge. Also, and this may be even more important, *we are lazy people.* We do not want to waste time by repeating the same steps again and again, and ... again. Such boredom causes errors. And being bored by such routines is totally legitimate. A computer (the machine , and earlier the person) exists to perform such routines reliably and repetitively: It takes in data, manipulates it following *your* commands (YEAH!), and gives the respective result. The point of writing computer programs is to *automate an intellectual challenge that has been solved* and make it reusable at all times - for yourself and ideally for others.

What this course is:

The intent is to hand you tools that will allow you to massage data in exactly the way you want it to be. We will start out manipulating your thinking, introduce you to programming in general, and then take off into specific working environments namely Unix/Linux and Matlab while teaching you how to map your data using GMT. We will cover many things in a short amount of time which means that we will give you many pointers which you can follow up on depending on your needs.

What it is not:

Complete.

Prerequisites:

none.

Textbook:

No textbook exists for this course. Handouts and lecture slides will be provided.

Grading:

This 2 credit class is pass/fail. Passing is based on mostly weekly homework assignments/lab exercises, and a final project (percentages of individual labs depend on total number of labs (max. 12)):

Labs+Homework+Project Presentation	70%
Homework	1/2 Lab
Project Presentation	1 Lab
Final Project	30%
Pass	>= 50%

Attendance and activity in class will be taken into consideration to raise the grade by small amounts, if necessary and justified.

The homework exercises consist of:

- Basic application of methods and practices presented in class
- One complex problem that will contribute directly to your final project / thesis work (that's the goal!)

The labs help you apply things taught in class. The complexity of the labs varies. Usually they consist of a simple introduction problem to get you used to the environment, understand new commands, etc. In a second part you will apply this in a slightly more complex way to data, or simply write more complex code.

The final project will (hopefully) be specific to your research project. We want to encourage you to set up an efficient and safe environment in which you apply the methods and tools introduced in class. In the beginning of the semester you will provide us with a snapshot of your project directory (If you don't have one, don't bother). Send rudimentary datafiles - scripts/programs should be executable. You will do the same at the end of the term. Our expectations include (further specification later in the term):

- versioning,
- data backup,
- parametrization
- automation (makefiles, creating documentation from source, ...)
- reuse, efficiency, documentation

Policies and makeup-labs:

You are subject to the UAF Student Code of Conduct (http://www.uaf.edu/catalog/current/academics/regs3.html). We will work with the Office of Disabilities Services (203 WHIT, 474-5655) to provide reasonable accommodation to student with disabilities. Makeup versions of labs will be provided if we have a convincing reason to do so. The makeup must occur prior to final project presentations.

Schedule:

The class meets: Mon (lecture+lab) + Tues (lab) 3:30-5:30 pm in REICH 316.

Sep 08	Introduction	Jeff Freymueller , Ronni Grapenthin
Sep 12,13	Lecture 1: Thinking Programs	Ronni Grapenthin
	Lab 1: Organizing your ideas	
Sep 19,20	Lecture 2: Fundamental Programming Principles I: Variables and Data Types	Ronni Grapenthin

	Lab 2: Matlab and Variables	
Sep 26,27	Lecture 3: Matlab I: (Advanced) Variables and functions	Jeff Freymueller
	Lab 3: Matlab structs and functions	
Oct 03,04	Lecture 4: Fundamental Programming Principles II: Control Structures	Ronni Grapenthin
	Lab 4: Matlab flow control	
Oct 10,11	Lecture 5: Matlab I/O I	Ronni Grapenthin
	Lab 5: Matlab I/O I (files)	
Oct 17,18	Lecture 6: Matlab I/O II	Ronni Grapenthin
	Lab 6: Matlab I/O II (plotting)	
Oct 24,25	Lecture 7: Unix Tools I	Jeff Freymueller
	Lab 7: Unix Tools	
Oct 31, Nov 01	Lecture 8: Unix Tools II	Jeff Freymueller
	Lab 8: Unix Tools	
Nov 07,08	Lecture 9: Live Shell Scripting	Ronni Grapenthin
	Lab 9: Unix Tools	
Nov 14,15	Lecture 10: Debugging	Ronni Grapenthin
	Lab 10: Debugging	
Nov 21,22	Lecture 11: GMT I	Bernie Coakley
	Lab 11: GMT – Data mapping	
Nov 28,29	Lecture 12: GMT II	Bernie Coakley
	Lab 12: GMT – Data mapping	
Dec 5-12	Independent Study: HTML	Ronni Grapenthin
	Lab 13: Setting up a website for project presentation	

Prior to each lecture you will find handouts, examples, and problem sets here. The problem sets are supposed to get you started poking around on your system and/or change the way you approach problems. The handouts will form some sort of mini-handbook that could be placed next to your computer.

Mailing List:
To discuss issues with labs, projects and general programming issues with your fellow students, we set up the mailing list:
btm2011@gi.alaska.edu
Please sign up at http://dogbert.gi.alaska.edu/mailman/listinfo/btm2011 and use this list first to ask your questions.

Notes:
If you do not have access to a unix-linux-mac environment, we recommend a that you install a similar setup on your own computer, like we'll have in the lab. We will use virtualbox as a virtualization software which allows to run, say, a linux distribution within a running Windows (no rebooting

required). Once virtualbox is installed you need to put a linux distribution of your choice (maybe ubuntu) on top of this. See Ronni (ronni <at> gi <dot> alaska <dot> edu) if you need help with that.