

Submit original with signatures + 1 copy + electronic copy to Faculty Senate (Box 7500).

See <http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures/> for a complete description of the rules governing curriculum & course changes.

TRIAL COURSE OR NEW COURSE PROPOSAL

APPROVED BY

Department	Geology and Geophysics	College/School	F627 XX CNSM
Prepared by	Carl Tano	Phone	907 474 5457

1. ACTION DESIRED
(CHECK ONE):

[Course number is F627, 2/21/2012 JH]

Trial Course	<input type="checkbox"/>	New Course	<input checked="" type="checkbox"/>
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2. COURSE IDENTIFICATION:

Dept	GEOS	Course #	F609	No. of Credits	3
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Justify upper/lower division status & number of credits:

This is a graduate-level science class with MATH F202X (Calculus III) and MATH F314 (Linear Algebra) as prerequisites.

3. PROPOSED COURSE TITLE:

Inverse Problems and Parameter Estimation

4. To be CROSS LISTED?

NO	If yes, Dept:	Course #:
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Prerequisites: MATH F202X and MATH F314; or permission of instructor. (3+0)

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

H = Humanities

S = Social Sciences

Will this course be used to fulfill a requirement for the baccalaureate core? If YES, attach form.

YES:

NO:

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

How many times may the course be repeated for credit?

TIMES

If the course can be repeated for credit, what is the maximum number of credit hours that may be earned for this course?

CREDITS

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

CREDITS

20. IMPACTS ON PROGRAMS/DEPTS

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

[REDACTED]

The Department of Geology and Geophysics will be affected by this proposal action in the sense that

[REDACTED]

APPROVALS: Add additional signature lines as needed

Signature, Chair, Program/Department of _____ Date _____

Signature, Chair, Program/Department of

Signature, Chair, College/School _____ Date 9/30/11

Signature, Chair, College/School

Signature, Dean, College/School of _____ Date Oct 3, 2011

Signature, Dean, College/School of

CNSH

Signature of Provost (if applicable) _____ 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

Signature, Chair _____ Date _____

Signature, Chair

Faculty Senate Review Committee: ___Curriculum Review ___GAAC

___Core Review ___SADAC

Course number is F627 (as of 2/21/2012, JH).

XX

QUICK REFERENCE: Section 8 contains the calendar of topics and deadlines.

1. Course information.

GEOS F609 **Inverse Problems and Parameter Estimation**, 3 credits, Spring 2013

Meeting times: Tuesday and Thursday, 9:45-11:15

Meeting location: TBD

Prerequisites: MATH 202 (Calculus III) and MATH 314 (Linear Algebra); or permission of instructor

2. Instructor information.

Instructor: Carl Tape

Office: 413D Elvey (Geophysical Institute)

Email: carltape@gi.alaska.edu

Phone: (907) 474-5456

Office hours: Wednesday, 10:00–11:00, or by appointment

3. Course materials.

- (a) **Textbooks.** The required (R) and supplemental (S) textbooks are (see “References” at the end of this syllabus) listed in the following table. “Software” lists the software (if any) used in ~~programs within each book~~

Textbook	R	S	Software	Availability			
				UAF bookstore	Mather reserve	PDF	UAF e-book
[1] Aster	X		Matlab		X		X
[2] Tarantola	X		none		X	X	
[3] Weisberg		X	R		X		X
[4] Menke		X	none		X		
[5] Parker		X	none		X		

- (b) Journal articles (and PDF books) assigned as reading will be available as PDFs through the course website on UAF Blackboard.
- (c) Students will need computers for their homework. General-use computers in UAF labs will be made available to students if needed.
- (d) Matlab will be the primary computational program for the course. Matlab is available via a UAF-wide license.

and sampling approaches. Assignments require familiarity with linear algebra and computational tools such as Matlab.

5. Course goals.

We will explore the ubiquitous realm of inverse problems in Earth sciences: how to use observations to make inferences about underlying physical quantities or processes. Our ultimate goal is to be able to recognize the fundamental components of an inverse problem — measurements, model parameters, misfit function, forward model — then to pose an approach to solving the problem, then solve the problem with computational algorithms. Concepts of inverse theory and parameter estimation are fundamental to all observational scientists, which includes most students in the natural sciences.

8. Course calendar (tentative).

	Day	Date	Topic	Reading Due [†]	Homework Due	Homework Assigned
1	Thurs	Jan-17	Overview of inverse problems	A1		PS-1
2	Tues	Jan-22	Review of linear algebra	A4		

3	Thurs	Jan-24	Review of vector calculus	AC	PS-1	PS-2
4	Tues	Jan-29	Method of least squares, Part I	T1,T3		
5	Thurs	Feb-1	Method of least squares, Part II	T1,T2	DC 1	DC 2

6	Tues	Feb-05	Simple linear regression	A2,W2		
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8	Tues	Feb-12	Data visualization	W1		
9	Thurs	Feb-14	Model selection	W10	PS-4	PS-5
10	Tues	Feb-19	Discretization	A3		
11	Thurs	Feb-21	Collinearity and rank deficiency	A4	PS-5	PS-6
12	Tues	Feb-26	Singular value decomposition	A4		
13	Thurs	Feb-28	Regularization	A6, A7	DC 6	DC 7

14	Tues	Mar-05	Principal component analysis	handout		final project
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9. Course policies.

- (a) **Attendance:** All students are expected to attend and participate in all classes.
- (b) **Tardiness:** Students are expected to arrive in class prior to the start of each class. If a student

does arrive late, they are expected to do so quietly and inform the instructor without disturbing the class.

- (c) **Participation and Preparation:** Students are expected to come to class with assigned read-

ing and other assignments completed as noted in the syllabus

(d) **Assignments:**

- i. All assignments are due at the start of class on the due date noted in the Syllabus.

(c) Overall course grades are based on the following criteria:

A	$x \geq 93$	excellent performance:
A-	$90 \leq x < 93$	student demonstrates deep understanding of the subject
B+	$87 \leq x < 90$	strong performance:
B	$83 \leq x < 87$	student demonstrates strong understanding of the subject,
B-	$80 \leq x < 83$	but the work lacks the depth and quality needed for an 'A'
C+	$77 \leq x < 80$	average performance:
C	$73 \leq x < 77$	student comprehends the essential material
C-	$70 < x < 73$	as reflected by the average quality of assignments

D	$60 \leq x < 70$	below average performance: student demonstrates comprehension of some concepts
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