

GEOLOGY 550 FLUVIAL PROCESSES

GENERAL

Geology 550 is an upper-division and graduate course intended for students who are interested in a deeper understanding of the processes shaping stream channels and transporting sediment. The approach taken in this class is *not* descriptive (for that try Geology 350); it is quantitative. I emphasize an understanding of the physics and mechanics of hydraulic and erosional processes active in streams; this involves both qualitative understanding and quantitative (i.e., mathematical) analysis. I expect people enrolled in this course to have taken at least the first semester of physics (i.e., mechanics) and to have finished their calculus sequence. You will need to be competent in use of spreadsheets. We will be making fairly extensive use of mathematics, but I will try to bring out the physical significance of the terms in the equations. The labs and exams will involve a substantial amount of calculation as well as logical, analytical reasoning.

I expect all students enrolled in the class to participate in field trips and class discussion. A part of your overall grade (see GRADING below) will depend on participation.

TEXTS

The required texts for the course are:

L. Dingman: **Fluvial Hydrology** (W.H. Freeman, 1984) and

D. Knighton: **Fluvial Forms and Processes** (Edward Arnold, 1998)

Dingman is now out of print. I have put one copy of each of these books on 2-hour reserve in the Library. Xerox copies of the relevant chapters are also available in the geology stockroom (VMH 108).

OTHER READINGS

Other required readings are indicated in the course outline or may be assigned in class. Several copies of these articles will be placed on reserve in the Geology stockroom (VMH 108) and may be checked out overnight.

EXAMS

There will be one midterm and a comprehensive final (see syllabus.) Exams will be open book/notes, but with no collaboration with others.

The midterm will be given during the week of Mar. 9 - 13. It will be a modified take-home exam. Specifically, I will make the midterm available in the Geology department office (FH 7) by 9AM on Monday, Mar. 9. You can pick it up anytime between then and noon, Friday, Mar. 13. Once you pick it up, you can have up to 4 hours to complete it. All midterms need to be returned to me, or to my mailbox in the department office by 4 PM on the 13th.

The final exam is officially scheduled for May 12 from 8-10 AM, but I intend to use the same format as for the midterm. It will be available in the Geology office by 9AM on Monday, May. 11. You can pick it up anytime between then and noon, Thursday, May. 14. Once you pick it up, you can have up to 4 hours to complete it. All exams need to be returned to me, or to my mailbox in the department office by 4 PM on the 14th.

GRADING

Midterm.....	15%
Final.....	25%
Labs.....	50%
Class participation.....	10%

LAB INFORMATION

The labs will consist of a mixture of lecture (to explain material/concepts), in-class work, discussion, field trips, and problem sets. You can anticipate an average of 8–10 hours of work per week on these *outside* of class. **All labs or problem sets are due at the following lab meeting unless otherwise indicated in class or on the syllabus.** I have had problems in the past with people falling far behind and having to take incompletes, so I shall be fairly ruthless in requiring papers to be submitted by their due dates. **Late papers will be downgraded.**

The objective of the labs is to develop your abilities to conceptualize and analyze problems in fluvial processes, and to give you experience with practical analytical and measurement techniques. I consider the lab work, *including participation in class discussions*, very important. You will notice that labs plus participation counts 60% of the course grade.

Two field labs – one to survey channel cross-sections and make velocity measurements, and one to look at channel geometry and spatial organization– will take place as 6 to 8-hour weekend trips on February 7 and May 2 . They are too lengthy to be done in an ordinary three-hour lab. To partially compensate for this, no formal labs will be held on Feb 3, Feb 24, April 28 and May 7 (see course schedule). I will be available in my office during those times to help you individually or collectively with problems. Two other field labs will take place during regular lab time on Feb. 17 and Apr. 14.

SPREADSHEET USE

The labs commonly involve calculations, some of which are very tedious and time-consuming, and plotting of data. These tasks are easily carried out using a microcomputer spreadsheet, such as Excel on the Macintosh. To ease the burden of calculation, I have prepared a number of Macintosh Excel templates and macros (programs) for use in this course. Although the calculations *could* be done by hand, I do want you to use the computer. I feel that learning to use spreadsheets and graphics programs is essential if one is to be a well-trained natural scientist.

LAB MATERIALS

You will need the following materials for the laboratory. With the exception of the field book, you should bring these materials to each lab.

Calculator with trig and log functions

Ruler-protractor with calibrations in mm (C-Thru W-43)

Ruler-protractor with calibrations in tenths and twentieths (C-Thru W-38)

Soft (2H) pencils; harder (3H or 4H) pencils

Drafting eraser (Artgum type or white vinyl)

Pencil sharpener/pointer

Red, blue, green, yellow colored pencils

Red, blue, green "Sharpie" pens

Rite-in-the-Rain field notebook (since we will be getting wet, no type but Rite-in-the-Rain is acceptable)

The Excel templates and macros are available from the Geology 550 website:

<http://www.humboldt.edu/~geology/courses/geology551>

Bring the notebook on field trips.

CLOTHING

When we go on field trips, it may be raining. Be prepared and dress accordingly. If it is raining on the days we survey cross-sections and profiles, we will need three or four umbrellas to protect the instruments.

BOOTS

On our field trips we will be walking and wading in streams. Tall rubber boots, or preferably hip boots or chest waders will be **necessary**. A small number of pairs of LARGE hip boots can be checked out from the Natural Resources and Fisheries stockrooms, but obviously most of you will have to scout around and borrow some, or bring your own if you have them. The Geology Department *does not* have any boots.

Geology 550
 Andre Lehre
 Office Hrs: Tu 9, W 9-11, Th 1-3
 and by arrangement

Spring 2009
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GEOLOGY 550 -- FLUVIAL PROCESSES

All reading, unless otherwise indicated, is in Dingman: Fluvial Hydrology (D), or in Knighton: Fluvial Forms and Processes (K). Other readings may be assigned in class

Geology 550 website: <http://www.humboldt.edu/~geology/courses/geology550>

When requested on the site use: **name:** geodept **password:** students

DAY	TOPICS	READING
20-Jan	Dimensions, units, physical properties, and fundamental equations	D 1-62; K 1-24; 65-80
20	LAB 1: Unit conversions	D 86-92
22	Physical properties of water	
27	Principles of dimensional analysis	
27	LAB 2: Dimensional analysis	
29	Forces in open-channel flow; types of flow; boundary layers	D 63-72; 76-86
3-Feb	Forces in open-channel flow; types of flow; boundary layers	
3	Work on Lab 2	
	Velocity distribution in uniform laminar flow;	
5	turbulence	D 95-102; K 96-99
7	LAB 3: FIELD LAB— Hydraulic data from Freshwater or Jacoby Cr (Saturday, 9–5)	
10	Velocity distribution in uniform turbulent flow	D 102-119
10	Work up data from field lab 3	
12	Velocity distribution in uniform turbulent flow	
17	Resistance to flow	D 137-149; 158-166; K 99-105
17	LAB 4: FIELD LAB—Hydraulic data from Freshwater or Jacoby Cr	
19	Resistance to flow	
24	Gradually varied flow	D 181-225; 244-269
24	Work up data from field lab 4	
26	Gradually varied flow	
3-Mar	Rapidly varied flow	D 207-236
3	LAB 5: Water-surface profiles	
5	Energy and power relations in streamflow	D 121-134; K 105-107
10	Forces on settling particles; entrainment of sediment	D 149-178; K 107-141
10	work on Lab 5; MIDTERM this week	
12	Forces on settling particles; entrainment of sediment	
17	SPRING BREAK	
19	SPRING BREAK	
24	Suspended load transport	K 63-71; 81-84
24	LAB 6: Estimation of suspended sediment transport	
26	Suspended load transport and bedforms	
31	Holiday	K 126-141
2-Apr	Bedload transport calculations	

DAY	TOPICS	READING
7-Apr	Bedload transport calculations	
7	LAB 7: Estimation of bedload transport	
9	Bedforms, bars, pools	K 187-205
14	Adjustment of channel form: hydraulic geometry	D 241-244; K 151-187
14	LAB 8: FIELD LAB	
16	Channel pattern: meanders	K 205-230
21	Channel pattern: meanders	
21	LAB 9: Channel stability	
23	Channel patterns: braided channels	K 230-241
28	Longitudinal profile	K 241-255
28	No formal lab -- use to finish other labs	
30	Longitudinal profile; channel changes	K 255-307
2-May	LAB 11: FIELD LAB— Channel morphology (Saturday 8-6)	
7-May	Bedrock channels	
7	no lab this week	
9	Bedrock channels	
14-May	FINAL EXAM - comprehensive - due by 4 PM	

OTHER INFORMATION MANDATED BY HSU

Catalog Description:

GEOL 550. Fluvial Processes (3). Quantitative and qualitative description of river processes. Mechanics of flow and sediment transport in open channels, adjustments of channel form and pattern, fluvial sediment budgets, and techniques for field measurement. Prereqs: GEOL 350, MATH 110, PHYX 107 (or 110); or IA. Weekly: 2 hrs lect, one 3-hr lab; may require one-day weekend field trip(s).

Educational Goals and Student Learning Outcomes

Goals

- G1) Provide an earth systems approach to geologic education that fosters critical thinking and the ability to make informed decisions on scientific issues in our society.
- G2) Provide students with a strong field-based education that incorporates the evolution of the Earth and its biota, and the classification of geologic patterns and materials at varied temporal and spatial scales.
- G3) Provide students with the ability to collect, process, and interpret scientific data.
- G4) Train students in the communication of scientific information using written, oral, graphic and electronic forms.
- G5) Provide a sufficiently broad and rigorous background with depth and currency in at least one area of specialization to allow qualified students to pursue graduate study and to enter professional careers in the earth sciences.

Student Learning Outcomes

I: Technical competence

- c) locate and access appropriate sources and data from both electronic and traditional resources (G4)
- g) recognize and describe the crustal processes that create landforms (G3)
- h) demonstrate depth and breadth of knowledge and currency in one or more advanced specialty fields (area of specialization) (G5)

II: Scientific method

- i) recognize, appreciate and communicate scientific uncertainty (G1, G3)
- j) use, formulate and test multiple working hypotheses based on the scientific method (G1, G3)

III: Communication

- k) effectively communicate scientific ideas and results verbally and in writing (G4)

IV: Earth Science and society

- l) understand the consequences of human activities on the environment (G1)
- n) recognize how long-term processes and evolution affects the global earth system (G1, G2)

Students with Disabilities: Persons who wish to request disability-related accommodations should contact the Student Disability Resource Center in House 71, 826-4678 (voice) or 826-5392 (TDD). Some accommodations may take up to several weeks to arrange. <http://www.humboldt.edu/~sdrc/>

Academic honesty: Students are responsible for knowing policy regarding academic honesty: http://studentaffairs.humboldt.edu/judicial/academic_honesty.php or <http://www.humboldt.edu/~humboldt/catalogpdfs/catalog2007-08.pdf>

Attendance and disruptive behavior: Students are responsible for knowing policy regarding attendance and disruptive behavior: http://studentaffairs.humboldt.edu/judicial/attendance_behavior.php

Add/Drop policy: Students are responsible for knowing the University policy, procedures, and schedule for dropping or adding classes. <http://www.humboldt.edu/~reg/regulations/schedadjust.html>

Emergency evacuation: Please review the evacuation plan for the classroom (posted on the orange signs), and review http://studentaffairs.humboldt.edu/emergencyops/campus_emergency_preparedness.php for information on campus Emergency Procedures. During an emergency, information can be found campus conditions at: 826-INFO or <http://www.humboldt.edu/emergency>