**GEOS 28600**

**Earth & Planetary Surface Processes**

**Winter 2020**

**Instructor:** Edwin Kite,[kite@uchicago.edu](mailto:kite@uchicago.edu)

(Geophysical Sciences; research is on Mars, icy moons, and rocky exoplanets).

**Website:** geosci.uchicago.edu/~kite/geos28600\_2020 (required reading, homework). (Website will be active before end 1/8).

**Grading scheme:** 55% homework, 10% individually small in-class exercises,

35% final OR 35% on term paper (please declare your choice at least 4 weeks before the grade deadline).

Class participation will be considered in determining final grades for people who are at a grade borderline.

**Homework: *All homeworks must be typeset.*** Printing out the text of your answer and then marking up equations by hand on the printout is OK.

Homework can be submitted by email ([kite@uchicago.edu](mailto:kite@uchicago.edu)), or in my mailbox on the first floor of the Hinds building. Homework is due 1 week after being issued. *Late policy:* 10% reduction in maximum grade per day late. Exceptions in case of medical emergency, family emergency, e.t.c.

You are allowed to discuss course material and homework assignments with each other, but you must work out and write up each problem solution by yourself without assistance. Exchanging solutions to homework problems or sharing solutions is strictly prohibited. It is a violation of this policy to submit a homework solution that you cannot explain orally to the instructor/TA. Copied solutions obtained from a written source, from the internet, or from another person will receive zero credit.

**Term paper:** *Undergraduate students who choose to do a term paper:*Four-page literature review, Nature style, of a topic of your choice. You may exceed four pages. *Graduate students who choose to do a term paper:* Four-page literature review, Nature style of a topic that is not directly connected to your thesis area (check the topic with the instructor), or four-page original research which may be related to your thesis research. You may exceed four pages. *All students:* Consider <http://www.planetary.brown.edu/pdfs/4794.pdf> as a “longer” model for Nature style.

Software. MATLAB or an equivalent (e.g., SciPy) is useful but not required. MATLAB is available at <http://academictech.uchicago.edu/vlab/> , under “All programs." Some labs will use MATLAB, but you will be given detailed instructions on its use and will not have to program.

**Office hours:** Wednesdays, 11:30a-12:30p (after class). Hinds 467, or by appointment [kite@uchicago.edu](mailto:kite@uchicago.edu). Please email at least 48 hours in advance with a range of suggested times. [*Please note that this office hours time is flexible, if two or more students would like regular office hours at some additional time, please email me and I can probably add that*.]

**Reading:**

Required textbooks: None. All required reading will be uploaded in pdf form to the class website. Additional optional reading will also be uploaded for most lectures.

**Review of useful books for this course:**

Anderson, The little book of geomorphology. <http://instaar.colorado.edu/~andersrs/The_little_book_010708_web.pdf> Entertaining, pedagogic. A good book to pick up if the others assume too much knowledge.

Anderson & Anderson, Geomorphology (This is the single best geomorphology textbook. Selections will be uploaded to website).

Melosh, Planetary Surface Processes. On reserve at Crerar (2 hours), and now available online ([http://dx.doi.org.proxy.uchicago.edu/10.1017/CBO9780511977848](http://dx.doi.org.proxy.uchicago.edu/10.1017/CBO9780511977848" \t "_blank); there should now be access for ‘unlimited simultaneous users’; let me know if you have any access problems). Overall, covers the ground, has many good rules-of-thumb. Rarely deep, occasionally idiosyncratic, and rarely does the derivations. Very good on impact processes; good on lithosphere processes; rather shallow on rivers and lakes.

**Review of other books useful for “reading around” this course (or background to this course) :**

Grotzinger & Jordan, Understanding Earth. The best intro Earth Science textbook. By the Project Scientist of the *Curiosity* rover.

McSween et al., Planetary Geoscience. This is the only textbook on planetary geoscience. Broad and refers to a wide range of quite technical topics, but doesn’t get to grips with any of them. Strong on narrative, weak on first-principles understanding. Useful as a “catalog” book to figure out what topics you’re interested in.

Leeder, Sedimentology and Sedimentary Basins. The only book on sedimentology that does a decent job on both history and physics approaches. The 2nd edition strikes a fine balance between ‘forensics’ and ‘physics’ approaches. The 3rd edition has relegated the physics to a series of appendices, but has more up-to-date references. Not on reserve but the library has copies of both editions, and the instructor has a copy of the 2nd edition. Let me know if you have any trouble getting hold of a copy. Useful for the 2nd half of the course.

Turcotte & Schubert, Geodynamics. Either the 2nd edition or 3rd edition (the 3rd edition has the benefit of MATLAB scripts but is otherwise roughly the same as the 2nd edition). Distinguishes itself by thorough, easy-to-follow derivations. Useful for the first 1/3 of this course; does not cover the topics from later in the course in any depth.

Pelletier, Quantitative Modeling of Earth Surface Processes. The only book that teaches landscape evolution modeling for MATLAB. I will attempt to get an e-copy available through UChicago library by week 8 (when this book will start to become relevant).

Generally recommended (but not specifically for this course).

Mahajan, The art of insight in science and engineering. MIT press; Free at <https://ocw.mit.edu/resources/res-6-011-the-art-of-insight-in-science-and-engineering-mastering-complexity-fall-2014/online-textbook/>

Additional resources for those interested in pursuing a particular topic in more depth (not required in any way for this course):

* Global-scale gravity, rotation, shape: Lambeck’s “Geophysical Geodesy.”
* Regional-scale gravity and topography: I am not aware of any good books on this but Watt’s “Isostasy and Flexure of the Lithosphere” comes close.
* Ices: Start with “Physics of Glaciers” by Cuffey & Patterson.

Projects are available (outside the framework of this course) under the supervision of the instructor for most any of the topics that will be discussed.