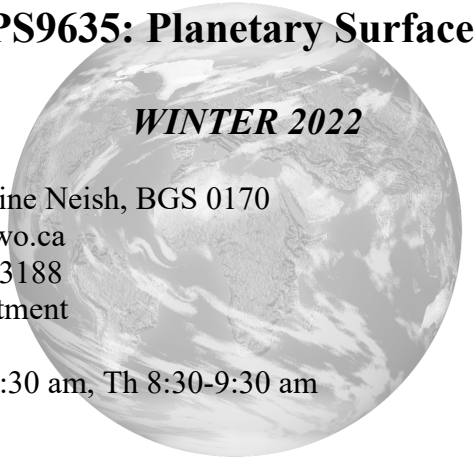
ES4435/PS9635: Planetary Surface Processes



WINTER 2022

Instructor: Dr. Catherine Neish, BGS 0170
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Telephone: (519) 661-3188
Office hours: By appointment

Class times: M 8:30-10:30 am, Th 8:30-9:30 am
Location: PAB 36

Course Description:

This course introduces the geologic processes operating on the solid surfaces in the solar system. Includes a survey of the terrestrial planets (including the Moon), large asteroids and comets, and the satellites of the outer solar system.

Prerequisites for ES4435: ES2232F/G and ES3321A/B
Prerequisites for PS9635: Permission from the instructor

Course Materials:

Required: *Planetary Surface Processes* by Melosh

In addition to the required textbook, material will be presented during lectures in the form of PowerPoint presentations and handouts. Some additional material may be posted on OWL (http://owl.uwo.ca). Students should check OWL on a regular basis for news and updates.

Course Objectives:

Upon completion of this course successful students will be able to:

- Explain the primary processes working to shape the surfaces of planets
- Apply knowledge of these processes to identify related features in field photographs and remote sensing data
- Develop reading and writing skills related to the interpretation of peer-reviewed literature in planetary geology

Anticipated Lecture Topics:

Earth Sciences 4435/Planetary Sciences 9635 covers the four main processes operating on solid surfaces in the solar system: tectonics, volcanism, impact cratering, and weathering. The topics listed below may be adjusted to reflect lecture progress or to introduce new developments in the field.

- *Ch. 1: The Grand Tour* (1 week)
    - Structure of the solar system
    - Classification of the planets
- *Ch. 2: The shapes of planets and moons* (1 week)
    - The overall shapes of planets
- *Ch. 3: Strength versus gravity* (1 week)
    - Stress, strain, and strength
    - Mechanisms of topographic support
- *Ch. 4: Tectonics* (2 weeks)
    - Sources of tectonic stress
    - Heat sources and heat transfer
    - Flexures and folds; Fractures and faults
- *Ch. 5: Volcanism* (2 weeks)
    - Melting and magmatism
    - Mechanics of eruption
    - Lava flows, domes, and plateaus
- *Ch. 6: Impact Cratering* (2 weeks)
    - Cratering mechanics
    - Ejecta deposits
    - Dating planetary surfaces with impact craters
- *Ch. 7: Regolith, weathering, and surface texture* (2 weeks)
    - Soil on airless bodies
    - Weathering

Course Evaluation:

The overall course grade, out of 100, will be calculated as listed below. Listed next to the respective components are their maximum contributions toward the course grade.

ES4435 Evaluation:

Component	*Notes*	*Value*
In-class quizzes OR Writing assignment	Open book quizzes on course material (best 4/5) Written report on a topic in planetary geology	10
Homework	Assignments based on content learned during lecture (best 7/8)	20
Midterm exam	To be held in class	30
Final exam	Scheduled by the Registrar	40

PS9635 Evaluation:

Component	*Notes*	*Value*
In-class quizzes OR Writing assignment	Open book quizzes on course material (best 4/5) Written report on a topic in planetary geology	10
Homework	Assignments based on content learned during lecture (best 7/8)	20
Term project	Oral and written report on a recent journal article in planetary geology	20
Midterm exam	To be held in class	20
Final exam	Scheduled by the Registrar	30

On occasion I will give informal quizzes during lecture periods. These **In-Class Quizzes** will be used to determine how well you understand the material, and will serve as a random check on attendance. Each quiz will receive a score between 0 and 2. If I don't receive the quiz, the score will be a 0. If it is a weak response, the score will be a 1. A strong response will receive a 2. No make-ups are allowed, except for serious extenuating circumstances (see Course Policies below). However, you may drop one quiz to cover any unexpected absences. Those students who turn in all quizzes will be able to drop the quiz with the lowest score.

I strongly encourage you to come to class and engage with your classmates. Education research has demonstrated the value of interactivity in helping students to learn and retain knowledge. HOWEVER, if your learning style favors more independent study, you can replace your score for the in-class quizzes by a **Writing Assignment** due the last day of class. This is a six-page research proposal on a topic of your choice in planetary geology. It should be based on the NASA Earth and Space Science Fellowship (NESSF), described in detail here: **http://tinyurl.com/arjogrz**. As it states in the solicitation, "*The proposal should present a well-defined problem and justification of its scientific significance, as well as a detailed approach for its solution.*" For more information, see the URL above.

Eight **Homework** assignments will be assigned during the course. These will typically be assigned on Thursday and will be due at the beginning of class on the following Thursday. No late work will be accepted, so please plan ahead. However, you may drop one homework to cover any unexpected absences. Those students who turn in all eight homeworks will be able to drop the homework with the lowest score. (*Note:* Students in PS9635 will be assigned extra homework questions to complete, in addition to those assigned to the students in ES4435.)

One **Midterm exam** and one **Final exam** will also be given. All exams will be closed book, except for one 8 x 11" sheet of notes (double-sided), and no electronic devices may be in your possession during the exams. It is Faculty of Science policy that a student who chooses to write an exam deems themselves fit enough to do so, and the student must accept the mark obtained. Claims of medical, physical, or emotional distress after the fact will not be considered.

In addition to homework and exams, students in PS9635 will be expected to critique a recent paper in planetary (papers must have been published between 2018 and 2022). This **Term Project** will consist of a written and oral component. The written component is expected to be **2 pages** long, and include ~1-2 paragraphs summarizing the findings of the paper, ~1-2 paragraphs describing any criticisms you had of the paper, and ~1-2 paragraphs describing the implications of the paper for astrobiology. The oral component is expected to be 10 minutes long, and will be presented in front of the class.

You may wish to consult journals such as *Nature, Science, Icarus*, the *Journal of Geophysical Research,* or the *Planetary Science Journal* for relevant articles. This is an important aspect of the course – my intent is to get you excited about the field of planetary geology, develop your critical thinking skills, and provide a venue to practice your written and public speaking skills. Note that one of the in-class "quizzes" will be an assessment of the students' speaking style, so all students are expected to attend the graduate student seminars.

Course Polices and Friendly Reminders:

Assignments: Assignments must be submitted electronically on the assigned due date and will not be accepted late, expect under medical or other compassionate circumstances (see below). Submitting a late assignment without appropriate documentation will result in a zero (0) grade.

Students must write their assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge this both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see below). APA style is the approved style of writing for all assignments produced for this course. Please refer to the University of Western Ontario Library webpage for information on citation style and format.

Accessibility: Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2111 x 82147 for any specific question regarding an accommodation.

Missed course components: If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. During the COVID-19 pandemic, medical notes are not required. Medical absence can be reported through the *Student Illness Reporting Tool* at https://www.registrar.uwo.ca/academics/academic_considerations/index.html.

If this portal is not available (i.e., if the COVID-19 pandemic has lifted before the end of the course), or if you have missed (or will be missing coursework) for a non-medical reason beyond your control, approval can be granted either through a *Self-reported Absence* (if the portal is available) or via the Dean's Office/Academic Counselling unit of your Home Faculty. Non-medical reasons must be accompanied by supporting documentation. If you are a Science student, contact information for the Academic Counselling Office for the Faculty of Science is available at https://www.uwo.ca/sci/counselling/.

In all cases, you must contact your instructor as soon as possible, and no later than 24 hours after the period covered, to clarify how you will be expected to fulfil the academic expectations you have missed (unless other instructions are indicated in this Course Outline). For further information, please consult the University's policy on academic consideration for student absences:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf.

Academic misconduct: Academic Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
http://www.uwo.ca/univsec/handbook/appeals/scholoff.pdf

Classroom Behaviour: Disruptive behavior will not be tolerated in class or on the course website. Please respect the rights of your classmates to benefit from the lecture by limiting your conversations to those essential to the class. Students who persist in loud, rude or otherwise disruptive behavior will be asked to leave. Cellular phones, pagers, and text-messaging devices are not to be used in class and must be placed in silent mode. Audio and/or videotaping of lectures is not permitted unless approval has been sought from the instructor in advance.