

GEOL 102.1

Introduction to Geology for Engineering

Fall 2021

<u>Instructor</u>	Prof. James Lee, P.Eng. (U of S) (Section 96) Kristin Dietrich, M.Sc. (St. Peter's College) Email: kristin.dietrich@usask.ca
<u>Contact Hours</u>	You can contact me by email during regular work hours, and in person Thursdays after lecture, noon - 1 pm.
<u>Lectures</u>	Room 206 Thursdays, Oct. 21, 28, and Nov. 4, 9 am – noon
<u>Laboratory</u>	Thursdays, Oct. 21 and Nov. 4, 1 – 4pm
<u>Website</u>	General course information and announcements will be posted on the course website (Canvas). Students are responsible for keeping up-to-date with the information on the course website: https://canvas.usask.ca/
<u>Prerequisites</u>	No prerequisites. This course is intended for 1st-year students in the College of Engineering.
<u>Corequisites</u>	GE 102 Introduction to Engineering I

Course Overview

This course will provide engineering students with a high-level overview of fundamental concepts in physical geology. Special consideration will be given to aspects of the Earth system where engineers and geoscientists work together to solve problems and mitigate risks relating to earth processes and earth materials. These topics include geologic hazards, mass wasting, surface and groundwater contaminants, and mine waste management. Laboratories will provide students with practical experience in how the chemical and physical properties of rocks and minerals influence their utility and behaviour in engineered environments. In addition, science and engineering careers that require a strong background in geoscience will be featured.

Learning Outcomes

By the end of this course, students will be expected to:

1. Identify the relationships between plate tectonics and the rock cycle and recognize links between geologic hazards and processes.
2. Demonstrate hands-on skill with basic rock and mineral identification.
3. Describe how the properties of rocks and minerals can be important to engineering applications.
4. Understand and interpret key vocabulary used to describe geological concepts.
5. Demonstrate the impact of earth sciences on society and articulate examples of how different professions can collaboratively apply knowledge of the earth sciences to solve societal problems.

Textbooks (required)

Physical Geology (1st USask Edition, 2019), K. Panchuk.

<https://openpress.usask.ca/physicalgeology/>

Physical Geology Workbook (1st USask Edition, 2019), J. McBeth.

<https://openpress.usask.ca/geolworkbook/>

Hard copies of the textbook are available from the University of Saskatchewan Bookstore:

<https://bookstore.usask.ca/students.php#MyTextbooks>

Additional References (recommended, but optional)

The textbook below is an excellent reference that further covers the course material as well as additional topics:

Physical Geology (17th ed., 2022), C. Plummer, D. Carlson, and L. Hammersley, McGraw-Hill.

Course Resources

General and section-specific course information for GEOL 102 as well as additional online resources may be found in Canvas (canvas.usask.ca) on the course website.

Course Description

Introductory exploration of the Earth system for engineering students to provide students with an appreciation of global and local-scale geological processes and the influence of these processes on the Earth system through geologic time. Key topics will include plate tectonics, geologic time, the rock cycle, weathering and erosion, geologic hazards, mineral resources, and earth-science careers. Students will learn practical applications of rock and mineral identification through laboratory activities.

Course Copyright and Distribution of Course Materials

Course materials are provided to you based on your registration in a class. All course materials, including course notes and documents, recordings, slide presentations, assignments, tests, and exams, are the intellectual property of the instructor and cannot be shared without written permission. Distributing, publishing, or providing unauthorized access to any provided course materials is prohibited; for example, this includes the practice of uploading or posting course materials to course-sharing websites, depositories, or “drop boxes” without the written permission of the instructor or copyright holder.

If materials are designated as open education resources (with a creative commons license) you can share and/or use in alignment with the [CC license](#). Additionally, other copyright-protected materials may be provided to you based on license terms and educational exceptions in the Canadian Copyright Act (see <http://laws-lois.justice.gc.ca/eng/acts/C-42/index.html>).

A violation of the university’s copyright policies may constitute non-academic misconduct. The USask “Standard of Student Conduct in Non-Academic Matters” can be found at: <https://www.usask.ca/secretariat/student-conduct-appeals/StudentNon-AcademicMisconduct.pdf>.

Some Course Principles (due to COVID-19)

We all recognize that this course is taking place in a time of transition. In dealing with COVID-19, we now know that situations can change and we must be flexible and ready to adjust our routines and behaviour. The last 18 months have been difficult for many, with trauma and loss experienced by many in our university community and beyond. Transitioning out of this pandemic period represents a change and may be challenging for some, so all course participants should interact with empathy and care.

Laboratories

What to Bring

- loose-leaf paper, pen, pencil, eraser, pencil sharpener

Students are expected to perform the exercises during the allotted time, and complete the lab activity worksheets during the labs.

Laboratory Safety

Safety is of paramount importance in the College. Students are expected to work in a safe and responsible manner, to follow all safety instructions, and use any specified personal protective equipment. Students failing to behave in a safe manner will be asked to leave.

Course Evaluation

Laboratories (two): 40%

Final Exam: 60%

Attendance and Participation

It is expected that students will attend all lectures and laboratory sessions. Students are responsible for all required readings, and topics presented in lectures and laboratories.

Passing Criteria

In order to pass the course, you must fulfill the following conditions:

- 1) attend all laboratory sessions and complete all required lab work, obtaining a grade of at least 50% in the laboratory portion of the course, AND
- 2) pass the final examination, AND
- 3) obtain an overall mark $\geq 50\%$

Laboratory Evaluation

Laboratories will make up 40% of the overall course mark (including the lab activity worksheets).

Attendance in labs and submission of laboratory activity worksheets is mandatory. Any labs which are not completed will be assigned a mark of zero (0). **NOTE: you must pass the laboratory portion of the course to pass the entire course (else laboratory grade = final grade).**

Each lab is weighted equally. Grading of each lab will be based on: (i) pre-lab quiz (10%), (ii) performance during the lab activities (25%), (iii) lab activity worksheet (50%), and (iv) group participation (15%).

Laboratories should be attempted and completed by all students individually. Experience has shown that students who do so also perform better in examinations.

All laboratories are due in-class during the lab session. There are NO extensions of due dates. Students who have missed a laboratory will not receive credit for it after the due date.

Final Exam

The final exam will be scheduled during the December final examination period. Do not schedule travel until after the official exam schedule is released. If a student is unable to write an exam for valid reasons, documentation must be provided to seek approval to write the missed exam.

Students are encouraged to review all examination policies and procedures: <http://students.usask.ca/academics/exams.php>

The final examination will be time-limited and encompass all of the course material. You must complete the examination individually; no help from others is permitted. Consequently, the use of any devices or software with communication capabilities is prohibited during the final exam.

Other Important Points

- Alternate times to write the final exam cannot be accommodated. If a student misses the final exam, an application must be made to the Engineering Student Centre to write a deferred exam.
- Students requiring academic accommodations must register with the office for Access and Equity Services for Students (AES) in accordance with AES procedures and deadlines. Only academic accommodations officially approved by AES will be accepted.

Course Outline

1. THE EARTH SYSTEM

- 1.1 Interactions between the biosphere, atmosphere, hydrosphere, cryosphere, and lithosphere
- 1.2 Earth's interior structure, composition, and physical properties

2. GEOLOGIC TIME

- 2.1 Measuring geologic time
- 2.2 Relative and absolute-age dating

3. PLATE TECTONICS

- 3.1 Types of plate boundaries
- 3.2 Features of plate boundaries: earthquakes, mountains, volcanoes

4. MINERALS

- 4.1 The atomic-scale basis of mineral properties
- 4.2 Common rock forming minerals and their properties
- 4.3 Mineral chemistry

5. ROCKS AND THE ROCK CYCLES

- 5.1 Types of rocks: igneous, sedimentary, metamorphic
- 5.2 Weathering, sedimentation, and sedimentary rock formation
- 5.3 Plate tectonic environments and igneous and metamorphic rock formation

6. VOLCANISM

- 6.1 Common types of volcanoes and characteristics
- 6.2 Volcanic hazards

7. MOUNTAIN BUILDING

- 7.1 Types of mountain building
- 7.2 Relationship of different kinds of mountains to plate tectonic boundaries

8. MASS WASTING

- 8.1 Types of mass wasting
- 8.2 Mass wasting hazards and management

9. EARTHQUAKES

- 9.1 Earthquake mechanics
- 9.2 Relationship to plate tectonic boundaries
- 9.3 Earthquake hazards

10. THE HYDROLOGIC CYCLE: SURFACE WATER

- 10.1 Reservoirs
- 10.2 Surface water patterns and behavior
- 10.3 Relationship to weathering and erosion

11. THE HYDROLOGIC CYCLE: GROUNDWATER

11.1 Groundwater resources: sources, sinks, threats

11.2 Groundwater contaminants: natural vs anthropogenic

12. GEOLOGIC RESOURCES

12.1 Geologic deposits: types, and relationships to geological processes

12.2 Resource extraction and environmental management of wastes

13. EARTH SCIENCES AND ENGINEERING

13.1 Common issues and synergies

13.2 Careers that interface with geological processes

Laboratories:

LAB 1- MINERAL AND ROCK PHYSICAL PROPERTIES – ASSESSING UTILITY OF EARTH MATERIALS FOR ENGINEERING APPLICATIONS

LAB 2- MINERAL AND ROCK CHEMICAL PROPERTIES – CHEMICAL WEATHERING BEHAVIOR OF EARTH MATERIALS AND IMPLICATIONS FOR WASTE MANAGEMENT

Academic Integrity

The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University. To this end, students are expected to submit their own individual work for academic credit, properly cite the work of others, and to follow all rules for examinations.

- students are encouraged to complete the Academic Integrity Tutorial to understand the fundamental values of academic integrity and how to be a responsible scholar and member of the USask community (tutorial link: <https://libguides.usask.ca/AcademicIntegrityTutorial>).
- students can access campus resources that support development of study skills, time and stress management, and ethical writing practices important for maintaining academic integrity and avoiding academic misconduct.

Academic misconduct, plagiarism, and cheating will not be tolerated. If any form of academic misconduct is discovered, appropriate disciplinary action will be taken. Academic misconduct is a serious matter and can result in grade penalties, suspension, and expulsion. Students are expected to be familiar with the academic misconduct regulations (<https://governance.usask.ca/student-conduct-appeals/academic-misconduct.php#About>).

- definitions appear in Section II of the academic misconduct regulations.
- the academic misconduct regulations apply regardless of type of assessment or presence of supervision during assessment completion
- students are advised to ask for clarification as to the specific expectations and rules for assessments in all of their courses

- students are urged to avoid any behaviour that could result in suspicions of cheating, plagiarism, misrepresentation of facts. Posting copyrighted course materials (e.g., notes, questions, assignments or exams) to third-party websites, services or other media without permission is an academic or non-academic misconduct offense.

Non-academic offenses are dealt with under the [Standard of Student Conduct in NonAcademic Matters and Regulations and Procedures for Resolution of Complaints and Appeals](#).

Ethics in Professional Engineering

In addition, ethical behaviour is a fundamental pillar of the engineering profession. The professional- engineering association in every province has a Code of Ethics, which its members are expected to follow. Students in the process of becoming professional engineers are also expected to conduct themselves in an ethical manner.

The Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS) Code of Ethics states that engineers shall:

- "... conduct themselves in an honourable and ethical manner, upholding the values of truth, honesty and trustworthiness, ... " [Section 20 (1), The Engineering and Geoscience Professions Regulatory Bylaws, 2020]
- "... conduct themselves with fairness, courtesy and good faith towards clients, colleagues, employees and others; give credit where it is due and accept, as well as give, honest and fair professional criticism" [Section 20 (2)e, The Engineering and Geoscience Professions Regulatory Bylaws, 2020]

To this end, it is expected that all students will create a course environment that is conducive to learning and will not participate in or promote any form of unethical behaviour.

Student Support Services

Access and Equity Services (AES)

Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may have disabilities should contact AES for advice and referrals at any time. Those students who are registered with AES with mental health disabilities and who anticipate that they may have responses to certain course materials or topics, should discuss course content with their instructors prior to course add / drop dates. In order to access AES programs and supports, students must follow AES policy and procedures. For more information or advice, visit <https://students.usask.ca/health/centres/access-equity-services.php>, or contact AES at 306-966-7273 or aes@usask.ca.

Students registered with AES may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through AES by the stated deadlines.

Support Services for Engineering Students

- Engineering Student Centre (Rm. 2A05 Engineering Building)
- Email: esc@usask.ca; Phone: 306-966-5274; https://engineering.usask.ca/contact_info/esc-office.php

End of day tutorial sessions will be offered by the College of Engineering for the Common First Year and will provide support for all courses.

Student Learning Services

Student Learning Services (SLS) offers assistance to USask undergrad and graduate students. For information on specific services, please see the SLS web site <https://library.usask.ca/studentlearning/>.

Teaching, Learning and Student Experience

The Teaching, Learning and Student Experience Unit (TLSE) focuses on providing developmental and support services and programs to students and the university community. For more information, see <https://students.usask.ca/>. Specific resources include:

- Student Wellness Centre (3rd & 4th Floors, Place Riel): <https://students.usask.ca/health/>
- Financial Services: <https://students.usask.ca/money/>

Land Acknowledgement

We acknowledge that the University of Saskatchewan is on **Treaty Six Territory** and the **Homeland of the Métis**. We pay our respect to the First Nation and Métis ancestors of this place and reaffirm our relationship with one another. I would also like to recognize that some may be attending this course from other traditional Indigenous lands. I ask that you take a moment to make your own Land Acknowledgement to the peoples of those lands. In doing so, we are actively participating in reconciliation as we navigate our time in this course, learning and supporting each other.