APPLIED SCIENCE AND MANAGEMENT DIVISION
GEOL 200
3 Credit Course
Fall, 2021

COURSE OUTLINE

GEOL 200

MINERALOGY

3 CREDITS

PREPARED BY: Joel Cubley, Instructor/Coordinator, Earth Sciences
DATE: January 29, 2020

APPROVED BY: Stephen Mooney, Acting Dean, Applied Science and Management
DATE: March 2, 2020

APPROVED BY ACADEMIC COUNCIL: March 11, 2020
RENEWED BY ACADEMIC COUNCIL: Click or tap to enter a date

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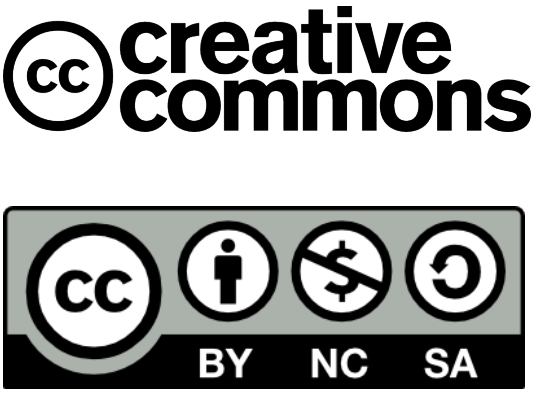

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Academic Council, Governance Office
Academic Council MyYC: Policies, Procedures and Forms

APPLIED SCIENCE AND MANAGEMENT DIVISION
GEOL 200
3 Credit Course
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MINERALOGY

INSTRUCTOR:	**OFFICE HOURS:**
OFFICE LOCATION:	**CLASSROOM:**
E-MAIL:	**TIME:**
TELEPHONE:	**DATES:**

COURSE DESCRIPTION
Mineralogy provides a practical and systematic treatment of the crystallography, physical, chemical, and optical properties of the main rock-forming and economic minerals. Students will learn how to apply knowledge of minerals' atomic structure and crystallography to identify and explain the physical properties of individual minerals and mineral groups. A course focus will be on the correlations between chemical concepts such as substitution and solid solution and the components of chemical formulas that control the properties and classification of the major mineral classes. Emphasis will be placed on understanding the occurrence and behavior of minerals with respect to changing physical and chemical conditions in geologic environments. Lab exercises focus on the identification of common minerals and associated rocks in both hand sample and thin section. Local examples of mineral species and rocks containing those minerals will be used whenever possible.

PREREQUISITES
Successful completion of Physical Geology (GEOL 105), or permission from the instructor.

EQUIVALENCY OR TRANSFERABILITY
This course has been recently developed and its transferability is being re-evaluated. Receiving institutions always determine course transferability. Further information and assistance with transfers may be available from the School of Science.

LEARNING OUTCOMES

Upon successful completion of the course, students will be able to

1. Describe common rock-forming minerals on the basis of chemical bonding, physical properties, crystal structure, structural formula, and occurrence.

2. Explain correlations between relevant chemical concepts (e.g., substitution, solid solution) and the parts of chemical formulas that control the properties and classification of the major mineral classes on Earth.

3. Describe and measure properties of hand specimens to confidently identify minerals and to place them in groups.

4. Utilize common optical microscopy techniques to characterize mineral assemblages in thin section and name rocks using accepted naming conventions.

5. Recognize symmetry elements in crystal's external form and describe how those elements are controlled by a mineral's unit cell geometry and crystal structure.

6. Describe the theory behind common mineral analysis techniques, as well as manipulate mineral chemistry data to produce common data products and mineral formulas.

COURSE FORMAT

This course consists of two 90-minute lectures and one 3-hour laboratory period per week. The schedule included in this course outline details the major topics covered in the lecture section; laboratory activities are complimentary to lecture material.

ASSESSMENTS:

Attendance & Participation

Students are strongly encouraged to attend all lectures and laboratory periods for this course. Whereas students will be given after-hours access to the Earth Sciences laboratory (T1090) to complete lab assignments, the course instructor will not necessarily be present to guide learning. It is thus important that students fully engage and participate during the designated lab period.

Assignments
This course includes weekly laboratory exercises that are due one week from the initial laboratory activity unless otherwise indicated by the instructor. Successful completion of these activities is critical for understanding and reinforcing lecture material. Two lecture-based assignments will be available on the College online learning management system (LMS) from the start of the semester; the first assignment reinforces material delivered prior to the midterm exam, the second focuses on material in the second half of the course. Whereas the assignments are not due until the end of the semester, it is strongly recommended that students complete these assignments a minimum of one week prior to the related exam in order to receive instructor feedback.

Late assignments will be graded based on the following scheme: a deduction of 10% per day up until a total deduction of 50% is reached, following that, assignments must be submitted prior to the date that the instructor hands back the graded assignment (set by the instructor).

Quizzes
Short quizzes will be administered in lecture at the start of each week. Material on these quizzes may be derived from the lecture material and/or assigned textbook readings.

Examinations
This course has two lecture examinations, a midterm and a final. The midterm exam is conducted during scheduled lecture time; the final exam is conducted during the final exam period scheduled by the Office of the Registrar. There is also a final laboratory exam conducted during the final week of classes in the regularly scheduled laboratory time. The midterm lecture exam is a 1.5-hour exam; the lecture and laboratory final exams are designed to take 3 hours.

Missed exams will be assigned a grade of 0% unless re-scheduling for a valid reason is approved and determined in advance of scheduled exam date. If there are known conflicts with exam scheduling, please see the instructor as soon as possible to discuss an alternative examination date.

EVALUATION:

Laboratory Exercises (10)	30% (3% each)
Written Assignments (2)	10% (5% each)
Weekly Quizzes	5% (0.5% each)
Midterm Lecture Exam	10%
Final Laboratory Exam	15%
Final Lecture Exam	25%
Total	100%

REQUIRED TEXTBOOKS AND MATERIALS

There are number of textbooks available that can be used in support of learning in this course. It is recommended that a student obtain access to one of the following resources.

Perkins, D. 2011. Mineralogy (3rd ed.). Prentice Hall. 504 pp.

Klein, C. and Philpotts, A. 2017. Earth Materials: Introduction to Mineralogy and Petrology (2nd ed.). Cambridge University Press. 616 pp. *Note: the first edition of this textbook (2013) is also acceptable.*

ACADEMIC AND STUDENT CONDUCT

Information on academic standing and student rights and responsibilities can be found in the current Academic Regulations that are posted on the Student Services/ Admissions & Registration web page.

PLAGIARISM

Plagiarism is a serious academic offence. Plagiarism occurs when a student submits work for credit that includes the words, ideas, or data of others, without citing the source from which the material is taken. Plagiarism can be the deliberate use of a whole piece of work, but more frequently it occurs when students fail to acknowledge and document sources from which they have taken material according to an accepted manuscript style (e.g., APA, CSE, MLA, etc.). Students may use sources which are public domain or licensed under Creative Commons; however, academic documentation standards must still be followed. Except with explicit permission of the instructor, resubmitting work which has previously received credit is also considered plagiarism. Students who plagiarize material for assignments will receive a mark of zero (F) on the assignment and may fail the course. Plagiarism may also result in dismissal from a program of study or the College.

YUKON FIRST NATIONS CORE COMPETENCY

Yukon College recognizes that a greater understanding and awareness of Yukon First Nations history, culture and journey towards self-determination will help to build positive relationships among all Yukon citizens. As a result, to graduate from ANY Yukon College program, you will be required to achieve core competency in knowledge of Yukon First Nations. For details, please see www.yukoncollege.yk.ca/yfnccr.

ACADEMIC ACCOMMODATION

Reasonable accommodations are available for students requiring an academic accommodation to fully participate in this class. These accommodations are available for students with a documented disability, chronic condition or any other grounds specified in section 8.0 of the Yukon College Academic Regulations (available on the Yukon College website). It is the student's responsibility to seek these accommodations. If a student requires an academic accommodation, he/she should contact the Learning Assistance Centre (LAC): lac@yukoncollege.yk.ca.

TOPIC OUTLINE

Lecture*	Topics	Recommended reading**
1	Course introduction; electronic configuration of atoms and ions, bonding and the periodic table; radioactive decay	P (Ch.1); KP (Ch.8: 229-235)
2	Physical properties of minerals in hand specimen	P (Ch.3); KP (Ch.3: 37-52)
3	Fundamentals of crystal structures: atomic vs. ionic radii, coordination number, Pauling's rules, controls on atomic substitutions	P (Ch. 13); KP (Ch. 4)
4	Crystallography I: Symmetry elements and operations; crystal systems and crystallography notation (crystal classes); unit cells	KP (Ch. 5: 88-93); P (Ch. 9: 177 – 183, 197-209; Ch. 11: 240-250)
5	Crystallography II: Miller indices; crystal forms stereographic projection of crystals; point groups;	P (Ch. 9: 183-197); KP (Ch. 5: 93-111)
6	Crystallography III: Twinning; space groups; Bravais lattices; polymorphism	KP (Ch. 5: 112-132); P (Ch. 10: 210-239)
7	Introduction to microscopy (Part I) – interaction of light with minerals, polarization, refraction	P (Ch.4: 64-77); KP (Ch.6: 135-145)
8	Introduction to microscopy **(**Part II) – birefringence and retardation, color and pleochroism, extinction angles	
9	Optical indicatrices I: the uniaxial indicatrix	P (Ch 4: 77-85); KP (Ch. 6 146-153)
10	Optical indicatrices II: the biaxial indicatrix	
11	Systematic mineralogy approach; introduction to mineral species, groups, families, classes	P (Ch 2: 39-43); KP (Ch. 7: 164-167)
12	Independent tetrahedra silicates (nesosilicates) and double tetrahedra silicates (sorosilicates)	KP (Ch. 7: 182-185; Ch. 14: 416-420); P (Ch. 14: 337-349)
13	Ring silicates (cyclosilicates) and single/double chain silicates (inosilicates)	KP (Ch.7: 173-178; Ch. 14: 420-424; 429-430) P (Ch. 14: 326-336)
14	Sheet silicates (phyllosilicates)and framework silicates (tectosilicates)	KP (Ch. 7: 166-172, 178-182; Ch. 14: 424-428); P (Ch. 14: 302-324)

15	Carbonate minerals	KP (Ch. 11: 338-343)
16	Phosphate, sulfate and halide minerals	P (Ch 6: 123-134); KP (Ch. 11: 343-347)
17	Oxide and hydroxide minerals	KP (Ch. 7: 185-190; Ch. 11: 336))
18	Sulfide minerals and native metals	P (Ch. 8: 164-173); KP (Ch. 7: 190-192; Ch. 16: 478-488)
19	X-ray diffraction (XRD) and electron microprobe analyses of minerals: theory, data interpretation and presentation	P (Ch.12); KP (Ch. 3: 53-59)
20	Hyperspectral imaging: theory, data interpretation and presentation	
21	Mineral evolution: the history of mineral species from the early universe to present	

*Note that each number lecture may not exactly correspond with a 1.5-hour lecture delivery. Some topics will take two lectures to complete; it is the responsibility of the student to be aware where they are in the course progression.
**Recommended readings from Klein and Philpotts (KP) or Perkins (P).

Laboratory topics

Week	Topic
1	Mineral formulas, chemical analyses and stoichiometry
2	Crystal Symmetry I: Block models
3	Crystal Symmetry II: Stereographic projections
4	Crystal nucleation from an aqueous solution and a simulated melt.
5	Introduction to polarizing microscopes and optical microscopy: relief, birefringence, Becke lines; plane polarized and cross-polarized light
6	Uniaxial and biaxial optic figures and signs; 2V angles; length fast/slow determinations
7	Igneous minerals in hand sample and thin section
8	Metamorphic minerals in hand sample and thin section
9	Sedimentary minerals in hand sample and thin section
10	X-ray diffraction of minerals in local mine tailings: data collection and analysis