APPLIED SCIENCE AND MANAGEMENT DIVISION
SCHOOL OF MINING AND TECHNOLOGY
SCHOOL OF SCIENCE

COURSE OUTLINE

GEOL 110

MINERALOGY/PETROLOGY

81 HOURS
3 CREDITS

PREPARED BY: Joel Cubley DATE: September 20, 2012
Joel Cubley, Instructor

APPROVED BY: Shelagh Rowles DATE: September 20, 2012
Shelagh Rowles, Dean

YUKON COLLEGE

Course Outline prepared by Joel Cubley, 20 September 2012.

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APPLIED SCIENCE AND MANAGEMENT DIVISION
GEOLOGY 110
3 Credit Course

MINERALOGY/PETROLOGY

INSTRUCTOR: Dr. Joel Cubley

OFFICE HOURS: TBA
OFFICE LOCATION: A2316

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COURSE OFFERING: January 7 – April 26, 2013
DAYS & TIMES: **Lectures**: Mondays & Wednesdays, 3:00-4:30pm (A2210)
Laboratory: Tuesday, 9:00am-12:00pm (A2801)

COURSE DESCRIPTION

This course focuses on the structure and chemical makeup of earth materials, specifically the physical and chemical properties of minerals on both macroscopic and microscopic scales. Students will learn how to identify rocks and rock-forming minerals contained in hand samples, and how to manipulate rock classification schemes for igneous, sedimentary, and metamorphic rocks. Basic principles of mineralogy (crystal systems, chemical and physical properties) will be explored, as well as elementary petrological theory. Investigations will be framed in light of characteristic geologic environments, many of which can be found in the Yukon. Students will be given an introduction to polarized light microscopy and how it can augment hand sample rock and mineral identification.

LEARNING OUTCOMES

Upon successful completion of the course, students will have demonstrated the ability to

- Correctly identify common minerals using a combination of hand sample and thin section properties, and relate those properties to their crystal structures and chemistry.

- Describe the types and relative abundances of phases in a rock based on observations from hand specimens and thin sections.

- Manipulate petrological classification schemes for igneous, sedimentary and metamorphic rocks based on mineral proportion and textural information.

- Predict what minerals should be stable and are likely to be found in a variety of environments (sedimentary, igneous, metamorphic).

- Apply an understanding of simple igneous systems, including the use of binary and ternary phase diagrams in interpreting igneous rock petrogenesis.

- Use metamorphic mineral assemblages, textures, and an understanding of mineral reactions and chemical equilibrium to constrain deformation history and P-T conditions.

DELIVERY METHODS/FORMAT

This course consists of three 50-minute lectures and one lab period per week. The lecture schedule included in this course outline details the major topics covered and when those topics will be presented throughout the course. Please note that this schedule will likely be modified throughout the term, as some topics may not be finished within the predicted lecture time.

PREREQUISITES

Successful completion of GEOL105 and/or permission from the instructor.

COURSE REQUIREMENTS/EVALUATION

Attendance and Participation

Students are strongly encouraged to attend all lectures and laboratory exercises. Lab exercises can be completed only during lab periods and materials may not be available outside these hours. The laboratory assignments are intended both to reinforce and build upon lecture concepts, and full participation is vital to student success. Laboratories require the use of materials (e.g. mineral specimens, microscopes) that are difficult and expensive to replace. Treat these materials with care. Do not treat laboratory rules as suggestions. **Under no circumstances is food or drink (including water) to be taken into the laboratories.**

Assignments

Weekly lab exercises will be due at the start of the following lab section. In addition to these exercises, students will be assigned a number of short theory assignments for the lecture segment of the course. Late work will not be accepted.

Tests/Exam

Any student who is absent from a test or exam for legitimate reasons will be eligible to write a deferred exam. Please note that excuses such as car trouble, vacation travel, oversleeping, and misreading the test schedule are not considered legitimate reasons and do not qualify the student for a deferred exam. For missed exams, the student must contact the instructor within 48 hours of the missed exam by phone or email. For missed final exams, students must the instructor to discuss an appropriate course of action. Any deferred exams will be scheduled by the Chair.

Evaluation

Tests and Assignments	***Weight***	***Dates***
Weekly Lab Assignments	30% (3% each)	Due at the start of each subsequent lab section.
Lab Mid-Term Exam	10%	During scheduled lab time in the sixth week of classes.
Lab Final Exam	20%	During scheduled lab time in the final week of classes.
Final Exam	30%	During the final exam period.
Lecture Theory Assignments	10% (2.5% each)	To be determined.
Total	100%	

The letter-grading scheme used in this course is the standard college scheme. Final grades will be rounded up to the nearest decimal place and assigned a letter grade based on this scheme. Grades will not be raised in order to facilitate a better overall grade standing at the end of the course. Final grades will be changed in the event that an error in grade addition or entry occurs. In such a case, students are asked to contact the instructor immediately. The College policy on grading and related matters is described in the "Student Evaluation, Grades, and Records" section of the current College Calendar.

Plagiarism

Plagiarism involves representing the words of someone else as your own, without citing the source from which the material is taken. If the words of others are directly quoted or paraphrased, they must be documented according to recommended document style. The

resubmission of a paper for which you have previously received credit is considered a form of plagiarism.

Plagiarism is academic dishonesty, a serious academic offence, and will result in you receiving a mark of zero (F) on the assignment or the course. In certain cases, it can also result in dismissal from the College.

Writing Centre

All students are encouraged to make the Writing Centre a regular part of the writing process for coursework. Located in C2231 (adjacent to the College Library), the Writing Centre offers half-hour writing coaching sessions to students of all writing abilities. Coaching sessions are available in person and through distance technologies (e.g. Skype or phone plus email). For further information or to book an appointment, visit the Centre's website: dl1.yukoncollege.yk.ca/writingcentre.

STUDENTS WITH DISABILITIES OR CHRONIC CONDITIONS

Reasonable accommodations are available for students with a documented disability or chronic condition. It is the student's responsibility to seek these accommodations. If a student has a disability or chronic condition and may need accommodation to fully participate in this class, he/she should contact the Learning Assistance Centre (LAC) at (867) 668-8785 or lassist@yukoncollege.yk.ca.

REQUIRED TEXTBOOKS/MATERIALS

Klein, Cornelis and Philpotts, Anthony. 2013. *Earth Materials: Introduction to Mineralogy and Petrology*. Cambridge University Press.

EQUIVALENCY/TRANSFERABILITY

No transfer agreements have yet been established for GEOL110.

MINERALOGY/PETROLOGY TENTATIVE LECTURE TOPICS

Week	Topic
1	Chemistry review: chemical bonding; complexities of chemical bonding in minerals; cations and anions; the periodic table with regard to minerals and mineral formation.
2	Crystal morphology and symmetry elements: point groups and crystal systems; unit cells and crystal lattices; Miller and Miller-Bravais indices; space groups. Structures of non-silicate minerals.
3	Introduction to crystallization processes; crystal imperfections (defects, zoning, twinning); mineral classification schemes; physical properties of minerals.
4	Ionic radii; coordination number; packing; Pauling's rules; silicate structures; substitution and solid solutions.
5	Introduction to optical mineralogy of uniaxial and biaxial minerals.
6	**Midterm Exam**
7	Igneous silicate minerals; classification and textures of igneous rocks.
8	Igneous petrology: fractional crystallization; igneous phase diagrams; tectonic discriminant diagrams; modes of occurrence of igneous rocks.
9	Sedimentary minerals (zeolites, clays, sulfates, halides, oxides, carbonates); weathering processes and sedimentary rock classification.
10	Sedimentary petrology: lithification and diagenesis; major depositional environments and associated rock types; plate tectonic significance.
11	Metamorphic minerals and characteristic textures; classification schemes for metamorphic rocks; tectonic setting of metamorphic belts.
12	Metamorphic petrology: metamorphic grade and facies; metamorphic reactions and phase equilibria; P-T diagrams and chemographic projections; introduction to thermobarometry.
13	Economic minerals (magmatic, hydrothermal, and sedimentary ores; native metals, sulfides and sulfosalts, oxides and hydroxides, gems).
14	Introduction to ore deposit models and associated mineralization types.

TENTATIVE LAB TOPICS

Week	Topic
1	Mineral nucleation and growth experiment.
2	Crystal symmetry and stereographic projections.
3	Mineral description and hand sample identification.
4	Introduction to rock hand sample descriptions; modal mineralogy estimates; macroscopic texture recognition.
5	Polarized light microscopy part I: Microscope operation and thin section handling; optical mineralogy fundamentals (birefringence; Becke lines, pleochroism refractive index, extinction angle, etc.)
6	Polarized light microscopy part II: rock microtextures; systematic mineral identification techniques; paragenetic sequences.
7	**Midterm Lab Exam**
8	Classification and textures of phaneritic igneous rocks; tectonic discrimination diagrams; basic petrography.
9	Classification and textures of aphanitic igneous rocks; tectonic discriminant diagrams; basic petrography.
10	Hand sample classification and thin section petrography of sedimentary rocks; sedimentary structure recognition and description.
11	Metamorphic rock classification and textural description (*metapelites*); bulk compositional constraints on metamorphic assemblages; metamorphic facies and P-T constraints.
12	Metamorphic rock classification and textural description (*metabasites*); metamorphic facies and P-T constraints.
13	Economic mineral identification and description; introduction to reflected light microscopy.
14	**Final Lab Exam**