APPLIED SCIENCE AND MANAGEMENT DIVISION
SCHOOL OF SCIENCE
Winter, 2018

COURSE OUTLINE

GEOL 110

MINERALOGY/PETROLOGY

3 CREDITS

PREPARED BY: Joel Cubley, Instructor DATE: November 3, 2017

APPROVED BY: Margaret Dumkee, Dean DATE: November 3, 2017

APPROVED BY ACADEMIC COUNCIL: November 2012

APPLIED SCIENCE AND MANAGEMENT DIVISION
GEOLOGY 110
3 Credit Course
Winter, 2018

MINERALOGY/PETROLOGY

INSTRUCTOR: Dr. Joel Cubley

OFFICE HOURS: M (1-3 pm)

OFFICE LOCATION: T1090

CLASSROOM: Lecture: M111
Laboratory: T1090

E-MAIL: jcubley@yukoncollege.yk.ca

TIME: Lecture: M/W (10:30 am – 12pm)
Laboratory: W (1:00 – 4:00pm)

TELEPHONE: (867) 456-8605

DATES: January 3- April 25, 2018

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.

PREREQUISITES:

Successful completion of GEOL105 (Physical Geology) and/or permission from the instructor.

EQUIVALENCY/TRANSFERABILITY:

Geology 110 has established equivalency with the following institutions:

University of British Columbia – EOSC 220 (3)
University of Northern British Columbia – ENSC 1XX (3)
University of Victoria – EOS 205 (1.5)
Vancouver Island University – GEOL 1XX (3)

LEARNING OUTCOMES:

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

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

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

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

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

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

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

COURSE FORMAT

This course consists of two 90-minute lectures and one 3-hour 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.

ASSESSMENTS

Attendance and Participation

Students are strongly encouraged to attend all lectures and laboratory exercises. The laboratory assignments are intended to both reinforce and build upon lecture concepts, and full participation is vital to student success. **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, with no exceptions.

Readings from the textbook will be assigned to support lecture instruction. Students should expect to spend 1-2 hours per week on background reading, and 3-4 hours on laboratory and/or theory assignments.

Tests/Exams

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 contact the Chair of the School of Science. Any deferred exams will be scheduled by the Chair.

EVALUATION

Tests and Assignments	***Weight***	***Dates***
Weekly Lab Assignments	40% (4% each)	Due at the start of each subsequent lab section.
Lecture Midterm 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	20%	During exam period, as scheduled by registrar.
Lecture Theory Assignments	10% (2.5% each)	Assignment 1: Due January 29th Assignment 2: Due February 16th Assignment 3: Due March 16th Assignment 4: Due April 6th
Total	100%	

The letter-grading scheme used in this course is the standard Yukon College scheme.

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.

REQUIRED TEXTBOOKS/MATERIALS:

Klein, C. and Philpotts, A. 2016. Earth Materials (2nd ed.). Cambridge University Press, Cambridge, UK. 616 p.

PLAGIARISM

Plagiarism is a serious academic offence. Plagiarism occurs when students present the words of someone else as their own. Plagiarism can be the deliberate use of a whole piece of another person's writing, but more frequently it occurs when students fail to acknowledge and document sources from which they have taken material. Whenever the words, research or ideas of others are directly quoted or paraphrased, they must be documented according to an accepted manuscript style (e.g., APA, CSE, MLA, etc.). Resubmitting a paper 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) at (867) 668-8785 or lassist@yukoncollege.yk.ca.

Topic Outline

Date	Topics	Recommended reading*
January 3rd	Course introduction; physical properties of minerals	Ch. 2 (p. 16-24) Ch. 3
January 8th	Electronic configuration of atoms and ions, bonding and the periodic table; radioactive decay, instrumental methods for characterization of minerals	
January 10th	Fundamentals of crystal structures: atomic vs. ionic radii, coordination number, Pauling's rules, controls on atomic substitutions	Ch. 4
January 10th	*Lab 1: Mineral formulas, analyses, and stoichiometry*	
January 15th	Symmetry elements and operations, crystal systems, crystallography notation	Ch. 5
January 17th	Miller indices, twinning, space groups, stereographic projections	Ch.5
January 17th	*Lab 2: Crystal symmetry*	
January 22nd	Introduction to microscopy (Part I) – interaction of light with minerals, polarization, refraction	Ch. 6
***January 24th**	Introduction to microscopy **(**Part II) – birefringence and retardation, color and pleochroism, extinction angles	Ch.6
January 24th	**No lab session (Mineral Exploration Roundup)**	
January 29th	Optical indicatrices I: the uniaxial indicatrix	Ch. 6
January 31st	Optical indicatrices II: the biaxial indicatrix	Ch. 6
January 31st	*Lab 3: Introduction to polarizing microscopes and optical microscopy – relief, birefringence, Becke lines, thin section sketches*	
February 5th	Igneous minerals (Part I): silicate mineral groups, feldspars, micas, quartz	Ch. 7
February 7th	Igneous minerals (Part II): olivine, clinopyroxene, orthopyroxene, hornblende, common accessory minerals	Ch. 7
February 7th	*Lab 4: Uniaxial and biaxial optic signs, 2V angles, length fast/length slow*	
February 12th	Midterm Exam Review	n/a
February 14th	**Midterm Lecture Exam**	
February 14th	*Lab 5: Crystal nucleation from an aqueous solution and a simulated melt*	
Feb. 19/21	**No classes (Reading Week)**	
February 26th	Genesis of igneous melts, melting points, eutectic diagrams, lever rule	Ch. 8
February 28th	Properties of melts, magma ascent and differentiation, cooling and heat conduction, Stokes Law, immiscible liquids	Ch. 8
February 28th	*Lab 6 – Felsic igneous rocks in thin section and hand sample*	
March 5th	Igneous rock classification and modes of occurrence	Ch. 9 (238-258)

March 7th	Igneous rocks and their plate tectonic settings	Ch. 9 (258-287)
March 7th	*Lab 7 – Mafic igneous rocks in thin section and hand sample*	
March 12th	Metamorphic minerals (Part I): alumnosilicates, garnet, staurolite, cordierite	Ch. 13
March 14th	Metamorphic minerals (Part II): metamorphic amphiboles (actinolite, tremolite, glaucophane), pyroxenes (diopside, omphacite), wollastonite	Ch. 13
March 14th	*Lab 8 – Metapelites in thin section and hand sample*	
March 19th	Introduction to metamorphic petrology: prograde vs. retrograde reactions, Le Chatelier's principle, thermodynamics and Gibb's phase rule, grade vs. facies, crystallographic facies	Ch. 14
March 21st	AFM diagrams and projections: tie line flips and terminal reactions, petrogenetic grids, AFM/ACF diagram construction	Ch. 14
March 21st	*Lab 9 – Metabasites and calcsilicates in thin section and hand sample*	
March 26th	Geothermobarometry and phase equilibria: exchange versus net-transfer reactions, partition coefficients, T-X diagrams, thermodynamic forward modelling vs. traditional thermobarometry	Ch. 14
March 28th	Sedimentary rock-forming minerals and distinguishing features	Ch. 10
March 28th	*Lab 10 – Siliciclastic and carbonate rocks in thin section and hand sample*	
April 4th	Siliciclastic sedimentary rocks – classification, occurrence and plate tectonic significance	Ch. 10
April 9th	Carbonate sedimentary rocks - classification, occurrence and plate tectonic significance	Ch. 10
April 11th	Lecture Final Exam Review	n/a
April 11th	*Lab Final Exam Review*	
April 18th	***Final Lab Exam***	

*All recommended readings from Klein and Philpotts (2016).