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

COURSE OUTLINE

GEOL 110

MINERALOGY/PETROLOGY

90 HOURS
3 CREDITS

PREPARED BY: _____ DATE: December 17, 2015
Joel Cubley, Instructor

APPROVED BY: _____ DATE: December 17, 2015
Margaret Dumkee, Dean

YUKON COLLEGE

Course Outline prepared by Joel Cubley, 17 December 2015.

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APPLIED SCIENCE AND MANAGEMENT DIVISION
GEOLOGY 110
3 Credit Course

MINERALOGY/PETROLOGY

INSTRUCTOR:	Dr. Joel Cubley
OFFICE HOURS:	Mondays 1–3 p.m.
OFFICE LOCATION:	T1090
TELEPHONE/E-MAIL:	465-8605 / jcubley@yukoncollege.yk.ca
FAX:	

COURSE OFFERING:	January 7 – April 27, 2016
DAYS & TIMES:	Lecture: Tuesday/Thursday, 10:30 a.m. - 12:00 p.m. (T1083) Lab: Wednesday 1 p.m. – 4 p.m. (T1090)

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:

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.

DELIVERY METHODS/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.

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. 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.

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 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 26th Assignment 2: Due February 16th Assignment 3: Due March 17th Assignment 4: Due April 7th
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, C. and Philpotts, A. 2012. Earth Materials. Cambridge University Press, Cambridge, UK. 552 p.

EQUIVALENCY/TRANSFERABILITY:

No transfer agreements have yet been established for GEOL110.

Tentative 2016 Mineralogy/Petrology Topics

Date	Topics	Recommended reading*
January 7th	Course introduction; physical properties of minerals	Ch. 2 (p. 16-24)
January 12th	Electronic configuration of atoms and ions, bonding and the periodic table; radioactive decay, instrumental methods for characterization of minerals	Ch. 3
January 13th	*Lab 1: Mineral formulas, analyses, and stoichiometry*	
January 14th	Fundamentals of crystal structures: atomic vs. ionic radii, coordination number, Pauling's rules, controls on atomic substitutions	Ch. 4
January 19th	Symmetry elements and operations, crystal systems, crystallography notation	Ch. 5
January 20th	*Lab 2: Crystal symmetry*	
January 21st	Miller indices, twinning, space groups, stereographic projections	Ch.5
***January 26th**	Introduction to microscopy (Part I) – interaction of light with minerals, polarization, refraction	Ch. 6
January 27th	**No lab session (Mineral Exploration Roundup)**	
***January 28th**	Introduction to microscopy **(**Part II) – birefringence and retardation, color and pleochroism, extinction angles	Ch.6
February 2nd	Optical indicatrices I: the uniaxial indicatrix	
February 3rd	*Lab 3: Introduction to polarizing microscopes and optical microscopy – relief, birefringence, Becke lines, thin section sketches*	
February 4th	Optical indicatrices II: the biaxial indicatrix	Ch. 6
February 9th	Igneous minerals (Part I): silicate mineral groups, feldspars, micas, quartz	Ch. 7
February 10th	*Lab 4: Uniaxial and biaxial optic signs, 2V angles, length fast/length slow*	
February 11th	Igneous minerals (Part II): olivine, clinopyroxene, orthopyroxene, hornblende, common accessory minerals	Ch. 7
February 16th	Midterm Exam Review	n/a
February 17th	*Lab 5: Crystal nucleation from an aqueous solution and a simulated melt*	
February 18th	***Midterm Lecture Exam***	
Feb. 23/24/25	**No classes (Reading Week)**	
March 1st	Genesis of igneous melts, melting points, eutectic diagrams, lever rule	Ch. 8
March 2nd	*Lab 6 – Felsic igneous rocks in thin section and hand sample*	
March 3rd	Properties of melts, magma ascent and differentiation, cooling and heat conduction, Stokes Law, immiscible liquids	Ch. 8
March 8th	Igneous rock classification and modes of occurrence	Ch. 9 (238-258)
March 9th	*Lab 7 – Mafic igneous rocks in thin section and hand sample*	
March 10th	Igneous rocks and their plate tectonic settings	Ch. 9 (258-287)
March 15th	Metamorphic minerals (Part I): alumnosilicates, garnet, staurolite, cordierite	Ch. 13
March 16th	*Lab 8 – Metapelites in thin section and hand sample*	
March 17th	Metamorphic minerals (Part II): metamorphic amphiboles	Ch. 13

	(actinolite, tremolite, glaucophane), pyroxenes (diopside, omphacite), wollastonite	
March 22nd	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 23rd	*Lab 9 – Metabasites and calcsilicates in thin section and hand sample*	
March 24th	AFM diagrams and projections: tie line flips and terminal reactions, petrogenetic grids, AFM/ACF diagram construction	Ch. 14
March 29th	Geothermobarometry and phase equilibria: exchange versus net-transfer reactions, partition coefficients, T-X diagrams, thermodynamic forward modelling vs. traditional thermobarometry	Ch. 14
March 30th	*Lab 10 – Siliciclastic and carbonate rocks in thin section and hand sample*	
March 31st	Sedimentary rock-forming minerals and distinguishing features	Ch. 10
April 5th	Siliciclastic sedimentary rocks – classification, occurrence and plate tectonic significance	Ch. 10
April 6th	*Final lab exam review period*	
April 7th	Carbonate sedimentary rocks - classification, occurrence and plate tectonic significance	Ch. 10
April 12th	*Lecture Final Exam Review*	n/a
April 13th	***Final Lab Exam***	

*All recommended readings from Klein and Philpotts (2013).