EARTH SCIENCE 2206A MINERAL SYSTEMS, CRYSTALLOGRAPHY, AND OPTICS Fall 2015

Instructor: Roberta Flemming: B&GS room 0172, rflemmin@uwo.ca (office hours TBA)

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Lectures: Mondays and Wednesdays, 9:30 am to 10:20 am, PAB 34 (Physics and Astronomy Building)

Laboratory: B&GS 1069: Tuesdays 6:00-9:00 pm or Wednesdays 2:30-5:30 pm

Objectives: This course introduces students to minerals. We will examine their crystalline nature, chemical composition, physical properties and optical properties. Students will also develop an understanding of the interconnections between these phenomena. From a theoretical perspective, students will understand how the properties of minerals are a product of their crystalline nature and how mineral structures can be understood systematically. Practical laboratories will strengthen students understanding of the above concepts and students will become proficient at identifying minerals using physical and optical properties.

Corequisite: Earth Sciences 2200a or Enrolment in the Materials Science Program

		Course topics/themes - Tentative schedule	**Reading in Text**
Crystallography			**Klein and Dutrow:**
Week 1:	Sept 14, 16	Introduction, Physical properties of minerals; Point symmetry	Ch 1-2
Week 2:	Sept 21, 23	Six crystal systems: symmetry & axes; Crystal forms & Miller indices	Ch 6
Mineral Chemistry			**Klein and Dutrow:**
Week 3:	Sept 28, 30	Periodic table, radius ratio, coordination polyhedra, closest packing	Ch 3-4
Week 4:	Oct 5, 7	Chemical substitution, solid solution, immiscibility and ordering	Ch 3-5, 11, 12
Optical mineralogy			**Nesse:**
Week 5:	Oct 12, 14	**Thanksgiving**, Polarized light; optical properties of minerals	Ch 1, 3-5
Week 6:	Oct 19, 21	optical properties cont'd; Uniaxial minerals (tetragonal, hexagonal)	Ch 6
Week 7:	Oct 26, 28	Biaxial minerals (orthorhombic, monoclinic, triclinic)	Ch 7
Systematic mineralogy of rock-forming minerals			**Klein and Dutrow:**
Week 8:	Nov 2, 4	Structural principles of silicates; **MIDTERM**	Ch 18
Week 9:	Nov 9, 11	Orthosilicates olivine, garnet, Al_2SiO_5; Ring silicates	Ch 18-19
Week 10:	Nov 16, 18	Single vs double chain silicates: pyroxenes, amphiboles	Ch 18-19
Week 11:	Nov 23, 25	Sheet silicates: clays, serpentine, micas, chlorite	Ch 18-19
Week 12:	Nov 30, Dec 2	Framework silicates: quartz, SiO_2 polymorphs, and feldspars	Ch 18-19
Week 13:	Dec 7, 9	Non-silicate minerals: native elements, oxides, sulfides, carbonates	Ch 15-17

Laboratory topics:

Labs	Date	Crystallography / Optical Mineralogy	Quiz	Minerals
Week 1:	Sept 15	Physical Properties of Minerals	no	native elements, halides
Week 2:	Sept 22	Point symmetry operations; six crystal systems	yes	oxides
Week 3:	Sept 29	External morphology: crystal forms Miller indices	yes	sulphides
Week 4:	Oct 6	Closest packing and coordination	yes	carbonates, sulphates
Week 5:	Oct 13	Optical microscopy - plane & cross polarized light	yes	orthosilicates
Week 6:	Oct 20	Optical microscopy – Anisotropic - uniaxial	yes	ring & chain silicates
Week 7:	Oct 27	Optical microscopy – Anisotropic – biaxial	yes	sheet silicates
Week 8:	Nov 3	Optical microscopy – Rock forming minerals I	yes	framework silicates
Week 9:	Nov 10	Optical microscopy – Rock forming minerals II	yes	
Week 10:	Nov 17	Optical microscopy – Rock forming minerals III	no	
Week 11:	Nov 24	Review session (mock final exam)		mock mineral exam
Week 12:	Dec 1*	**Final lab exam***		**Final mineral exam***
Week 13:	Dec 8	No lab		

*** NOTE: FINAL LAB EXAM** for **ALL STUDENTS** will be on the **SAME DAY** as decided by **CLASS VOTE**. Choices are either Dec 1: 5:30-9:30 pm or Dec 2: 3:30-7:30 pm (4 hr time slot is divided into 2 groups).

Course Materials:

- *Manual of Mineral Science*, 23rd Ed. (2008), by C. Klein and B. Dutrow, Wiley. (Required)
  [Or you can use previous edition: *Manual of Mineral Science*, 22nd Ed. (2002), by C. Klein, Jr, Wiley.]
- *Minerals in Thin Section,* 2nd Ed. (2003) D. Perkins and K.R. Henke, Prentice Hall. (Optional)
- *Introduction to Optical Mineralogy*, 4th Ed. (2012) by W.D. Nesse, Oxford University Press (Optional).
  [Or you can use the previous edition: *Introduction to Optical Mineralogy*, 3rd Ed. (2004) by Nesse]
- Supplementary material will be given weekly, at website https://owl.uwo.ca

Evaluation:

Midterm class test: (50 minutes)	November 4	20%
Lab assignments:	Weekly (9)	20 %
Lab mineral quizzes:	Weekly (8)	10 %
Lab exam: (2 hours)	Dec 1 or 2 (by class vote)	20 %
Final exam: (2 hours)	Scheduled by the Registrar	30 %

No electronic devices may be in your possession during tests/exams. Non-programmable calculators are OK

Note: It is Faculty of Science policy that a student who chooses to write a test or exam deems themselves fit enough to do so. Claims of medical, physical, or emotional distress after the fact will not be considered. However, if a student improves their grade in their final exam by 10% over their grade in the midterm test, the student may opt to have the final exam given full weight (50%) and the midterm grade discounted. [This does not apply if the student fails to write the midterm exam.] If a student should miss the midterm test for any reason, will not be a makeup test. Instead the student's final exam will be reweighted at 50%.

Ethical Conduct: Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

Plagiarism: Students must write their assignments in their own words. Whenever you take an idea, or a passage from another author, you must acknowledge this both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence.

Missed Course Components:
If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible.
If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in WSC 140, and can be contacted at 519-661-3040 or scibmsac@uwo.ca. Their website is http://www.uwo.ca/sci/undergrad/academic_counselling/index.html.

A student requiring academic accommodation due to illness must use the Student Medical Certificate (https://studentservices.uwo.ca/secure/medical_document.pdf) when visiting an off-campus medical facility. For further information, please consult the university's medical illness policy at http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

If you miss the Final Exam, please contact your faculty's Academic Counselling Office as soon as you are able to do so. They will assess your eligibility to write the Special Exam.
You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

Accessibility:
Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661 – 2111 x.82147 for any specific question regarding an accommodation.

Support Services:
Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mental_health) for a complete list of options about how to obtain help.
Additional student-run support services are offered by the USC, http://westernusc.ca/services.
The website for Registrarial Services is http://www.registrar.uwo.ca.

Course Website:
Students should check OWL (http://owl.uwo.ca) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. Students are responsible for checking OWL on a regular basis.