EARTH SCIENCE 2206A MINERAL SYSTEMS, CRYSTALLOGRAPHY, AND OPTICS Fall 2014

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, P&AB 106 (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 Materials Science; **Antirequisite:** The former Earth Sciences 205a

		Course topics / themes - Tentative schedule	**Reading in Text**
Crystallography			**Klein and Dutrow:**
Week 1:	Sept 8, 10	Introduction, Physical properties of minerals; Point symmetry	Ch 1-2
Week 2:	Sept 15, 17	Six crystal systems: symmetry & axes; Crystal forms & Miller indices	Ch 6
Mineral Chemistry			**Klein and Dutrow:**
Week 3:	Sept 22, 24	Periodic table, radius ratio, coordination polyhedra, closest packing	Ch 3-4
Week 4:	Sep 29, Oct 1	Chemical substitution, solid solution, immiscibility and ordering	Ch 3-5, 11, 12
Optical mineralogy			**Nesse:**
Week 5:	Oct 6, 8	Properties of polarized light; optical properties of minerals	Ch 1, 3-5
Week 6:	Oct 13, 15	**Thanksgiving**; Uniaxial minerals (tetragonal, hexagonal)	Ch 6
Week 7:	Oct 20, 22	Biaxial minerals (orthorhombic, monoclinic, triclinic)	Ch 7
Systematic mineralogy of rock-forming minerals			**Klein and Dutrow:**
Week 8:	Oct 27, 29	**MIDTERM**; Structural principles of silicates	Ch 18
Week 9:	Nov 3, 5	Orthosilicates olivine, garnet, Al_2SiO_5; Ring silicates	Ch 18-19
Week 10:	Nov 10, 12	Single vs double chain silicates: pyroxenes, amphiboles	Ch 18-19
Week 11:	Nov 17, 19	Sheet silicates: clays, serpentine, micas, chlorite	Ch 18-19
Week 12:	Nov 24, 26	Framework silicates: quartz, SiO_2 polymorphs, and feldspars	Ch 18-19
Week 13:	Dec 1, 3	Non-silicate minerals: native elements, oxides, sulfides, carbonates	Ch 15-17

Laboratory topics:

Labs	Date	Crystallography / Optical Mineralogy	Quiz	Minerals
Week 1:	Sept 09	Physical Properties of Minerals	no	native elements, halides
Week 2:	Sept 16	Point symmetry operations; six crystal systems	yes	oxides
Week 3:	Sept 23	External morphology: crystal forms Miller indices	yes	sulphides
Week 4:	Sept 30	Closest packing and coordination	yes	carbonates, sulphates
Week 5:	Oct 7	Optical microscopy - plane & cross polarized light	yes	orthosilicates
Week 6:	Oct 14	Optical microscopy – Anisotropic - uniaxial	yes	ring & chain silicates
Week 7:	Oct 21	Optical microscopy – Anisotropic – biaxial	yes	sheet silicates
Week 8:	Oct 28	Optical microscopy – Rock forming minerals I	yes	framework silicates
Week 9:	Nov 4	Optical microscopy – Rock forming minerals II	yes	
Week 10:	Nov 11	Optical microscopy – Rock forming minerals III	no	
Week 11:	Nov 18	Review session (mock final exam)		mock mineral exam
Week 12:	Nov 25*	**Final lab exam***		**Final mineral exam***
Week 13:	Dec 2	No lab		

*** NOTE: FINAL LAB EXAM** for **ALL STUDENTS** will be on the **SAME DAY** as decided by **CLASS VOTE**. Choices are either Nov 25: 5:30-9:30 pm or Nov 26: 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. (2004) D. Perkins and K.R. Henke, Prentice Hall. (Optional)
- *Introduction to Optical Mineralogy*, 3rd Ed. (2004) by W.D. Nesse, Oxford University Press (Optional).
- Supplementary material will be given weekly, at website https://owl.uwo.ca

Evaluation:

Midterm class test: (50 minutes)	October 27	20%
Lab assignments:	weekly (9)	20 %
Lab mineral quizzes:	weekly	10 %
Lab exam: (2 hours)	Nov 25 or 26 (by Class Vote)	20 %
Final exam: (2 hours)	TBA	30 %

Note: 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]

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/handbook/appeals/scholoff.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.

In case of medical illness:
If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately.
For further information please see: http://www.uwo.ca/univsec/handbook/appeals/medical.pdf

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services.
The form can be found here: https://studentservices.uwo.ca/secure/medical_document.pdf

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.