EAS 232 Mineralogy II
2021

Optical techniques in determinative mineralogy with particular emphasis on transmitted-light microscopy and its application to common rock-forming minerals. Mineral associations, textures and elementary ideas on the origin of igneous, metamorphic and sedimentary rocks. [Faculty of Science]

Prerequisites: EAS 224

Course Objectives:

By the end of this course, you will be able to:

- Explain the theory of the interaction of light and minerals
- Discuss optical phenomena, such as changes in the path of light at mineral boundaries or origin of interference colours, by applying this theory
- For important rock forming minerals, name and determine ("measure") key optical properties that allow their identification
- Apply the methods and procedures outlined in the lectures to identify and characterize common rock-forming minerals using a transmitted-light microscope
- Connect this process of optical mineral identification with your knowledge of mineral associations ("which minerals usually occur together") to guide you during mineral identification.
- Describe and interpret basic textures of igneous, metamorphic, and sedimentary rocks.

The knowledge and skills that you acquire in this course will provide you with the requisite background in petrography for your petrology coursework in the third year.

Instructor:

Thomas Stachel
Room: ESB 1-14
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email: tstachel@ualberta.ca

Office Hours:

Until further notice: on-line by appointment (email or call me)

Lectures:

M W F
13:00-13:50

Online: zoom

Downloads:

The slides for each chapter are posted on eClass; full lecture notes will be posted afterwards

Lab Session (in person delivery):

H1	Wednesday	14:00-16:50	ESB 3-04

Strongly Recommended Text:

Nesse, W.D. (2012): Introduction to Optical Mineralogy. 4th Edition, 368 p. Oxford University Press (~ $200).

The previous edition(s) are almost identical and may be used instead:
Nesse, W.D. (2004): Introduction to Optical Mineralogy. 3rd Edition, 348 p. Oxford University Press.

Reference Texts:

Deer, W.A., Howie, R.A. and Zussman, J. (2013): An introduction to the rock-forming minerals. 3rd Edition, 498 p. Mineralogical Society (London).

MacKenzie, W.S., Donaldson, C.H and Guilford, C. (1982): Atlas of igneous rocks and their textures. 148 p. Longman.

MacKenzie, W.S. and Guilford, C. (1980): Atlas of rock forming minerals in thin section. 98 p. Longman.

Yardley, B.W.D., MacKenzie, W.S. and Guilford, C. (1990): Atlas of metamorphic rocks and their textures. 120 p. Longman Scientific & Technical.

Websites (there is a lot more out there):

Mineralogy Database:
http://webmineral.com/

Guide to Thin Section Microscopy (pdf book) by Raith, Raase and Reinhardt (2011):
http://www.minsocam.org/msa/openaccess_publications/Thin_Sctn_Mcrscpy_2_rdcd_eng.pdf

Teaching Mineralogy (Topical Resources): Optical Mineralogy and Petrography:
https://serc.carleton.edu/NAGTWorkshops/mineralogy/optical_mineralogy_petrography.html

Molecular Expressions: Introduction to Optical Microscopy, Digital Imaging, and Photomicrography:
http://micro.magnet.fsu.edu/primer/index.html

NOVA Mineralogy (with videos of rotating thin sections):
https://blogs.nvcc.edu/mineralogy/

Virtual Microscope (great online tool to look at thin sections, with sample rotation, variable magnification, crossed polarizers etc.)
https://www.virtualmicroscope.org/

Course Outline:

Lecture Topics:	**Reading in Nesse:**
Properties of light and the petrographic microscope	Chapter 1-2
Refractive index, relief, and isotropic minerals	Chapter 3-4
Anisotropic minerals. Retardation and interference colors	Chapter 5
Uniaxial optics: the indicatrix, interference figures and optic sign	Chapter 6
Biaxial minerals: biaxial indicatrix and interference figures	Chapter 7
Identifying minerals in thin section	Chapter 9
Framework silicates	Chapter 10 (pp. 134-160)
Sheet silicates	Chapter 11 (pp. 171-179)
Chain silicates	Chapter 12 (pp. 191-224)
Disilicates and ring silicates	Chapter 13 (pp. 245-247)
Orthosilicates	Chapter 14 (pp. 248-250; 253-261)
Carbonates and Phosphates	Chapter 15 (pp. 269-278; 289-292)
Oxides	Chapter 16 (pp. 318-320)
Igneous and metamorphic rocks (origin, classification, textures)	

Laboratories:

Week of	**Laboratory Topic**
January 11 and 18	*No laboratory*
January 25	Lab 1: Introduction to the petrographic microscope, refractive index and relief
February 1	Lab 2: Double refraction: the calcite rhomb
February 8	Lab 3: Interference colors and fast and slow directions
February 15	*Reading Week*
February 22	Lab 4: Uniaxial interference figures
March 1	Lab 5: Biaxial interference figures
March 8	Lab 6: Felsic igneous minerals
March 15	Lab 7: Mafic igneous minerals
March 22	Lab 8: Metamorphic minerals I (pelitic minerals)
March 29	Lab 9: Metamorphic minerals II
April 5	Lab Final

Course Mark-Weight Distribution:

50% Lecture
Midterm: 20%
Final: 30%

50% Laboratory
Lab Assignments: 20%
Lab Final: 20%
Lab quizzes (two): 10%

Individual components of the course will be given a numerical mark. A cumulative course mark will be calculated from those scores, weighted as tabulated above. Note that the standard letter grading system will be used for the final evaluation of course performance. The grading system will be applied using a combination of absolute achievement and relative standing in the class. In past years, the mean grade in this course has been in the B- to B range. The mean grade this year will be based on my judgment of the overall caliber of this class relative to past cohorts.

Grades are unofficial until approved by the Department and/or Faculty offering the course.

Lab Assignments:

Lab assignments are handed in at the beginning of the next lab (i.e., usually in the following week). Assignments that are handed in late will receive a reduction of the grade of 10% per day. Assignments cannot be handed in during weekends.

Exams:

Midterm: Wednesday, February 24, online, 13:00-13:50.
Final (tentative date): Monday, April 26, 9:00-10:50. Until further notice, the final exam will be conducted online.
Please verify the final exam date on BearTracks once the Final Exam Schedule is posted.

Deferred Exams/Assignments Policy:

A student who cannot write a term examination or complete a term assignment due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for deferral of the weight of the missed exam to the final exam and of missed assignments to other assignments. For lab quizzes, the weight of a deferred quiz will be equally distributed over the remaining quiz and the lab final.
Deferral of term work is a privilege and not a right; there is no guarantee that a deferral will be granted. Misrepresentation of Facts to gain a deferral is a serious breach of the *Code of Student Behaviour*.

Deferred Final Examination:

A student who cannot write the final examination due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for a deferred final examination. Such an application must be made to the student's Faculty office within 48 hours of the missed examination and must be supported by a Statutory Declaration or other appropriate documentation (Calendar section 23.5.6). Deferred examinations are a privilege and not a right; there is no guarantee that a deferred examination will be granted. Misrepresentation of Facts to gain a deferred examination is a serious breach of the Code of Student Behaviour.

Students who are granted permission to sit a deferred final exam must do that exam on: Wednesday, May 10th, online or room to be assigned, 10:00-11:50

Exams:

Students will not be allowed to begin an examination after it has been in progress for 30 minutes.

Format of Exams:

Midterm and final exams are in the form of short questions requiring written answers (explanations of concepts but not essays) and labeled sketches (if possible online).

Representative Evaluative Material:

Example questions from previous midterm and final exams will be discussed in class before the respective exams (and will then be posted with the lecture notes for that day on the course webpage).

Accessibility Resources:

Students who require accommodations in this course due to a disability affecting mobility, vision, hearing, learning, or mental or physical health are advised to discuss their needs with Accessibility Resources, 1-80 Students' Union Building, 492-3381 (phone). Web site:
https://www.ualberta.ca/current-students/accessibility-resources

Academic Success Centre:

Students who require additional help in developing strategies for better time management, study skills or examination skills should contact the Academic Success Centre (2-300 Students' Union Building). Web site:
https://www.ualberta.ca/current-students/academic-success-centre

Miscellaneous

Policy about course outlines can be found in Section 23.4(2) of the University Calendar.

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behavior (online at https://www.ualberta.ca/governance/resources/policies-standards-and-codes-of-conduct/code-of-student-behaviour) and avoid any behavior which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All forms of dishonesty are unacceptable at the University. Any offence will be reported to the Senior Associate Dean of Science who will determine the disciplinary action to be taken. Cheating, plagiarism and misrepresentation of facts are serious offences. Anyone who engages in these practices will receive at minimum a grade of zero for the exam or paper in question and no opportunity will be given to replace the grade or redistribute the weights. As well, in the Faculty of Science the sanction for cheating on any examination will include a disciplinary failing grade (no exceptions) and senior students should expect a period of suspension or expulsion from the University of Alberta.

Note: Recording is permitted only with the prior written consent of the professor or if recording is part of an approved accommodation plan.

Disclaimer

Any typographical errors in this Course Outline are subject to change and will be announced in class. The date of the final examination is set by the Registrar and takes precedence over the final examination date reported in this syllabus.