

## **EAS 232 Mineralogy II 2016**

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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:**

This course will introduce you to determinative mineralogic methods that use transmitted-light microscopy. The theory of the interaction of light with minerals will be explained. The methods you learn in the laboratory will be applied to identifying and characterizing common rock-forming minerals. You will be introduced to the concept of mineral associations, to the interpretation of textures of rocks, and to petrographic aspects of igneous, metamorphic, and sedimentary rocks. By the end of this term, you will be able to identify common rock-forming minerals in thin section, and have completed the requisite background in mineralogy necessary for your petrology coursework in the third year.

### **Instructor:**

Thomas Stachel  
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email: [tstachel@ualberta.ca](mailto:tstachel@ualberta.ca)

### **Office Hours:**

Monday, 15:00-16:00 (or by appointment)

### **Lectures:**

M W F  
13.00-13.50  
Tory 1-103

### **Downloads:**

<http://courses.eas.ualberta.ca/eas232/downloads/>

### **Lab Sessions:**

H1	Monday	14:00-16:50	ESB 3-04
H2	Tuesday	14:00-16:50	ESB 3-04
H3	Wednesday	14:00-16:50	ESB 3-04
H4	Thursday	14:00-16:50	ESB 3-04

### **Strongly Recommended Text:**

Nesse, W.D. (2012): Introduction to Optical Mineralogy. 4<sup>th</sup> Edition, 368 p. Oxford University Press (~ \$170).

The previous edition(s) are almost identical and may be used instead:  
Nesse, W.D. (2004): Introduction to Optical Mineralogy. 3<sup>rd</sup> 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. 3<sup>rd</sup> 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):**

Minerals under the Microscope (University of Bristol):

<http://www.gly.bris.ac.uk/www/teach/opmin/mins.html>

Mineralogy Database:

<http://webmineral.com/>

Atlas of Igneous and Metamorphic Rocks, Minerals, and Textures (University of North Carolina):

<http://www.geolab.unc.edu/Petunia/IgMetAtlas/mainmenu.html>

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

## 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
<i>January 4 and 11</i>	<i>No laboratory</i>
January 18	Lab 1: Introduction to the petrographic microscope, refractive index and relief
January 25	Lab 2: Double refraction: the calcite rhomb
February 1	Lab 3: Interference colors and fast and slow directions
February 8	Lab 4: Uniaxial interference figures
<i>February 15</i>	<i>Reading Week</i>
February 22	Lab 5: Biaxial interference figures
February 29	Lab 6: Felsic igneous minerals
March 7	Lab 7: Mafic igneous minerals
March 14	Lab 8: Metamorphic minerals I (pelitic minerals)
March 21	Lab 9: Metamorphic minerals II
<i>March 28</i>	<i>Eastern</i>
<i>April 4</i>	<i>Lab Final</i>

## **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 10**, Tory 1-103, 13:00-13:50

Final (tentative date): Friday, **April 15**, room will be assigned, 14:00-16:00

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: Monday, **April 25<sup>th</sup>**, room to be assigned, **10:00-12:00**

### **Exams:**

Your student photo I.D. is required at exams to verify your identity. Students will not be allowed to begin an examination after it has been in progress for 30 minutes. Students must remain in the exam room until at least 30 minutes has elapsed. Electronic equipment cannot be brought into examination rooms.

### **Cell/smart phones:**

Cell/smart phones are to be turned off during lectures and labs (no texting under the table!). Electronic devices are not to be brought to exams.

### **Format of Exams:**

Midterm and final exams are in the form of short questions requiring concise written answers and labeled sketches.

### **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 Services:**

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 Student Accessibility Services, 1-80 Students' Union Building, 492-3381 (phone) or 492-7269 (TTY). Web site:

<http://www.ssds.ualberta.ca/>

### **Academic Support Centre:**

Students who require additional help in developing strategies for better time management, study skills or examination skills should contact the Student Success Centre (2-300 Students' Union Building). Web site:

<http://www.studentsuccess.ualberta.ca/>

## **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 <http://www.uofaweb.ualberta.ca/governance/studentappeals.cfm>) 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.