ADVANCED MINERALOGY 51-460/660
FALL 2006 SYLLABUS

INSTRUCTOR: Dr. George J. Hudak
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Office Hours: M 1:50 – 2:50
T 9:10 – 10:10
W 1:50 – 2:50
F 12:40 – 1:40

SCHEDULE: Lecture M, W, F 11:30 – 12:30

TEXTBOOK: The 22nd Edition of the Manual of Mineral Science, by Cornelis Klein;
Dana's Minerals and How to Study Them, 4th Edition, by C. Hurlbutt & W.E. Sharp.

COURSE POLICIES:

Course Objectives: There are several objectives for this course, including: 1) review and expand your understanding and knowledge of crystallography and crystal symmetry; 2) review and expand your understanding of fundamental chemical principles that dictate the structure and composition of minerals; 3) increase your understanding of the relationships between the chemical, and structural aspects of minerals (a topic called "Systematic Mineralogy"); 4) broaden your understanding of the variety of minerals that occur in various mineral groups (e.g. the pyroxenes of the amphiboles), and gain a better understanding of the genetic and environmental implications that various species of minerals have; and 5) learn about a number of advanced techniques for identifying minerals and/or better understanding their structure and/or composition.

As this is an "Advanced Mineralogy" course, we will be building upon material learned in your previous Mineralogy (51-205) course. At times it will be beneficial to consult your Mineralogy notes and/or Mineralogy textbook for fundamentals related to topics that we will be covering in the "Advanced Mineralogy"course.

General Course Outline As you can see from the attached syllabus, we will be building upon several key features of mineralogy that were covered in-depth in the sophomore-level Mineralogy course (51-205). These include 1) crystallography and crystal symmetry (including Miller indices and stereonet projections of selected crystals); 2) fundamental hand-sample mineral identification parameters and techniques (including additional tests not learned in the 51-205 course); 3) a review of phase diagrams; and 4) hand-sample mineral identification. Each of these topics will be taught using information from the textbooks, as well as laboratory-oriented homework exercises.

Additionally, we will spend a considerable amount of time learning "Systematic Mineralogy". Homework exercises for this aspect of the course are designed to enhance your understanding of the various chemical and structural groups that comprise minerals.

During the final part of the course we will broaden our mineral identification skills by learning about several types of analytical tools that we have here at UW Oshkosh. These will include: 1) identifying minerals using X-ray diffraction; 2) evaluating mineral chemistry using the Scanning Electron Microscope (housed in the Biology Department in the basement of Halsey); 3) identifying "opaque" minerals using reflected light microscopy; and 4) if time permits, evaluating mineral genesis conditions using the Fluid Inclusion stage (on the first floor of Harrington Hall).

Reference collections for you to study are located in the metal cabinets marked MINERALS. Minerals are arranged by chemistry (e.g. silicates, carbonates, etc.) and by crystal system (e.g. tectosilicates, phyllosilicates, etc.) in the cabinets. There is a three-ring binder in the lab labeled "Mineralogy Lab: Mineral List and Database" that tells you the location of the mineral samples in the cabinets.

DO NOT GET BEHIND, because there will be no time to catch up.

Attendance: This is a lecture course. Your regular attendance and note-taking will have a significant effect on your grade. It is in your best interest to attend each lecture.

D2L Site: There is a D2L site for this course. Consult with this site on a daily basis to download lecture handouts, class assignments, updates on course topics, and other information that will help you succeed in the course.

Additional Course Materials: In addition, there is a white three-ringer binder in the Mineralogy/Lithology labeled "Mineralogy Lecture Notes". This binder contains my notes on the various subjects covered in the Mineralogy course formerly taught at UW Oshkosh, and much of the material I will cover in detail in this course. The notes have been compiled from various sources, and from various undergraduate and graduate-level mineralogy courses taught throughout the country. USE THESE NOTES TO ENHANCE THE NOTES YOU TAKE DURING CLASS!

Homework: Mineralogy, by nature, is a very laboratory intensive course, as all of you have already experienced from your previous Mineralogy course. Although this course has no formal lab, you will be expected to spend a considerable amount of time in the Mineralogy/Lithology lab completing hand-sample mineral identification, and learning to identify new mineral species. In addition, you will complete several homework assignments on structural, chemical, and/or analytical aspects of mineralogy.

There will be six (6) homework assignments during the semester. Each assignment will be worth 50 points. Homework assignments are due by 4:00 pm on their due date. Assignments are to be turned in to Dr. Hudak's mailbox in Harrington 215. Assignments not turned in on time will be charged a "Late Fee" (in other words, you will automatically lose points by not turning assignments in on time). You will not get any points (e.g. get "0" points) on assignments turned in more than 1 week past the due date.

Mineral Identification Quizzes Brief mineral identification quizzes will be given Friday mornings at the beginning of class. The quizzes will be cumulative, so you will be responsible for a new group of minerals assigned each week, plus all previous groups of minerals that have been assigned and studied***. YOU MUST ACHIEVE AN AVERAGE OF 75% ON THE WEEKLY MINERAL IDENTIFICATION QUIZZES IN ORDER TO PASS THIS CLASS.*** *You will also be given a final mineral identification exam during the last week of the semester.*

Tray Reports: ***TRAY REPORTS ARE MANDITORY IN THIS COURSE. YOU MUST COMPLETE AT LEAST FIVE (5) ORAL TRAY REPORT DURING THE SEMESTER IN ORDER TO PASS THIS COURSE.*** These are independent efforts on your part (it's O. K. to contact me about a mineral if you get stumped) in which you must identify a set of mineral unknowns using the mineral identification techniques you use in lab. Tray reports for each mineral may include any of the following items: identification, chemical composition, mineral associations, mineral occurrence, and uses (either economic or geologic). *You must get 7 of the 9 minerals in the trays correct in order to receive credit for the tray (if you don't get 7 correct, you may continue to try again at a later date)*. *You will not be allowed to use any notes while completing the tray reports*. The tray reports essentially provide you with an opportunity to obtain additional points in the course.

Each of the five mandatory tray reports will be worth 20 points. The points from the mandatory tray reports will not be added to your mineral identification scores. Up to 5 additional tray reports may be completed during the semester, and these tray reports will be added to your Mineral Identification Quiz scores. Each of the five additional tray reports will be worth 10 points each.

I will put a sign-up sheet in the Mineralogy/Lithology lab to schedule tray reports. You cannot sign up for a tray report time until the previous tray report has been successfully completed (the exception, of course, is for the first tray report). No tray reports will be allowed after December 6, 2006.

Exams: Exams and quizzes will be used to evaluate your understanding of the materials presented in this class. If you are going to be absent from an exam please notify me (a phone call or an e-mail will do) ahead of time so that we can arrange another time for you to take the exam. I will also need additional time to construct different questions for the make-up exams. You must have a valid reason for missing an exam.

Pop-quizzes during lectures will only be administered if it becomes apparent to me that the class is not keeping up on the course readings.

There will be four 150- point exams on the lecture materials. The first exam will cover Crystal Chemistry, Crystal Structure, and Miller Indices. The second Exam will cover Phase diagrams and Mineral Chemistry. The third exam will cover systematic mineralogy of the silicate minerals. The fourth exam will test your knowledge of carbonate, sulfate, chromate, phosphate, oxide and sulfide minerals. The exams will be given during scheduled class periods and you will be given one hour to complete each exam.

Total Points: The total points in the class break down in the following way:

Exams:	4 @ 150 points each	600 points
Homework:	6 @ 50 points each	300 points
Tray Reports	5@ 20 points each	100 points
Weekly ID Quizzes	9@ 25 points each	225 points
	Total	***1225 points***

Optional Tray Reports: Up to 100 additional points

Final Grades: Your grade is based on your *total points* earned in the course, plus any additional points obtained from optional tray reports.The following grading scheme will be used:

A = 95% and above
AB = 90% - 94.9%
B = 82.5% - 89.9%
BC = 77.5% - 82.4%
C = 70% - 77.4%
CD = 65% - 69.9%
D = 60% - 64.9 %
F = less than 60%

ADVANCED MINERALOGY 51-460/660
Topical Outline

Week Beginning	***Lecture Topics***	***Homework Topics***
Sept. 6	Introduction, Crystallography, External Form	
Sept. 11	Miller Indices, Stereograph Projections* Isometric (Hexoctahedral) Tetragonal (Ditetragonal Dipyramidal) Hexagonal (Dihexagonal Dipyramidal) Hexagonal (Hexagonal Scalenohedral) Hexagonal (Trigonal Trapezohedral) Orthorhombic (Rhombic Dipyramidal) Monoclinic (Prismatic) Triclinic (Pinacoidal)	*Miller Indices/Stereonets (Sept. 22)*
Sept. 18	Crystal Chemistry & Structure / Systematic Mineralogy ***Exam 1, Friday, Sept. 22 (Crystallography, Miller Indices)***	*Pauling's Rules (Sept 29)*
Sept. 25	Silica Minerals/Feldspars (tectosilicates)*	*Feldspar Phase Diagrams* (Oct. 6)
Oct. 2	Zeolites/Nesosilicates/Sorosilicates*	
Oct. 9	Cyclosilicates/Inosilicates – Pyroxenes*	
Oct. 16	Inosilicates–Amphiboles / Phyllosilicates* ***Exam 2, Friday, October 20 (Tectosilicates, Nesosilicates, Sorosilicates, Cyclosilicates, Inosilicates)***	*Inosilicates (Oct. 27)*
Oct 23	Layer Silicates (Phyllosilicates)*	*Phyllosilicates (Nov. 3)*
Oct 30	Carbonates, Nitrates, Borates, Sulfates*	
Nov. 6	Chromates, Phosphates, Oxides, Hydroxides*	
Nov. 13	Sulfides* ***Exam 3, Friday, November 17 (Phyllosilicates, Carbonates, Nitrates, Borates, Sulfates, Chromates, Phosphates, Oxides, Hydroxides, Sulfides)***	*Ore Deposit Mineralogy (Nov. 21)*
Nov. 20	X-Ray Diffraction (XRD) *(Thanksgiving Break Nov. 21-Nov. 26)*	
Nov 27	XRD/Scanning Electron Microscopy	
Dec. 4	SEM / Reflected Light Microscopy	
Dec 11	Reflected Light Microscopy/Fluid Inclusions ***Exam 4: Wednesday, December 13 (Final Exam)***	

* Indicates 25-point mineral identification quiz at the start of Friday lecture.

Reading Assignments

Week Beginning		***Reading Assignments***
Sept. 6	Introduction, Crystallography, External Form	MMS - Chapters 1,5
Sept. 11	Miller Indices, Stereograph Projections	MMS - Chapter 5, 6 DM – Chapter 3
	Isometric (Hexoctahedral)	MMS - p. 269-276
	Tetragonal (Ditetragonal Dipyramidal)	MMS - p. 259-262
	Hexagonal (Dihexagonal Dipyramidal)	MMS - p. 263-266
	Hexagonal (Hexagonal Scalenohedral)	MMS - p. 266-269
	Hexagonal (Trigonal Trapezohedral)	MMS - p. 268
	Hexagonal (Rhombohedral)	MMS - p. 268 – 269
	Orthorhombic (Rhombic Dipyramidal)	MMS - p. 257-259
	Orthorhombic (Rhombic Pyrmadal)	MMS - p. 258-259
	Monoclinic (Prismatic)	MMS - p. 255-257
	Triclinic (Pinacoidal)	MMS - p. 254
Sept. 18	Crystal Chemistry & Structure	MMS – Chapter 3 DM – Chaper 5
Sept. 25	Physical Properties /Systematic Mineralogy	MMS – Chapter 2 DM – Chapter 4
Oct. 2	Silica Minerals/Feldspars/Foids (tectosilicates)	MMS - Chapter 11 selections MMS - p. 475-486, 543-557 DM – p.229-244
Oct. 9	Zeolites/Nesosilicates/Sorosilicates	MMS - Chapter 11 selections MMS - p. 486-490, 557 – 565 (zeolites) DM – p. 244-248 (zeolites) MMS – p. 445-448, 491-505 (nesolicates) DM – p. 273-284 (nesosilicates) MMS – p. 448-449, 506-510 (sorosilicates) DM – p. 271-273 (sorosilicates)
Oct. 16	Cyclosilicates/Inosilicates – Pyroxenes & Pyroxenoids	MMS – Chapter 11 selections MMS – p. 449- 452, 510-514 (cyclosilicates) DM – p. 266-270 (cyclosilicates) MMS – p. 452-456, 514-523 (inosilicates) DM – p. 259, 262-266 (inosilcates)
Oct 23	Inosilicates–Amphiboles / Phyllosilicates	MMS – Chapter 11 selections MMS - p. 452, 457-462, 523-527 (amphiboles) DM – p. 259-262 (amphiboles)

Week Beginning		***Reading Assignments***
Oct 30	Layer Silicates (Phyllosilicates)	MMS - Chapter 11 selections MMS – p. 462-475, 527-543 (phyllosilicates) DM – p. 248-259 (phyllosilicates)
Nov. 6	Carbonates, Nitrates, Borates, Sulfates	MMS – Chapter 10 DM – p.195-214 (carbonates and borates) DM – p. 218-227 (sulfates)
Nov. 13	Chromates, Phosphates arsenates)	MMS – p. 425-431 (chromates) MMS – p. 410-411, 433-440 (phosphates, DM – p. 214 – 218 (phosphates)
Nov. 20	Oxides, Hydroxides, Halides, Sulfides	MMS – Chapter 9 (oxides, hydroxides, halides) MMS – p.351-369 (sulfides, sulfarsenides, arsenides) DM – p.170-191 (oxides) DM – p. 191-195 (halides) DM – p. 149-170 (sulfides)
Nov 27	X-Ray Diffraction	MMS – Chapter 7 Concentrate on p. 309-321 DM – p. 103
Dec. 4	Electron Microprobe/SEM	MMS – Chapter 7 Concentrate on p. 326-328, 291-292
Dec 11	Reflected Light Microscopy	MMS- p. 308-309 OMOP – Chapter 1, Chapter 3

Reading Assignments:
MMS = Manual of Mineral Science, 22nd Edition, by Cornelis Klein
DM = Dana's Minerals and How to Study Them, 4th Edition, by Cornelius Hurlbutt and W. Edwin Sharp
OMOP = Ore Microscopy and Ore Petrography, by James R. Craig and David J. Vaughan