

EENS 211**Mineralogy****Fall 2009**Dr. Stephen A. Nelson snelson@tulane.eduOffice: Rm 208 Blessey Hall
Office Phone: 504-862-3194
Office Hours: MWF 1:00 -3:00 PM**I. COURSE GOALS & OBJECTIVES**

Since minerals are the basic building blocks of earth materials, this course is designed to give the student a fundamental background in minerals, necessary to understand processes. The student will learn the basic principles behind the arrangement of atoms to form crystal structures, how these atoms are coordinated and bonded and how this is reflected in the external form, chemical composition, and physical properties of the crystals.. The student will learn how to identify the most common minerals in hand specimen and, by using optical techniques, learn how to identify the common minerals in thin section.

II. TEXTBOOKS

There are two required textbooks for this course. The first is required reading for the course and the second is a general reference that you will also use in Petrology next semester.

1. Klein - *Manual of Mineral Science*, 23rd edition, by Cornelis Klein and Barbara Dutrow. This text covers crystallography, crystal structure, and crystal chemistry and has useful mineral identification tables. It will be used extensively for lectures at the beginning and end of the course.
2. DHZ - *An Introduction to the Rock Forming Minerals*, 2nd Edition, by W.A. Deer, R.A. Howie, and J. Zussman. This is a general reference text covering identification of minerals with the petrographic microscope. It will be used in the lab during the second half of the course.

III. COURSE GRADING

The course grade will be determined on the basis of the number of points scored out of a possible 1000 points. These points will be apportioned as follows:

Homework & Labs	15%	Midterm Exam	20%
Lab Exam I	10%	Lab Final Exam	20%
Lab Exam II	10%	Final Exam	25%

NOTE: The pre-requisite for enrollment in EENS 212, Petrology, is a grade of C- or better in EENS 211, Mineralogy.

IV. WEB PAGE

Lecture notes and other course materials can be found on the EENS 211 web page. This can be found at <http://www.tulane.edu/~sanelson/eens211/>

Handouts for the Laboratory exercises can be found on the My Tulane (Blackboard) site for EENS-211-41, if for some reason you don't get them in class.

V. TENTATIVE SCHEDULE OF LECTURES & LABS

<u>Date</u>	<u>Topic</u>	<u>Reading</u>
Aug. 25	Lecture: Introduction to Symmetry Operations	Klein pp. 1-18 109-128
	Lab: Elements of Crystal Symmetry	Klein pp. 109-128
Aug. 27	Lecture: The 32 Crystal Classes	Klein pp. 109-128
	Lab: Elements of Crystal Symmetry (continued)	Klein pp. 109-128
Sept. 1	Lecture: Crystal Morphology, Crystal Symmetry, Crystallographic axes	Klein pp. 129-131
	Lab: Crystallographic Axes and Introduction to Crystal forms	Klein pp. 134-142
Sept. 3	Lecture: Axial Ratios, Weiss parameters, Miller Indices	Klein pp. 131-134
	Lab: Miller Indices of Crystal Faces and Crystal Forms	Klein pp. 131-134
Sept. 8	Lecture: Crystal Form, Zones, Crystal Habit, 32 Crystal Classes	Klein pp. 134-142 182-208
	Lab: Stereographic Projection of Crystal Faces, Crystal angles, and Zones	Klein pp. 169-181
Sept. 10	Lecture: Crystallographic Calculations	Klein pp. 182-208
	Lab: Crystallographic Angles and Axial Ratio Calculations	Klein pp. 182-208
Sept. 15	Lecture: X-ray crystallography: the powder method	Klein pp. 307-321
	Lab: X-ray Powder diffraction demonstration Ionic Spacing in Halite	Klein pp. 307-321
Sept. 17	Lecture: Twinning in crystals, Polymorphism, Polytypism, Pseudomorphism	Klein pp. 227-234 266-285
	Lab: Twinning and physical properties of Minerals	Klein pp. 19-36
Sept. 22	Lecture: Physical Properties of Minerals	Klein pp. 19-36
	Lab: LAB EXAM I - Crystallography	
Sept. 24	Lecture: Crystal Chemistry	Klein pp. 37-65
	Lab: Mineral Identification - native elements, sulfates, sulfides, oxides, hydroxides, halides	Klein pp. 331-398
Sept. 29	Lecture: Coordination and Pauling's Rules	Klein pp. 66-89
	Lab: Mineral Identification - halides, carbonates, tungstates, molybdates, borates, chromates, phosphates, and arsenates	Klein pp. 399-433
Oct. 1	Lecture: Mineral Chemistry	Klein pp. 90-108 321-330
	Lab: Mineral Identification - Neso-, soro-, and ino-silicates	Klein pp. 483-518
Oct. 6	Lecture: Mineral Stability, phase diagrams	Klein pp. 245-256
	Lab: Mineral Identification - cyclo- and phyllo- silicates	Klein pp. 518-534

Oct. 8	Lecture: Binary phase diagrams, congruent melting	Klein pp. 245-256 Lecture Notes
	Lab: Mineral Identification - tectosilicates	Klein pp. 534-553
Oct. 13	Lecture: Binary phase diagrams, incongruent melting, solid solution, and exsolution	Klein pp. 276-282 143-148
	Lab: Phase Diagrams	Lecture Notes
Oct. 15	Fall Break - no class	
Oct. 20	Lecture: Properties of Light: reflection, refraction, dispersion, and refractive indices, Isotropic Minerals, the immersion method, isotropic indicatrix	Lecture Notes
	Lab: LAB EXAM II Mineral Identification	
Oct. 22	Lecture: MIDTERM EXAM	
	Lab: Optics Lab I. Properties of Light and Introduction to Isotropic Materials	Lecture Notes
Oct. 27	Lecture: Uniaxial minerals, uniaxial indicatrix, optic sign, & ray path	Lecture Notes
	Lab: Optics Lab II. Introduction to Anisotropic Substances	Lecture Notes
Oct. 29	Lecture: Interference phenomena, compensation & optic sign	Lecture Notes
	Lab: Optics Lab III. Interference and Compensation	Lecture Notes
Nov. 3	Lecture: Biaxial Minerals	Lecture Notes
	Lab: Optics Lab IV. Uniaxial Interference Figures and Summary of Uniaxial Optical Properties	Lecture Notes
Nov. 5	Lecture: Biaxial Minerals	Lecture Notes
	Lab: Optics Lab V. Biaxial Minerals	Lecture Notes
Nov. 10	Lecture: Silicate Structures	Klein pp. 434-482
	Lab: Optics Lab VI. Identification of Olivines and Pyroxenes - Calculation of mineral formulae.	DHZ
Nov. 12	Lecture: Olivines, Garnets, Aluminosilicates, Pyroxenes and Amphiboles	Klein pp. 484-519
	Lab: Optics Lab VII. Identification of Al_2SiO_5 minerals and amphiboles.	DHZ
Nov. 17	Lecture: Micas, serpentine, and chlorite	Klein pp. 519-534
	Lab: Optics Lab VIII. Identification of Phyllosilicate Minerals	DHZ
Nov. 19	Lecture: Clay Minerals	Klein pp. 521-525
	Lab: Optics Lab IX. Identification of Feldspars and Feldspathoids,	DHZ, Handout
Nov. 24	Lecture: Tectosilicates	Klein pp. 534-553
	Optics Lab X. Determination of Plagioclase Composition	DHZ, Handout

Nov. 26	Thanksgiving Holiday - no class	
Dec. 1	Lecture: Carbonates, oxides, & accessory minerals	Klein pp. 368-416
	Lab: Optics Lab XI. Identification of Common Metamorphic and Accessory Minerals	DHZ
Dec. 3	Lecture: Catch-up and Review Session	
	Lab: Catch-up and Review	
Dec. 7	Lab Final Examination 1:00 to 5:00 PM	
Dec. 10	Lecture Final Examination 8:00 AM to 12:00 PM	

Learning Outcomes for this Course

1. The student will gain an understanding of how atoms interact to form minerals and how the structure and chemical composition of minerals determine the properties and occurrence of minerals.
2. The student will learn how to identify the common minerals in hand specimen.
3. The student will learn how to identify the common rock forming minerals in thin section

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