EENS 2110 **Mineralogy** **Fall 2017**
Revised 9/18/2017

Dr. Stephen A. Nelson
snelson@tulane.edu

Office: Rm 208 Blessey Hall
Office Phone: 504-862-3194
Office Hours: by appointment

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. *Manual of Mineral Science 23rd Edition*, by Klein and 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. The text is available from the Tulane Bookstore

2. *An Introduction to the Rock Forming Minerals*, 2nd Edition, by W.A. Deer, R.A. Howie, and J. Zussman (**DHZ**). 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 and will serve as a reference book in EENS-2120 next semester.

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 2120, Petrology, is a grade of C- or better in EENS 2110.

IV. WEB PAGE

Lecture notes and other course materials can be found on the EENS 2110 web page at
http://www.tulane.edu/~sanelson/eens211/

PDF versions of the lecture notes and PowerPoinnt presentations will be available on Canvas .

V. 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.

VI. REVISED SCHEDULE OF LECTURES & LABS

Date	Topic	Reading
Aug. 31	**Lecture:** Introduction to Symmetry Operations	Klein p. 1-18, 109-128
	Lab: Elements of Crystal Symmetry	Klein p. 109-128
Sept. 5	**Lecture:** The 32 Crystal Classes	Klein p.109-128
	Lab: Elements of Crystal Symmetry (continued)	Klein p. 109-128
Sept. 7	**Lecture:** Crystal Morphology, Crystal Symmetry, Crystallographic axes	Klein p. 129-131
	Lab: Crystallographic Axes and Introduction to Crystal forms	Klein p. 134-142
Sept. 12	**Lecture:** Axial Ratios, Weiss parameters, Miller Indices	Klein p.131-134
	Lab: Miller Indices of Crystal Faces and Crystal Forms	Klein p.131-134
Sept. 14	**Lecture:** Crystal Form, Zones, Crystal Habit, 32 Crystal Classes	Klein p. 134-142 182-208
	Lab: Stereographic Projection of Crystal Faces, Crystal angles, and Zones	Klein p. 169-181
Sept. 19	**Lecture:** Crystallographic Calculations	Klein p. 182-208
	Lab: Crystallographic Angles and Axial Ratio Calculations	Klein p. 182-208
Sept. 21	**Lecture:** X-ray crystallography: the powder method	Klein p. 307-321
	Lab: X-ray Powder diffraction demonstration Ionic Spacing in Halite	Klein p. 307-321
Sept. 26	**Lecture:** Twinning in crystals, Polymorphism, Polytypism, Pseudomorphism	Klein p. 227-234 266-285
	Lab: Twinning and physical properties of Minerals	Klein pp. 19-36
Sept. 28	**Lecture:** Physical Properties of Minerals	Klein p. 19-36
	Lab: LAB EXAM I - Crystallography	
Oct. 3	**Lecture:** Crystal Chemistry	Klein p. 37-65
	Lab: Mineral Identification - native elements, sulfates, sulfides, oxides, hydroxides, halides	Klein p. 331-398
Oct. 5	**Lecture:** Coordination and Pauling's Rules	Klein p. 66-89
	Lab: Mineral Identification - halides, carbonates, tungstates, molybdates, borates, chromates, phosphates, and arsenates	Klein p. 399-433
Oct. 10	**Lecture:** Mineral Chemistry	Klein p. 90-108 321-330
	Lab: Mineral Identification - Neso-, soro-, and ino- silicates	Klein p. 483-518
Oct. 12	**Fall Break - No Class**	
Oct. 17	**Lecture:** Mineral Stability, phase diagrams	Klein p. 245-256 Lecture Notes
	Lab: Mineral Identification - cyclo- and phyllo- silicates	Klein p. 518-534

Oct. 19	**Lecture:** Binary phase diagrams, congruent melting	Klein p. 245-256 Lecture Notes
	Lab: Mineral Identification - tectosilicates	Klein p. 534-553
Oct. 24	**Lecture:** Binary phase diagrams, incongruent melting, solid solution, and exsolution	Klein p. 276-282 143-148 Lecture Notes
	Lab: Phase Diagrams	Lecture Notes
Oct. 26	**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. 31	**Lecture: MIDTERM EXAM**	
	Lab: Optics Lab I. Properties of Light and Introduction to Isotropic Materials	Lecture Notes Lab handout
Nov. 2	**Lecture:** Uniaxial minerals, uniaxial indicatrix, optic sign, & ray path	Lecture Notes
	Lab: Optics Lab II. Introduction to Anisotropic Substances	Lecture Notes Lab handout
Nov. 7	**Lecture:** Interference phenomena, compensation & optic sign	Lecture Notes
	Lab: Optics Lab III. Interference and Compensation	Lab handout Lab handout
Nov. 9	**Lecture:** Uniaxial Interference Figures	Lecture Notes
	Lab: Optics Lab IV. Uniaxial Interference Figures and Summary of Uniaxial Optical Properties	Lab handout
Nov. 14	**Lecture:** Biaxial Minerals	Lecture Notes
	Lab: Optics Lab V. Biaxial Minerals	Lab handout
Nov. 16	**Lecture:** Silicate Structures	Klein p. 434-482
	Lab: Optics Lab VI. Identification of Olivines and Pyroxenes - Calculation of mineral formulae.	DHZ
Nov. 21	**Lecture:** Olivines, Garnets, Aluminosilicates, Pyroxenes and Amphiboles	Klein p. 484-519 Lecture Notes
	Lab: Optics Lab VII. Identification of Al_2SiO_5 minerals and amphiboles.	DHZ
Nov. 23	**Thanksgiving Holiday**	
Nov. 28	**Lecture:** Micas, serpentine, and chlorite	Klein p. 519-534 Lecture Notes
	Lab: Optics Lab VIII. Identification of Phyllosilicates	DHZ
Nov. 30	**Lecture:** Clay Minerals	Klein p. 521-525 Lecture Notes
	Lab: Optics Lab IX. Identification of Feldspars and Feldspathoids,	DHZ, Handout
Dec. 5	**Lecture:** Tectosilicates	Klein p. 534-553
	Optics Lab X. Determination of Plagioclase Composition	DHZ, Handout

Dec. 7	**Lecture:** Carbonates, oxides, & accessory minerals	Klein p. 368-416 Lecture Notes
	Lab: Optics Lab XI. Identification of Common Metamorphic and Accessory Minerals	DHZ
Dec. 13	**Lecture Final Examination 1:00 PM to 5:00 PM**	
Dec. 16	**Lab Final Examination 1:00 PM to 5:00 PM**	

Obtain a PDF version of the syllabus

Return to EENS 2110 Page