Georgia Institute of Technology
School of Earth and Atmospheric Sciences

Course title:	Earth and Planetary Materials
Course number:	EAS 4803/8803
Term:	Spring 2019
Credit hours:	3
Time & location:	MW 3:05-4:25 PM @ ES&T L1116

Instructors: Prof. Yuanzhi Tang
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Overview

Fundamental principles and applications of mineralogy and petrology for understanding the composition of surface and subsurface materials on Earth and other planetary bodies.

Course Description

Minerals and rocks are the main components for planetary bodies. The formation, composition, and transformation of these materials can provide significant insights to the past and current environments. This course will cover both fundamental principles and applications of mineralogy and petrology for understanding the composition of surface and subsurface materials on Earth and other planetary bodies. Students will learn the chemical structures of important mineral classes, and how mineral assemblages and micro-textures record the conditions of rock formation and alteration. A range of laboratory techniques for mineralogy and petrology measurements will be introduced.

Learning Outcome

Upon completion of this course, students will be able to:

- Describe the main rock-forming minerals
- Understand the fundamental principles controlling mineral composition and ion substitution
- Understand the principles and applications of common analytical techniques for mineralogy and petrology measurements
- Develop skills that are necessary for scientific discussion and for the analysis of current scientific literature

Recommended Textbooks

- (K) Klein C. Manual of Mineral Science, 23rd Ed, John Wiley, 2008 (other edition OK)
- (W) Winter J.D. Principles of Igneous and Metamorphic Petrology, 2nd Ed, Prentice Hall, 2010 (other edition OK)

Evaluation and Grading

- Participation**:** 10% (If you miss 6 classes, you will not pass)
- Homeworks: 50%
- Midterm exam: 20%
- Final exam: 20%
- For homeworks and exams, graduate students will need to answer more questions. Extra credit questions/opportunities might also be given, and undergraduate students will be give more opportunities.

Late policy
All material handed in late will be deducted 10% per day

Participation Grade:
Student participation will be an important contributor to actively learning and learning from each other. Participation grades will be posted monthly. Class participation will be evaluated as follows:
•90-100%: always attend, participating often by asking questions or actively working with classmates on in class exercises.
•80-90%: Less than two unexcused absences, participating often
•70-80%: 2 to 4 unexcused absences, participating in class activities
•< 70%: More than 4 unexcused absences. Likely irregular participation.

Attendance:
Note if you miss 6 classes, you will not pass. The Institute Absence policy is available at: www.catalog.gatech.edu/rules/4/

Academic Integrity

Academic dishonesty will not be tolerated. This includes cheating, lying about course matters, plagiarism, or helping others commit a violation of the Honor Code. Plagiarism includes reproducing the words of others without both the use of quotation marks and citation. Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code and Student Code of Conduct, available online at www.honor.gatech.edu.

Learning Accommodations
If needed, we will make classroom accommodations for students with documented disabilities. These accommodations must be arranged in advance and in accordance with the Office of Disability Services (http://disabilityservices.gatech.edu).

Tentative class schedule (based on Spring 2017)

Week	Date	Tentative Topics	Book	Reading
1	1/9 1/11	**Introduction and overview** **Fundamentals of crystal chemistry** - Atoms and ions; bonding	K	Ch 1 Ch 3
2	1/16 1/18	No class 1/19 (MLK Day) - Packing, Pauling's rules	K	66-83
3	1/23 1/25	**Chemical composition of minerals** - Ionic substitution and solid solution - Determination of mineral formula - Mineral composition diagrams	K	96-104 Homework 1 104-108
4	1/30 2/1	**Rock-forming silicates** - Classification - Orthosilicates - Inosilicates	K	434-446 484-497 (skim) 446-456; 505-519 (skim) Homework 2
5	2/6 2/8	- Phyllosilicates and clay minerals - Tectosilicates	K	456-466; 519-534 (skim) 467-482; 534-552 (skim) Homework 3
6	2/13 2/15	**Carbonate minerals** **Basics of crystallography** - Bravais Lattices, Miller Indices **Analytical methods in mineral science**	K	 400-412 Ch 6 Ch 14
7	2/20 2/22	- X-ray diffraction, vibrational spectroscopy - Tour of user facility	K	Ch 14
8	2/27 3/1	**Midterm review** **Midterm exam**		
9	3/6 3/8	**Phase diagrams** - One component systems - Two component systems	W	Ch 6
10	3/13 3/15	**Phase diagrams** - Three component systems - Pressure and fluid effects - Bowen's reaction series	W	105-127
11	3/20 3/22	No classes (Spring Break)		
12	3/27 3/29	Classification of igneous rocks Major and minor elements	W	Ch 2; Ch 8
13	4/3 4/5	Normative mineralogy Trace elements	W	155-167
14	4/10 4/12	Formation environments of igneous rocks Optical petrography, igneous rock textures	W	Ch 10; Ch 3
15	4/17 4/19	Metamorphic processes and index minerals Metamorphic rock classification	W	Ch 21, 22
16	4/24	Metamorphic facies and reactions Low-T & metamorphic alteration on Mars	W	Ch 25, 26