Geology 422/622 and 423/623 — Petrology 2022
Department of Geosciences, NDSU
Syllabus version Feb 21, 2022 - Subject to change

Time:	Lecture: Tuesday and Thursday, 9:00 – 10:45 a.m. Lab: Wednesday, 12:00 – 1:50 p.m.
Location:	Sugihara Hall 148 – Microscopy Lab in Sugihara Hall 262
Instructor:	B. Saini-Eidukat, office 208 Sugihara Hall, ext. 1-8785 email: bernhardt.sainieiduk@ndsu.edu
Student visit hours:	Tuesdays, 2:00 - 4:00 p.m. at my office or in Sugihara 262
Texts:	required: Winter, J.D., 2010, "Igneous and Metamorphic Petrology," 2nd ed. www.whitman.edu/geology/winter/ required: D. Perkins & K. Henke, Minerals in Thin Section, 2nd ed., Prentice. Supplemental (not required): Ehlers, E.G., 1987, Optical Mineralogy, Vol. 1: Theory and Techniques, Vol. 2. Mineral Descriptions. Raith et al., 2012, Guide to Thin Section Microscopy, http://www.minsocam.org/msa/openaccess_publications/#Guide Supplemental (not required): "Igneous Petrology" by McBirney, 2nd ed.; "An Introduction to Metamorphic Petrology" by Yardley; also Wilson (1989); Philpotts; Klein and Dutrow.
Web Site:	www.ndsu.edu/pubweb/~sainieid/pet/

Lecture: This course is an introduction to Earth's igneous and metamorphic rocks. The prerequisite is a course in mineralogy. We will investigate how these rocks were formed, their geochemical and mineralogical characteristics, and how to interpret them to understand their genesis. We will learn from a combination of lectures, in-class exercises and discussion, homework, and a hands-on term project.
Lab: This laboratory course is an introduction to the theory and practice of optical microscopy; classification and identification of igneous and metamorphic rocks in hand specimen and thin section; and interpretation of rock textures and mineral assemblages.

Lecture, Lab and Exam Schedule; Readings

			Chapter
T	11 Jan	Earth composition and structure; Igneous rock classification	Winter 1,2
W	12	**Lab 1** – Optical properties of isotropic and uniaxial minerals	Lab Manual
Th	13	Optical petrography - theory and practice	Lab Manual
T	18	Optical petrography - theory and practice	Lab Manual
W	19	**Lab 2** – Optical properties of biaxial minerals	Lab Manual
Th	20	Intro to thermodynamics; One-component systems	Winter 5 & 6
T	25	Two-component systems	Winter 6
W	26	**Lab 3** – Feldspars, feldspathoids	Lab Manual
Th	27	Two-component systems; Partial melting	Winter 6
T	1 Feb	Two- and three-component systems	Winter 6 & 7
W	2	**Lab 4** – Mafic and ultramafic Rocks	
Th	3	Three-component systems	Winter 7
T	8	Major and minor element chemistry	Winter 8
W	9	**Lab 5** – Major and minor element chemistry of igneous rocks	Winter 8
Th	10	Major and minor element chemistry	Winter 8
T	15	Lecture **Exam 1**	(covers Winter 1,2 4-8)
W	16	**Lab 6** – Volcanic rocks	Winter 4
Th	17	Mantle stratigraphy, magma generation, diversification	Winter 10, 11
T	22	Trace element chemistry	Winter 9
W	23	**Lab 7** – Granitoids	
Th	24	Trace element chemistry (isotopes)	Winter 9
T	1 Mar	Mafic volcanism	portions of Winter 12, 13, 14, 15
W	2	**Lab – Exam 1**	(covers Labs 1 - 4)
Th	3	MORB	portions of Winter 10, 13, 15
T	8	Subduction-related volcanism	portions of Winter 16, 17, 18, 19
W	9	**Lab** – Project work	
Th	10	Subduction-related volcanism	portions of Winter 16, 17, 18, 19
T	15	Spring Break	
W	16	Spring Break	

Th	17 Mar	Spring Break	
T	22	Intro to metamorphic rocks; nomenclature	Winter 21, 22
W	23	**Lab 8** – Metapelites; Metamorphic textures	Winter 23
Th	24	Lecture **Exam 2**	(covers portions of Winter 9-19)
T	29	Metamorphic assemblages and phase equilibria	Winter 24, 25
W	30	**Lab 9** – Contact metamorphic rocks	
Th	31	Metamorphic assemblages and phase equilibria	Winter 24, 25
T	5 Apr	Metamorphic reactions; isograds	portions of Winter 26
W	6	**Lab 10** – High T and P rocks	
Th	7	Metamorphic reactions; Petrogenetic grids; Metacarbonates	portions of Winter 29
T	12	Metamorphic reactions; Petrogenetic grids	Winter 28
W	13	Project Work	
Th	14	Thermodynamics of metamorphic reactions	Winter 27
T	19	Metamorphic reactions; plotting reaction curves	Winter 27
W	20	Project Work	
Th	21	Geothermometers and geobarometers	Winter 27
T	26	Project work	
W	27	Student Presentations	
Th	28	Student Presentations	
T	3 May	Student presentations	
W	4	**Lab – Exam 2**	(covers Labs 5–10)
Th	5	Review	
T	10	**Lecture Exam 3**	(covers portions of Winter 21 – 29)

This schedule is subject to change.

Lecture Examinations: Three lecture exams will be given on the dates indicated above. These exams will include questions derived from lecture material, homework, and assigned reading.

Lecture Grading:	Exams 1, 2, 3	70%
	Quizzes & Homework	10%
	Project	20%

Graduate students (Geol 622) will be required to submit a written report on an independent project.

Laboratory Examinations and Grading:
Laboratory (423/623) grading will be based on laboratory assignments and three exams (short answer, problem solving, identification). Graduate students (Geol 623) will be required to submit an independent project report.

Exams 1 and 2	50%
Lab assignments	50%

Special Needs:
Students with disabilities or other special needs, who need special accommodation, are invited to share these concerns or requests with the instructor and contact the Disability Services Office as soon as possible.

Academic Responsibility:
All work in this course must be completed in a manner consistent with NDSU Policy 335: Code of Academic Responsibility and Conduct (www.ndsu.edu/academichonesty/policy335/).

Intended Student Outcomes:
- To be able to identify common rocks and their constituent minerals in hand specimen and thin section
- To understand and be able to apply rock classification schemes
- To understand the processes which form igneous and metamorphic rocks.
- To understand the basis of and the use of phase diagrams in petrology.
- To use mineral reactions to describe the formation of metamorphic rocks.
- To appreciate the relationships between Earth history, igneous and metamorphic processes, and plate tectonics.
- To carry out an original research project on some aspect of petrology and present results to a peer audience

COVID statement:

NDSU requires a face covering (mask) to be worn in all classroom settings. NDSU guidance is at www.ndsu.edu/covid19/face_covering_guidelines