The University of Jordan

Accreditation & Quality Assurance Center

Course Syllabus

Course Name: Igneous and Metamorphic Petrology 0335332

1	Course title	Igneous and Metamorphic Petrology
2	Course number	0305332
3	Credit hours (theory, practical)	3 credit hours (2 theory) and (1 practical)
	Contact hours (theory, practical)	2 lectures (1 hour each) + 1 lab session (3 hours)
4	Prerequisites	0335231
5	Program title	BSc. in Environmental and Applied Geology
6	Program code	
7	Awarding institution	The University of Jordan
8	Faculty	Science
9	Department	Geology
10	Level of course	Third or Fourth Year
11	Year of study and semester (s)	Offered in Spring or Fall. The course is not mandatory for students majoring in Geology.
12	Final Qualification	
13	Other department (s) involved in teaching the course	None
14	Language of Instruction	English references, textbooks and exams / Lectures are delivered in Arabic and English.
15	Date of production/revision	Spring 2017

16. Course Coordinator:

Dr. Ghaleb Jarrar: jarrargh@ju.edu.jo

17. Other instructors:

Dr. Hind Ghanem: h.ghanem@ju.edu.jo

18. Course Description:

This course advanced topics in hard rocks petrology. In igneous petrology part, students review the essentials of the origin, formation, properties, chemical composition, and properties of magmas; binary and ternary phase diagrams; igneous structures; igneous petrography and classification; tectonics and igneous processes. In the metamorphic petrology part, students review and study agents, types, processes, and conditions of metamorphism; structures, textures, and mineral assemblages; metamorphic facies and reactions; metamorphic phase diagrams. The course requires three hours of lab work on weekly basis to study specimens and thinsections of rocks. A field trip to the south of Jordan and Wadi Araba is required.

19. Course aims and outcomes:

A- Aims:
To describe, using the specialized geologic terminology, igneous and metamorphic rocks including their mineralogy, texture and structure.
To name and classify common igneous and metamorphic rocks based on internationally recognized schemes and criteria.
To understand the processes of generation, migration, crystallization and differentiation of magmas to form igneous rocks.
To understand mineralogical and textural changes that take place in rocks because of metamorphism.
To gain the basic skills needed to characterize petrographic and geochemical data for igneous and metamorphic rocks to interpret their petrogenesis.

B- Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to:

Classify igneous rocks based on mineralogy, chemistry, and texture from geochemical data and/or thinsections and hand specimens.
Demonstrate an understanding of magma formation and crystallization using phase diagrams
To explain the diversity of magmatic rocks using phase diagrams.
Explain how magmas form, crystallize, and mix.
Use chemistry of igneous rocks to differentiate between magma series and relate that to their tectonic setting.
Differentiate between types of volcanoes and relate that to the magma types.
Recognize the igneous associations on the basis of their composition and assign their tectonic setting .
Relate the agents of metamorphism to type and textures of metamorphic rocks and their tectonic setting.
Identify protolith of the various metamorphic rocks based on mineralogy and chemistry.
Relate textures and structures of metamorphic rock to stress and deformation.
Name metamorphic rocks based on texture, structure and index minerals.
Relate metamorphic zones to index minerals and the P-T conditions of metamorphism.
Interpret the metamorphic history of certain rocks and relate that to the tectonic environment.

20. Topic Outline and Schedule:

# of Lectures/labs	Topic	Reading
1	Review of Fundamental Concepts	Chapter 1 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Review of Igneous Structures and Field Relationships	Chapter 4 in An introduction to Igneous and Metamorphic Petrology by John Winter
2	An Introduction to Thermodynamics	Chapter 5 in An introduction to Igneous and Metamorphic Petrology by John Winter
2	The Phase Rule and One-and Two-Component Systems	Chapter 6 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Systems with More than Two Components	Chapter 7 in An introduction to Igneous and Metamorphic Petrology by John Winter

1	Generation of Basaltic Magmas	Chapter 10 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Diversification of Magmas	Chapter 11 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Layered Mafic Intrusions	Chapter 12 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Mid-Ocean Ridge Volcanism	Chapter 13 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Oceanic Intraplate Volcanism	Chapter 14 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Continental Flood Basalts	Chapter 15 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Subduction-Related Igneous Activity Part I: Island Arcs	Chapter 16 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Subduction-Related Igneous Activity Part II: Continental Arcs	Chapter 17 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Granitoid Rocks	Chapter 18 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Continental Alkaline Magmatism	Chapter 19 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Anorthosites	Chapter 20 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	An Introduction to Metamorphism	Chapter 21 in An introduction to Igneous and Metamorphic Petrology by John Winter
3	Stable Mineral Assemblages in Metamorphic Rocks	Chapter 24 in An introduction to Igneous and Metamorphic Petrology by John Winter
2	Metamorphic Facies and Metamorphosed Mafic Rocks	Chapter 25 in An introduction to Igneous and Metamorphic Petrology by John Winter
2	Metamorphic Reactions	Chapter 26 in An introduction to Igneous and Metamorphic Petrology by John Winter
2	Thermodynamics of Metamorphic Reactions	Chapter 27 in An introduction to Igneous and Metamorphic Petrology by John Winter
1	Metamorphism of Pelitic Sediments	Chapter 28 in An introduction to Igneous and Metamorphic Petrology by John Winter

1	Metamorphism of Calcareous and Ultramafic Rocks	Chapter 29 in An introduction to Igneous and Metamorphic Petrology by John Winter
2	Metamorphic Fluids, Mass Transport and Metasomatism	Chapter 30 in An introduction to Igneous and Metamorphic Petrology by John Winter
Lab 1	*Classification and Nomenclature of Igneous Rocks*	*Chapter 2 in An introduction to Igneous and Metamorphic Petrology by John Winter*
Lab 2	*Textures of Igneous Rocks*	*Chapter 3 in An introduction to Igneous and Metamorphic Petrology by John Winter*
Lab 3	Chemical Petrology	*Chapters 8 and 9 in An introduction to Igneous and Metamorphic Petrology by John Winter*
Lab 4	*Igneous petrology project*	-
Lab 5	*Igneous petrology project*	-
Lab 6	*Igneous petrology project*	-
Lab 7	*A Classification of Metamorphic Rocks*	*Chapter 22 in An introduction to Igneous and Metamorphic Petrology by John Winter*
Lab 8	*Structures and Textures of Metamorphic Rocks*	*Chapter 23 in An introduction to Igneous and Metamorphic Petrology by John Winter*
Lab 9	*Metamorphic petrology project*	-
Lab 10	*Metamorphic petrology project*	-
Lab 11	*Metamorphic petrology project*	-

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21. Teaching Methods and Assignments:

The class meets two times per week. The material is presented in PowerPoint presentations along with explanation and illustrations on the whiteboard. Students have the assigned textbook as the main reference, and they should take notes during class. Students are encouraged to be an active part of the lecture by asking them questions and giving them the freedom to ask questions, so their participation is an essential part of the lecture. The lab is an essential part of the material where students study hand samples, thinsections, work with maps and chemical data to explain the history of the rocks they see. A two days field trip to Wadi Araba and East and Northeast of Aqaba is a must.

22. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements: participation in class, quizzes, homework, field trip report, three exams

23. Course Policies:

A- Attendance policies:

Missing 15% or more of the lectures and labs with or without an officially accepted excuse will result in getting absence fail grade and the student will need to re-enrol in the lab when it is next available.

B- Absences from exams and handing in assignments on time:

- Missing exams with no excuse results in getting a zero grade of that exam. ONLY and ONLY if the student shows a proof of an emergency and compelling accepted excuse, a makeup exam will be given. However, students must be warned that makeup exams are at least 200% harder than regular exams.
- Missing labs results in a zero grade of that lab assignment.

C- Health and safety procedures:

NA

D- Honesty policy regarding cheating, plagiarism, misbehavior:

The regulations of the university will be applied.

E- Grading policy:

A: 90-100

A-: 85-89

B+: 80-84

B: 75-79

B-: 71-74

C+: 67-70

C: 63-66

C-: 59-62

D+: 54-58

D: 50-53

D-: 45-49

F: 0-44

F- Available university services that support achievement in the course:

NA

24. Required equipment:

NA

25. References:

A- Required book (s), assigned reading and audio-visuals:
Required textbook: An introduction to Igneous and Metamorphic Petrology by John Winter; Prentice Hall. ISBN: 9780132403429.

B- Recommended books, materials, and media:

Any other igneous and metamorphic petrology book.

26. Additional information:

NA

Name of Course Coordinator: Signature: Date:

2/5/2017 Head of curriculum committee/Department: ---------- Signature: --

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Head of Department: ---------- Signature: ----------

Head of curriculum committee/Faculty: ---------- Signature: ----------

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Dean: ---------- -Signature: ----------

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Assistant Dean for Quality

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Course File