1	**Course title**	Igneous Petrology
2	**Course number**	0305931
3	**Credit hours (theory, practical)**	3 credit hours
	Contact hours (theory, practical)	Sunday and Tuesday: 17:00-18:30
4	**Prerequisites/co requisites**	B.Sc. in Geology
5	**Program title**	M.Sc. in Geology
6	**Program code**	
7	**Awarding institution**	The University of Jordan
8	**School**	School of Science
9	**Department**	Geology Department
10	**Level of course**	
11	**Year of study and semester (s)**	2023/24
12	**Final Qualification**	
13	**Other department (s) involved in teaching the course**	none
14	**Language of Instruction**	English
15	**Date of production/revision**	Spring 2024

16. Course Coordinator: Prof. Dr. Ghaleb H. Jarrar

Office numbers, office hours, phone numbers, and email addresses should be listed. G 214; 5255000, ext 22273, jarrargh@ju.edu.jo

When we study a suite (a group of igneous rocks that have a common history) of igneous rocks we seek answers to one or more of the following:

- Understanding eruptive process and assessment of a volcanic hazard of a given volcano
- Documenting the structure and evolution a part of a given oceanic or continental crust
- Making inferences regarding ancient tectonic environment
- Understanding the formation of a given economic mineral deposits associated with this suite
- Establishing an absolute age for a sequence of rocks through the use of radioactive isotopes
- Identifying the source and conditions of formation of a given magma

Ultimate goal of all of these studies is to understand how magmatic processes operate!

17. Other instructors:

Office numbers, office hours, phone numbers, and email addresses should be listed.

None

18. Course Description:

As stated in the approved study plan with modifications

Igneous rocks are those formed by solidification of magma. This course assumes a basic knowledge of igneous rocks. A solid knowledge of rock-forming minerals is mandatory for all students of petrology. It should be born in mind that all rocks ultimately are derived from igneous rocks e.g., consider the history of a rock like shale, which consists of clay minerals and other clasts has its origin from a granite by means of weathering.
Igneous petrology deals with classification, occurrence, composition, origin and evolution from magmas. Field and lab description, microscopic identification of minerals falls under the **petrography** while the use of this info together with chemical data and the results of experimental results on magma to understand the evolution of these rocks form the basis of igneous **petrogenesis**.

19. Course aims and outcomes:

Aims

When we study a suite (a group of igneous rocks that have a common history) of igneous rocks we seek answers to one or more of the following:

- Understanding eruptive process and assessment of a volcanic hazard of a given volcano
- Documenting the structure and evolution a part of a given oceanic or continental crust
- Making inferences regarding ancient tectonic environment
- Understanding the formation of a given economic mineral deposits associated with this suite
- Establishing an absolute age for a sequence of rocks through the use of radioactive isotopes
- Identifying the source and conditions of formation of a given magma

Ultimate goal of all of these studies is to understand how magmatic processes operate!

B. **Learning outcomes**

After having completed this course, the graduate student should be able:

1. To differentiate between major magmatic suites on the basis of their of their tectonic setting;
2. To model the thermal history of a magmatic suite utilizing phase diagrams and relevant phase equilibria software.
3. To model the history of a given magmatic association utilizing major elements and trace elements chemistry of rocks and their minerals;
4. To model magmatic processes and thermos-tectonic history of a given suite based on well-calibrated mineral thermometers and barometers.
5. To make inferences regarding the economic potential of a given magmatic suite
6. To integrate all above mentioned tools including isotopes to write a petrogenetic model for a given magmatic suite

20. Topic Outline and Schedule:

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference

The following topics will be covered during this course:

- An introduction to magmas and magmatic rocks
- Major elements Chemistry of Igneous rocks
- Trace elements chemistry of Igneous rocks
- Binary and ternary phase diagrams as tools to understand the evolution of igneous rocks
- Geothermobarometry
- Basalts and related rocks
- Magma differentiation
- Gabbroic rocks
- Ultramafic and ultrabasic rocks
- Andesite, dacite and rhyolite
- How magmas erupt – an introduction to pyroclastic processes and products
- Granitic rocks
- Alkali rocks

21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

Lecturing, homework solving of real data, reading and evaluating relevant publications

22. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Grading is based on participation in solving homework assignments, two midterm exams, and a final exam.

Homework assignments and reading material will be posted on the webpage of this course on the E-Learning

23. Course Policies:

A- Attendance policies: University regulations apply

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

C- Health and safety procedures: Not applicable

D- Honesty policy regarding cheating, plagiarism, misbehavior: University regulations apply

E- Grading policy:

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

24. Required equipment: (Facilities, Tools, Labs, Training….)

25. References:

Selected References

The lectures will be based several textbooks.

1. Philpotts, A and Ague J. 2009. Principles of igneous and metamorphic petrology. 667 pp. Cambridge University Press.
2. Robin Gill (2010) Igneous rocks and processes, a practical guide, Wiley-Blackwell, 428 pp.
3. B., Frost and C. Frost (2014). Essentials of Igneous and Metamorphic Petrology, Cambridge University Press 303 pp.
4. Winter, J. 2009 Introduction of Igneous and Metamorphic Petrology. 697 pp. Printice Hall.

26. Additional information:

Name of Course Coordinator: Prof. Dr. Ghaleb H. Jarrar Signature: -*Jarrar* Date: February 2024

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

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

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

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