Academic course description – crystallography

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| Bachelor’s DEGREE**GEOCHEMISTRY**1st YEAR OF STUDY, 1st SEMESTER |

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| **Course title** | **crystallography** |
| Course code | 31020030020SL1111103  |
| Course type | full attendance |
| Course level | 1ST cycle (bachelor’s degree) |
| Year of study, semester | 1st year of study, 1st semester |
| Number of ECTS credits | 6 |
| Number of hours per week | 4 (2 lecture hours + 2 seminar hours) |
| Name of lecture holder | Assistant Professor Andrei Ionuţ Apopei  |
| Name of seminar holder | Assistant Professor Andrei Ionuţ Apopei  |
| Prerequisites |  |
| A | **General and course-specific competences** |
|  | **General competences**:* Applying efficient work strategies so as to gain knowledge of Crystallography that will prove useful for the study of future academic disciplines (Descriptive Mineralogy, Mineralogenesis, Igneous Petrography, Metamorphic Petrography, Sedimentary Petrography, Geology of Ore Deposits)

**Course-specific competences**:* Identifying and understanding the main concepts and phenomena related to Geometric Crystallography (crystallogenesis, habitus, space groups etc.), plane-polarized light microscopy (Physical Crystallography), Radiocrystallography (X-ray diffraction) etc.
* Understanding the functioning of the petrographic microscope as a tool in the identification of the optical properties of minerals
* Understanding the functioning of the X-ray diffractometer
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| B | **Learning outcomes** |
|  | Upon successfully completing the discipline, students become capable of:- identifying the axes, planes and centers of symmetry of various crystalline forms- identifying the crystallographic system of a crystal- identifying the properties of crystals based on microscopic studies with parallel nicols- identifying the properties of crystals based on microscopic studies with crossed nicols - identifying minerals based on X-ray diffraction  |
| C | **Lecture content** |
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| Week | Title of lecture | Teaching methods |  Duration  |
| 1 | Introduction (crystalline/amorphous substances, liquid crystals etc.) |  Lecture, problematization  | 3 hours |
| 2 |  I. Crystallogenesis I.1. Flaws in the crystal lattice | Lecture | 2.5 hours |
| 3 | I.2. Crystallogenetic processes | Lecture, problematization | 3 hours |
| 4 | II. Geometric Crystallography II.1. The laws of Geometric Crystallography  | Lecture, debate  | 2 hours |
| 5 | II.2. Analytical expressions and relations for facets and zones  | Lecture | 1.5 hours |
| 6 | III. Crystal symmetry III.1. Punctual symmetry  | Lecture  | 6 hours |
| 7 | III.2. Lattice symmetry  | Lecture  | 1.5 hours |
| 8 | IV. Physical CrystallographyIV.1. Optical properties  | Lecture, problematization | 4 hours |
| 9 | IV.2. Magnetic and electrical propertiesIV.3. Cohesion-related properties  | Lecture  | 1.5 hours |
| 10  | V. Radiocrystallography V.1. X-ray diffraction through crystals  | Lecture  | 1 hour |
| 11 | V.2. Methods for the X-ray analysis of crystals  | Lecture  | 2 hours |

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| D | **Recommended reading for lectures** |
|  | Rousseau, J-J. (1995) Cristallographie géométrique et radiocristallographie. Masson, Paris.Putnis, A. (1993). Introduction to Mineral Sciences (chapters 1-7). Cambridge University Press, Cambridge. |
| E | **Seminar content** |
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| Week | Title of seminar | Teaching methods | Duration  |
| 1.  | Visit to the Museum of Mineralogy  | Debate | 2 hours |
| 2. | Identification of the axes of symmetry of crystallographic forms  | Identification based on a model | 2 hours |
| 3. | Identification of the axes of symmetry of crystallographic forms  | Identification based on a model | 2 hours |
| 4. | Identification of the planes and centers of symmetry of crystallographic forms  | Identification based on a model | 2 hours |
| 5. | Identification of the planes and centers of symmetry of crystallographic forms  | Identification based on a model | 2 hours |
| 6. | Identification of simple crystallographic forms | Identification based on a model | 2 hours |
| 7. | Identification of simple crystallographic forms | Identification based on a model | 2 hours |
| 8. | Identification of complex (composed) crystallographic forms | Identification based on a model | 2 hours |
| 9. | Identification of complex (composed) crystallographic forms | Identification based on a model | 2 hours |
| 10. | Identification of complex (composed) crystallographic forms | Identification based on a model | 2 hours |
| 11. | The petrographic microscope. Optical properties determined using parallel nicols | Identification under the petrographic microscope | 2 hours |
| 12. | The petrographic microscope. Optical properties determined using parallel nicols | Identification under the petrographic microscope | 2 hours |
| 13. | Optical properties determined using crossed nicols | Identification under the petrographic microscope | 2 hours |
| 14. | The petrographic microscope. Optical properties determined using crossed nicols | Identification under the petrographic microscope | 2 hours |
| 15.  | Oral exam |  | 2 hours |

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| F | **Recommended reading for seminars** |
|  | American Mineralogist Crystal Structure Database (http://webmineral.com/data/)MacKenzie, W.S., Adams A.E. (1998). A Colour Atlas of Rocks and Minerals in Thin Section. Manson Publishing, London. |
| G | **Education style** |
| learning and teaching methods | Lecture, problematization, debate, identification based on models and the petrographic microscope |
| assessment methods | Written exam (30%) and continuous assessment (30%) (lecture), oral exam and continuous assessment (seminar) – 40% |
| Language of instruction | English  |