Snow and Ice throughout the Solar System

Educational subject description sheet

Basic information

Field of study AGH UST International Courses **Speciality** All **Department** Generic subjects **Study level** any level **Study form** Full-time studies **Education profile** General academic	**Didactic cycle** 2022/2023 **Subject code** POGJOS.A100000O.624edaab52c56.22 **Lecture languages** English **Mandatory** Elective **Block** General Modules **Subject related to scientific research** Yes **USOS code** 140-INT-xS-222

Subject coordinator	Justyna Topolska
Lecturer	Justyna Topolska

Period	**Examination**	**Number of ECTS points**
Winter semester	Assessment **Activities and hours** Lecture: 8 Project classes: 4 Laboratory classes: 13 Workshop classes: 5	3.0

Goals

C1	Providing students with the knowledge of snow and ice in the solar system.
C2	Providing students with knowledge on the direct role of the snow and ice-water cycle in life processes.

Subject learning outcomes

Code	Outcomes in terms of	Directional learning outcomes	Examination methods
Knowledge – Student knows and understands:			
W1	Students acquire knowledge of snow and ice in the solar system. After completing it, they are able to explain which are the most significant volatiles in the solar system form ice and snow ice. They are goign to be with phase diagrams and able to explain the different phases of water ice.		Activity during classes, Test
W2	Students will acquire knowledge and understand the direct role of the snow and ice-water cycle in life processes, including current and future technologies related to sustainable water resources for settlements on Earth – and in space.		Activity during classes, Test
Skills – Student can:			
U1	After successful completion of the course, students will be able to formulate problems related to ice- and snow formation critically and independently. They will be able to apply equations of state and able to perform calculations for the relevant physical processes within the given timeframe. This will be achieved via problem solving and work during the interactive sessions. Students will be able to motivate, plan and perform scientific experiments during the practical work and use experiments to test hypotheses. They will be able to use a literature survey to critically select and evaluate relevant scientific and technical information within the subject. Presentation skills for international scientific events are trained via mini conference. The students will develop social skills to be able to work effectively in a group during the interactive sessions and practicals.		Activity during classes, Project
U2	The students will be able to apply their knowledge to the question of life in extreme environments, both outside the terrestrial environment and on Earth. For the latter, special focus will be given to environmental challenges in the arctic regions and elsewhere on Earth. Students will evaluate relevant technological and ethical aspects of anthropogenic changes to arctic climate and ecosystems and their global effects, with a focus on sustainable development and the Swedish national/EU equality goals		Activity during classes, Project
Social competences – Student is ready to:			
K1	Work during the interactive sessions will help students identify knowledge gaps and take responsibility for self-directed learning.		Activity during classes, Project

Programme content that ensure achieving learning outcomes for the module

The course includes teaching and learning activities to interpret and predict physical phenomena as well as training in experimental techniques, report writing, oral presentation and teamwork. Lectures will be interwoven with projects and interactive sessions. A special focus of this course is on the practical projects, which include field observations, laboratory experiments, data analysis and hands-on exercises.

Student workload

Activity form	Average amount of hours* needed to complete each activity form
Lecture	8
Project classes	4
Laboratory classes	13
Workshop classes	5
Preparation of project, presentation, essay, report	50
Student workload	**Hours** 80
Workload involving teacher	**Hours** 30

* hour means 45 minutes

Study content

No.	Course content	Subject learning outcomes	Activities

1.	1. L: The physics of ice: ice and snow (LTU) 2. P: Field practical 1.1 preparation to sampling, sampling contamination in snow packs (LTU) 3. L: The climatology of ice: the water cycle and our climate (AGH) 4. W: The geography of ice I: ice and snow on Earth (LTU) 5. L: The geography of ice II: glaciation and periglacial processes 6. P: Lab practical 1 - analysing (ant)arctic ice cores for past changes of Earth's climate (LTU) 7. W: The astronomy of ice I: ice on Mars (AGH – guest speaker) 8. L: The astronomy of ice II: comets, exoplanets and the habitable zone (LTU) 9. L: The biology of ice: life in extreme environments (AGH) 10. W: The technology of ice: humans in the arctic (LTU) 11. P: Field practical 1.2 –, 4h (AGH), 2h data analysis and interpretation techniques 12. W: The economies of ice: global trade, winter sports and tourism (LTU) 13. P: The changing pattern of ice: time series analyses of permafrost and snow depths (LTU)	W1, W2, U1, U2, K1	Lecture, Laboratory classes, Project classes, Workshop classes

Course advanced

Teaching methods:

Lectures, Laboratory classes, Project, Group work, Project based learning, Visual thinking, Peer assessment, Teaching methods and techniques used at a place where a practical placement is performed

Activities	Examination methods	Credit conditions
Lecture	Activity during classes, Test	mark 3.0
Project classes	Activity during classes, Project	mark 3.0
Lab. classes	Project	mark 3.0
Workshop	Project	mark 3.0

Additional info

The school is assessed through assignments and practical projects. Completion of all compulsory tasks with grade "Pass" is required for successful completion of the course. The final grade for the course is compiled from individual results obtained for all compulsory tasks and is awarded after approval of all compulsory. The grading scale for the course is 3 (pass), 4, 5, in

accordance with the Swedish and Polish HE grading systems. The grading scheme will be integrated into an additional Universeh agreed marking scheme once available. The language of the exam is going to be clearly provided before the course starts. English is expected to be the main language of all activities. However, the compulsory activity of creating a multilingual glossary will also include one of the following languages: Polish, Swedish or German.

Requirements and method of completing particular forms of classes

One extra class is going to organized to re-pass all missing tasks.

Method of calculating the final grade

The final mark will be an average of the marks obtained from all tasks during classes.

Method and procedure for compensating for missed coursework resulting from student absence from classes

Lectures- self studying.

Entry requirements

· Students with a scientific background or engineering profiles
· English level B2

Attendance requirements for particular classes, with indication whether student attendance is compulsory

The prezence on all practical classes is obligatory. Missing 1 lecture is possible.

Literature

Obligatory

1. Introduction to Geomicrobiology: Kurt O. Konhauser

Optional

1. Encyclopedia of Snow, Ice and Glaciers 2011 Edition | Editors: Vijay P. Singh, Pratap Singh, Umesh K. Haritashya

Research and publications