GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2020-2021

Geophysics (C002463)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)

Credits	Study time	Contact hrs
5.0	150 h	45.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	Dutch	Gent	practicum	15.0 h
			group work	5.0 h
			lecture	12.5 h
			online lecture	12.5 h

Lecturers in academic year 2020-2021

De Batist, Marc	WE13	lecturer-in-charge
Van Rooij, David	WE13	co-lecturer

Offered in the following programmes in 2020-2021	crdts	offering
Bachelor of Science in Geology	5	A
Preparatory Course Master of Science in Geology	5	A

Teaching languages

Dutch

Keywords

Geophysics, gravity, geomagnetics, paleomagnetics, geothermics, seismology

Position of the course

The Geophysics course provides the student with a sound overview in solid Earth physics. Emphasis is on fundamental geophysics, still this course provides basic elements of applied geophysics. The movements of the Earth are discussed in a geophysical perspective. Gravity and magnetics are essential topics. Geothermic principles provide the base for understanding fundamental geological processes, such as those related to cooling in the lithosphere. The generation and propagation of seismic waves is discussed in a dual perspective, both geological and physical, and such elements provide the key towards the elucidation of the deeper structure of the Earth.

Contents

Geophysical perspective on the movements of the Earth. The gravity field and the gravitational potential. Spheric harmonic analysis. Geophysical significance of the geoid. Gravimetric practice. Gravimetric anomalies. Satellite altimetry and gravimetry. Isostasy.
Origin and properties of the Earth’s magnetic field. Magnetic intensity and induction. The geomagnetic potential: spherical harmonic analysis. Magnetic observations: quantities and instruments. Variations in the Earth’s magnetic field. Magnetisation of rocks. Susceptibility and its anisotropy. Dia- and paramagnetism, ferri-, ferro- and antiferromagnetism. Magnetic minerals. Domains. Remanent magnetisation: NRM, TRM e.a. Blocking temperature. Paleomagnetic practice. Demagnetisation and determination of IRM. Spatial processing and statistics. Paleo-intensity.
The Earth as a thermal engine. Sources of heat. The adiabatic temperature gradient. Heat conduction, heat flux, the Laplace equation. Heat flux at the Earth’s surface. Geothermal practice. Heating and cooling: thermal diffusivity. Cooling of an oceanic lithosphere: Parsons and Sclater model. Thermal evolution of a subducting plate.
Focal mechanism of an earthquake. Elastic rebound and stress drop. Byerlee’s equation. Effective normal stress. Non-elastic deformation. Thermally activated creep. Rheologic structure of the lithosphere. Fault movements in space and time. Seismic gaps. Radiation models for elastic waves. Fault plane solution.

Propagation of seismic waves in three dimensions. Velocity and acoustic impedance. Surface waves. Dispersion. Time and frequency domain. Application of Fourier's theorem. Energy and amplitude of an earthquake. The Mercalli scale. Energy denisty and flux. Attenuation. Magnitude of an earthquake. The Richter scale. The seismic moment and source energy.
Propagation of seismic waves in layered media. Normal and oblique incidence. Reflection and refraction, partition of energy. Interpretation of t(x) diagrams for horizontal and dipping layers. The ray parameter and the determination of the structure of the Earth. Jeffrey and Bullen's diagram: application for the determination of an epicentre.

Initial competences

The student has acquired a prior knowledge regarding the structure and functioning of the Earth within the course module 'System Earth: Geology'.
In the second year, the course Structural Geology with Exercises on Geological Maps [...] The courses Physics 1, 2 and 3 should be followed in parallel.

Final competences

1 The student has acquired general scientific and intellectual competences and has a coherent vision on the physics of the Earth and of the lithosphere in particular.
2 Second semester courses in the third bachelor year build upon this basis: marine geology, hydrogeology, stratigrafie (magnetostratigraphy). The same holds for master courses dealing for instance with applied geophysics, borehole geophysics and genesis and evolution of sedimentary basins.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Group work, lecture, practicum, online lecture

Extra information on the teaching methods

Electronic learning environment (http://Ufora.UGent.be)
Teaching methods may need to be adjusted, should the COVID19 situation demand this.

Learning materials and price

Course notes. Cost: 10 EUR.

References

A. Casenave & K. Feigl (1994) - Formes et mouvements de la Terre. Satellites et géodésie. CNRS Editions.
C.M.R. Fowler (2005) - The Solid Earth. Cambridge University Press
R. J. Lillie (1999) – Whole Earth Geophysics. Prentice Hall.
W. Lowrie (2007) – Fundamentals of Geophysics. Cambridge University Press.
H.C. Nataf & J. Sommeria (2000) – La physique et la Terre. CNRS Editions.
D.L. Turcotte & G. Schubert (2002) – Geodynamics. Cambridge University Press.

Course content-related study coaching

Interactive assistance during excercises and with electronic learning environment (http://Ufora.UGent.be).
Development of geophysical skills.
Coaching by professors and assistants.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions

Examination methods in case of permanent evaluation

Participation, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

PE (examination): written.
Evaluation of insight in basic concepts, and of the capacity to apply such concepts in real world problems.
NPE: during exercises and at the presentation of a critical analysis of a scientific paper (group assignment). Grades are transferrable to second examination period, not to the next year.

Calculation of the examination mark

10 % NPE
90 % PE