ECTS INFORMATION PACKAGE

GEOPHYSICS

SOSNOWIEC 2010/2011
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ECTS departmental coordinator: Jerzy Cabala

Publisher: University of Silesia, Faculty of Earth Sciences, Sosnowiec

ECTS Information Package Geophysics was created due to the collaborative effort of scholars of the Faculty of Earth Sciences and Faculty of Mathematics, Physics and Chemistry. The Information Package is available in English and Polish and can be found on the Internet [http://www.wnoz.us.edu.pl/ects.php](http://www.wnoz.us.edu.pl/ects.php)
INTRODUCTION

The Information Package for Geophysics is addressed to former pupils of secondary school, candidates and students who wish to study geophysics (at the BSc level for the first three years and the MSc level for additional two years) at the Faculty of Earth Sciences. It consists of the basic procedures of the European Credit Transfer System (ECTS) developed by the Commission of the European Communities to ensure that student’s achievements obtained at host institutions abroad will receive academic recognition at the home institution. ECTS enables the participating higher education institutions to recognize student’s achievements in learning thanks to commonly accepted assessment tools – credits and grades. ECTS can also be used within a single institution or among numerous institutions within a single country.

Principles of ECTS

ECTS is based on the principle of mutual trust and confidence between the participating higher education institutions. Three elements are the foundation of ECTS: information (on curriculum and student’s achievements), agreement (between the participating institutions and a student), and use of ECTS credits. In practice, these three elements are related to three key documents:

ECTS INFORMATION PACKAGE – this is the major source of information on curriculum. It is updated annually and serves as a guide to the higher education institution and its units. It contains information on requirements for admission, academic calendar, student’s accommodation etc. The description of courses is an essential part of the information package and it includes contents of courses and their status, level, prerequisites, timetable, types of assessment, ECTS credits etc.

LEARNING AGREEMENT – includes the curriculum and number of credits available at the host institution and is drawn up by the student and institutions involved before the student goes abroad.

TRANSCRIPT OF RECORDS – includes the learning achievements of the student prior to and after the period of study abroad. Every course taken by the student is recorded on the transcript of records with not only the ECTS credits but also the grade awarded according to the local grading scale and the ECTS grading scale. The combination of grades and ECTS credits reflects the student’s performance both qualitatively and quantitatively.

ECTS credits

ECTS credits constitute a value allocated to course units to describe a student’s workload which is required to complete successfully. They reflect the quantity of work each course requires in relation to the total quantity of work required to complete a full academic year of study at the institution including lectures, classes, laboratory practicals and field trainings, seminars, individual work – in a library or at home – and examinations or other forms of assessment. Thus credits express a relative value. In ECTS, 60 credits represent the workload of a year of study; usually 30 credits are given for a semester. ECTS credits can be awarded for practical projects and to thesis preparation when these activities are an assessed part of the official programme of study. ECTS credits are allocated to courses and awarded to students who successfully complete those courses by passing examinations or other assessments.
ECTS GRADING SCALE

Results of examinations and other types of assessment are usually expressed in grades. There are many grading systems in Europe. The ECTS grading scale has been developed to help institutions to interpret grades given to a student by a host institution. The ECTS grading scale provides additional information on student’s performance and it does not replace the grading system of the home institution. The higher education institutions make their own decisions on how to adopt the ECTS grading system to their own systems.

<table>
<thead>
<tr>
<th>ECTS grades and definitions</th>
<th>Polish grades</th>
</tr>
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<tbody>
<tr>
<td>A  EXCELLENT</td>
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</tr>
<tr>
<td>BARDZO BOBRY</td>
<td></td>
</tr>
<tr>
<td>B  VERY GOOD</td>
<td>4.5</td>
</tr>
<tr>
<td>DOBRY PLUS</td>
<td></td>
</tr>
<tr>
<td>C  GOOD</td>
<td>4.0</td>
</tr>
<tr>
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<td></td>
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<tr>
<td>D  SATISFACTORY</td>
<td>3.5</td>
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<tr>
<td>DOSTATECZNY PLUS</td>
<td></td>
</tr>
<tr>
<td>E  SUFFICIENT</td>
<td>3.0</td>
</tr>
<tr>
<td>DOSTATECZNY</td>
<td></td>
</tr>
<tr>
<td>FX FAILED</td>
<td>2.0</td>
</tr>
<tr>
<td>NIEDOSTATECZNY</td>
<td></td>
</tr>
<tr>
<td>F  FAILED</td>
<td></td>
</tr>
</tbody>
</table>

***
UNIVERSITY OF SILESIA

40-007 Katowice, ul. Bankowa 12
Tel. +48 32 258 24 41, 258 72 31
Fax +48 32 259 96 05
e-mail: DWZ@usl.adm.edu.pl, http://www.us.edu.pl

Rector: Prof. dr. hab. Wiesław Banyś
Vice-Rector for Research and Economic Cooperation: Prof. dr. hab. Andrzej Kowalczyk
Vice-Rector for Education: Prof. dr. hab. Czesław Martysz
Vice-Rector for Finance and Development: Prof. dr. hab. Stanisław Kucharski
Vice-Rector for Students Affairs, Promotion and International Cooperation:
Prof. dr. hab. Barbara Kożusznik

University of Silesia was founded in 1968 as the ninth university in Poland. The University resulted from the fusion of the Higher School of Pedagogy and the Branch of the Jagiellonian University. The latter had been established in Katowice in 1963. University of Silesia is spread over six cities: Katowice, Sosnowiec, Cieszyn, Rybnik, Jastrzębie Zdrój and Chorzów. Most of the university buildings are located in Katowice.

University of Silesia is a state university and it comprises eleven faculties:

Faculty of Biology and Environmental Protection
Faculty of Philology
Faculty of Mathematics, Physics and Chemistry
Faculty of Earth Sciences
Faculty of Social Sciences
Faculty of Pedagogics and Psychology
Faculty of Law and Administration
Faculty of Radio and Television
Faculty of Engineering Sciences
Faculty of Pedagogics and Art
Faculty of Theology

In addition, there are also numerous inter-faculty units, among others:

Silesian International Business School
International School of Political Sciences
School of Management
Center for Studies on Human and Environment
School of the Polish Language, Literature and Culture
Inter-faculty Individual Studies in Humanities
Inter-faculty Individual Studies in Science and Mathematics
Inter-faculty Studies in Environmental Protection
The Library of the University of Silesia
Teaching staff

total: 1858 including:
professors: 322
associate professors: 146

Total number of students: 35 161

ECTS university co-ordinator: prof. dr hab. Danuta Skrzypek, e-mail: dskrzyp@us.edu.pl

Academic calendar

The academic year begins no later than on October 1st and ends by September 25th of the next calendar year. There are two semesters: winter and summer. The Winter semester begins on October 1st and ends on January 31st. The Summer semester begins in mid-February and ends at the beginning of June. Both semesters end with the exam period lasting for 2 to 3 weeks.

Holidays:

- All Saints’ Day: 1st November
- Independence Day: 11th November
- Winter break: Christmas - New Year
- Spring break: Easter
- Labour Day: 1st May
- Constitution Day: 3rd May

Requirements for admission

There are limited numbers of candidates for the first year of courses that can be admitted to the University of Silesia for one of the three types of studies, i.e. full-time, part-time, and continuing education. The limits are set annually for each of the subjects of study by the University Senate. Candidates for the first year courses are required to pay the registration fee stated by the Ministry of Education.

The candidates for studies should contact the central registration office in the Rector's Office, 12 Bankowa Street, Katowice. Detailed rules and criteria for recruitment are published at the beginning of the academic year in the guide-book for the candidates. People who are interested in studying at the University of Silesia in 2009/2010 can also find information on the university web pages recruitment: the criteria of entering, the decision of the Senate concerning the rules of entering the university and the number of candidates for one place at university studies in the academic year 2009/2010. Further information is also available in the Section of Teaching (dn@us.edu.pl, phone: 032 359 17 70, 359 18 80).

Accommodation and Health Care

The University of Silesia has about 3300 places in 11 students halls of residence. There are students’ refectories located near the halls of residence. Students of the University receive a GP’s treatment as well as a medical checkup which is practiced in appropriate outpatients’ clinics.
Students clubs

There are four students clubs linked to the University of Silesia:
„Straszny Dwór” – located in the Hall of Residence number 3 in Katowice
„Za Szybą” – located in the Hall of Residence number 7 in Katowice
„Antidotum” – located in the Hall of Residence number 1 in Sosnowiec
„Pod Rurą” – located at the Faculty of Pedagogics and Psychology in Katowice.

Library

More than 1 million books and 1200 journals are available for students at the University Main Library. The Library has a computerised system of information and is connected to the major data bases and InfoWare CD/HD.

Important addresses

OFFICE OF FOREIGN RELATIONS       Katowice, ul. Bankowa 12   Tel. +48 32 259 96 01
                                    Fax +48 32 259 81 93

OFFICE OF EDUCATION                 Katowice, ul. Bankowa 12   Tel. +48 32 259 75 33

OFFICE OF RESEARCH AND             Katowice, ul. Bankowa 12   Tel. +48 32 258 78 78
COOPERATION WITH INDUSTRY

OFFICE OF STUDENTS’ AFFAIRS         Katowice, ul. Bankowa 12   Tel. +48 32 259 74 13

UNIVERSITY LIBRARY                  Katowice, ul. Bankowa 14   Tel. +48 32 259 96 01

ACADEMIC HEALTH CARE                Katowice, ul. Szkolna 7     Tel. +48 32 259 65 68
Students in the Faculty of Earth Sciences have an opportunity to study Geography, Geology and Geophysics. Research and educational activities are carried out in geographical (GG) and geological (GL) departments, laboratories, faculty and inter-faculty units:

Physical Geography (GG)
Economic Geography (GG)
Geomorphology (GG)
Climatology (GG)
Paleogeography and Paleocoeology of Quaternary (GG)
Geocotourism (GG)
Geochemistry, Mineralogy and Petrology (GL)
General Geology (GL)
Stratigraphy and Paleontology and (GL)
Applied Geology (GL)
Hydrogeology and Engineering Geology (GL)

Research and Educational Geographical Laboratory (GG) and Educational Geological Laboratory (GL), Meteorological Observatory and Laboratory of the Dynamics of Environment (GG) and: Laboratory of Structural Research, Museum of the Earth, Maps Store and Library

There are 230 staff members including 31 professors and doctors with habilitation, 111 PhD’s, and 3 assistants (junior research staff). There are 1250 students both full-time and part-time at the Faculty and 60 PhD students. The Faculty is also involved in education of students from the Individual Studies in Mathematics and Natural Sciences, studies in Environmental Protection as well in Geophysics. The Faculty cooperates with domestic and foreign research institutions including numerous universities from Europe, USA, Japan and Egypt. The following journals are edited by the Faculty members: Geographia. Studia et Dissertationes, Geologia (Geology), Kras i Speleologia (Karst & Speleology), Wyprawy Polarne (Polar Expeditions), Landform Analysis.

Following Student Scientific Groups work actively in the Faculty such as Geographers (coordinator: dr M. Rzętala), Geologists (co-ordinator: prof. dr hab. J. Żaba), Geophysicists (co-ordinator: dr R. Dubiel), Gemmologists (co-ordinator: dr E. Szełęg), Paleontologists (co-ordinator: dr W. Krawczyński), Explorers (co-ordinator: prof. dr hab. L. Teper) and Hydrogeologists (co-ordinator: dr P. Siwek). In the past years they organized numerous conferences, excursions and field camps within Poland, the Czech Republic, Slovakia, Ukraine, Russia, Belarus, former Yugoslavia and Spain. Students’ interests in the Faculty are represented by Student Government.
GEOLOGICAL SCIENCES

Full time studies in Geophysics are interfaculty studies realised by Faculty of Earth Sciences with the Institute of Physics of the University of Silesia. Geophysics studies are realised in two-level scheme (I level + II level). Enrolment on the I level (BSc) studies is based on the competition of the results documented by the High School Matriculation Certificates (credits are counted for two subjects selected from following: geography, mathematics, physics, chemistry, biology, computer science and foreign language. I level studies are lasting 3 years and students are obtaining general education in geophysics. Terms of graduation at I level studies are to obtain credits from all courses indicated at programme reception of at least 180 ECTS credits and to pass of BSc examination. Undergraduates are obtaining certificate of licenced geophysicists (BSc) and are allowed to apply for enrolment on II level (MSc) studies:

- geophysics
- physics
- geology

Undergraduates in geophysics who obtain their BSc degrees can continue the two-year MSc degree studies in one of the following specialities/specialization:

- Geochemistry and Mineralogy
- Stratigraphy and Prospecting Geology
- Medical Physics
- Experimental Physics
- Theoretical Physics
- Computer Physics
- Physics of Nanosystems and Quantum Computer Techniques

To obtain MSc degree, students are required to complete successfully all compulsory and chosen optional courses, collect at least 120 ECTS credits, pass all exams, including the final master’s exam, and to submit a MSc dissertation. The MSc degree in geophysics or/and physics is awarded to graduates depending where the MSc dissertation is submitted e.i. at the Faculty of Earth Science or/and at Institute of Physics.

A graduate of BSc degree studies should have the knowledge of the subjects included in the programme of the studies, to the extent of being able to assist in geological work. They shall be able to participate in a team work and be prepared to take on specialized studies on the MSc level. A graduate of MSc degree studies shall be independent in using the knowledge of his specialization, be creative and have good organizing skills. Distinctive graduates shall be prepared to take on PhD degree studies and scientific research. The best MSc degree graduates recommended by professors are invited to apply for admission to the four-year PhD degree studies in Earth Sciences.
DEPARTMENT OF APPLIED GEOLOGY

Head: prof. dr hab. inż. Wacław Zuberek

Department structure:
Geology of Deposits Group (head: prof. dr hab. Lesław Teper)
Earth Physics Group (head: prof. dr hab. inż. Wacław Zuberek)
Applied Geophysics Group (head: prof. dr hab. Adam Idziak)

Research activities:
- prospecting, investigation and documentation of deposits
- protection of deposits and environment in mining areas
- contaminants in natural environment connected with exploitation and ore treatment
- tectonophysics and investigation of the processes of rocks destruction
- mining seismology, seismoacoustics and microseismology
- geophysical investigation of pollutant migration in groundwater and soil
- application of geophysics to archeology

Teaching activities: participation in general geophysical and geological education at the Bachelor’s level and in special courses within Geophysics and Geology with specialization in Protection of Lithosphere and Deposits Resources (MSc degree and PhD degree studies). The Department trains experts in mining geophysics, geophysics and physics of lithosphere, atmosphere and hydrosphere, economic geology, protection of mining areas, environment protection. Students learn geophysical methods (seismic, geoelectrical and magnetic) and how to investigate raw materials and recognise the effects of their exploitation. Students also acquire knowledge on waste disposal management and protection of mining area. Students learn also geological legislation and how to operate modern scientific equipment.

DEPARTMENT OF GEOCHEMISTRY, MINERALOGY AND PETROGRAPHY

Head: prof. dr hab. Janusz Janeczek

Department structure:
Geochemistry Group (head: prof. dr hab. Łukasz Karwowski)
Mineralogy Group (head: prof. dr hab. Janusz Janeczek)
X-ray Laboratory (head: dr Grażyna Bzowska)
Petrology Group (head: prof. dr hab. Krystyna Kruszewska)

Research activities:
- mineralogy and petrography of the Tatra Mts, Sudety Mts, and Upper Silesia
- radioactive minerals as analogues for the radioactive waste forms
- physics of minerals
- organic matter and trace elements in minerals and rocks
- mineralogy of atmospheric dust from Upper Silesia

Teaching activities: participation in general geology education at the Bachelor’s level, and in special courses within Geochemistry and Mineralogy for both MSc and PhD students.
Students in the Department gain knowledge of the investigation of minerals and rocks and about the behaviour of elements in litho- and biosphere. Students also acquire knowledge on methods of investigating organic matter and fluid inclusions. Students are familiarized with the theory of the manufacturing of glass, semiconductors and ceramics.

**DEPARTMENT OF GENERAL GEOLOGY**

**Head:** prof. dr hab. Jerzy Żaba

**Department structure:**
- General Geology Group (head: prof. dr hab. Jerzy Żaba)
- Sedimentology Group (head: prof. dr hab. Antoni Wójcik)
- Physical Geology and Geotectonics Group (head: prof. dr hab. Jerzy Żaba)

**Research activities:**
- geodynamics of platforms in Poland and in neighbouring countries
- the Quaternary paleomorphology of central Poland
- dynamics of clastic and carbonate sedimentation
- geotectonics and exodynamics

**Teaching activities:** participation in general geology education at the Bachelor’s level, and in special courses within Prospecting Geology (MSc degree and PhD degree studies). The Department educates experts in geological prospecting and geological mapping. Students learn modern methods of geological data collection, processing and visualization of the geological data etc.

**SECTION OF HYDROGEOLOGY AND ENGINEERING GEOLOGY**

**Head:** prof. dr hab. Andrzej Kowalczyk

**Research activities:**
- hydrogeological and zoological mapping
- management of groundwater resources in mining areas
- protection and monitoring of groundwater quality in Upper Silesia
- regional hydrogeological characterisation of the Upper Silesia massif
- hydrochemical zonation in sedimentary basins

**Teaching activities:** participation in general geology education at the Bachelor’s level and in special courses within Hydrogeology and Protection of the Water Environment (MSc degree and PhD degree studies). Students are educated to solve both theoretical and practical problems related to hydrogeology especially in Upper Silesia. Students are familiarized with field and laboratory methods in hydrogeology, they learn basics of hydrogeological modelling, documentation and monitoring of groundwater resources.
SECTION OF STRATIGRAPHY AND PALEONTOLOGY

Head: prof. dr hab. Edward Głuchowski

Research activities:
- Late Paleozoic miospores and acritarchs in Poland
- palynological studies in the Upper Silesia area
- faunal successions in Devonian, Carboniferous and Triassic of southern Poland
- taxonomy of selected groups of fossils (conodonts, brachiopods, corals, ammonites, gastropods, echinoderms)
- paleoecology and biogeography of faunal communities in Paleozoic and Mesozoic, mostly in Devonian and Cretaceous
- integrated ecosystem analysis of geological events, as exemplified by late Devonian mass extinction

Teaching activities: participation in general geology education at the Bachelor’s level and in special courses within Paleontology and Stratigraphy (MSc degree and PhD degree studies). The trains experts in fossil animals and plants and in chronology of events within the litho- and biosphere. Students learn principles and methods of investigation of fossils, reconstruction of the paleoenvironments, correlation and biostratigraphy.
STUDY PROGRAMME:

GEOPHYSICS
EXPLANATIONS:

Each course in the geophysics programme (GF) is assigned to a consecutive number which helps to use the part of the Information Package containing their descriptions. To make it easier, the course numbers are preceded by codes of the research discipline (SOCRATES CODE).

Courses written in bold are obligatory
Courses written in italics are optional

A, B - suggested version of the course
E/Z - examination/other form of assessment
l - summer semester
z - winter semester
* - possibility of taking an examination without attending the course
** - summer vacation
**** - to be chosen from the list of proposed special and/or monographic lectures
***** - obligatory for students who wish to continue Master’s degree programme at the Institute of Physics
****** - obligatory for students who wish to continue Master’s degree programme at the Faculty of Earth Sciences

BW - individual student’s work
WNoZ - realized at the Faculty of Earth Sciences (WNoZ), according to the rules set by WNoZ
IF - realized at the Institute of Physics (IF), according to the rules set by IF
L - lectures
P - practicals
Lab - laboratory

Attention: the students are obligated to participate in the library skill training and get acquainted with the workplace safety and ergonomy principles during the first semester.
# GEOPHYSICS: Bachelor’s degree programme (GF I)

## Semester 1

<table>
<thead>
<tr>
<th>Course number</th>
<th>Course title</th>
<th>Hours</th>
<th>ECTS credits</th>
<th>E/Z</th>
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<tbody>
<tr>
<td>GF001</td>
<td>Introduction to physics: mechanics</td>
<td>45</td>
<td>7</td>
<td>E</td>
</tr>
<tr>
<td>GF002</td>
<td>Introduction to mathematical analysis</td>
<td>30</td>
<td>7</td>
<td>E</td>
</tr>
<tr>
<td>GF003</td>
<td>Introduction to error analysis</td>
<td>15</td>
<td>2</td>
<td>Z</td>
</tr>
<tr>
<td>GF004</td>
<td>Physical geology I</td>
<td>30</td>
<td>6</td>
<td>Z</td>
</tr>
<tr>
<td>GF005</td>
<td>Physical chemistry</td>
<td>30</td>
<td>6</td>
<td>E</td>
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<tr>
<td></td>
<td>English 1*</td>
<td>30</td>
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<td></td>
<td>Physical education 1</td>
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<td>Introduction to physics: electricity and</td>
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<tr>
<td></td>
<td>magnetism</td>
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</tr>
<tr>
<td>GF007</td>
<td>Mathematical analysis</td>
<td>30</td>
<td>5</td>
<td>E</td>
</tr>
<tr>
<td>GF008</td>
<td>Physical geology II</td>
<td>30</td>
<td>5</td>
<td>E</td>
</tr>
<tr>
<td>GF009</td>
<td>Physics laboratory I</td>
<td>45</td>
<td>3</td>
<td>Z</td>
</tr>
<tr>
<td>GF010</td>
<td>Mineralogy, Petrography, geochemistry</td>
<td>45</td>
<td>8</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>English 2*</td>
<td>30</td>
<td>1</td>
<td>Z</td>
</tr>
<tr>
<td></td>
<td>Physical Education 2</td>
<td>30</td>
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**FIELD COURSE **:

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<thead>
<tr>
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<tbody>
<tr>
<td>GF038</td>
<td>General geology</td>
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<tbody>
<tr>
<td>GF011</td>
<td>Introduction to physics: optics structure</td>
<td>45</td>
<td>5</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>of matter</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>GF012</td>
<td>Physics laboratory I</td>
<td>45</td>
<td>3</td>
<td>Z</td>
</tr>
<tr>
<td>GF013</td>
<td>Physics of the Earth</td>
<td>45</td>
<td>6</td>
<td>E</td>
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<tr>
<td>GF014</td>
<td>Introduction to computer science</td>
<td>30</td>
<td>2</td>
<td>Z</td>
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<tr>
<td>GF015</td>
<td>Applied geophysics I</td>
<td>30</td>
<td>5</td>
<td>Z</td>
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<tr>
<td>GF016</td>
<td>Historical geology, stratigraphy and</td>
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<td>8</td>
<td>E</td>
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<tr>
<td></td>
<td>paleontology</td>
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<td></td>
<td>English 3</td>
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## Semester 4

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<tr>
<td>GF017</td>
<td>Introduction to physics: thermodynamics</td>
<td>30</td>
<td>4</td>
<td>E</td>
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<tr>
<td></td>
<td>and statistical physics</td>
<td>45</td>
<td>4</td>
<td>Z</td>
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<tr>
<td>GF018</td>
<td>Computer methods in geophysics</td>
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<td>3</td>
<td>E</td>
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<tr>
<td>GF019</td>
<td>Introduction to Solid State Physics B</td>
<td>30</td>
<td>7</td>
<td>Z</td>
</tr>
<tr>
<td>GF020</td>
<td>Physics laboratory II</td>
<td>120</td>
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<tr>
<td>GF021</td>
<td>Applied geophysics II</td>
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<td>E</td>
</tr>
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<td></td>
<td>English 4*</td>
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</tr>
<tr>
<td></td>
<td>FIELD COURSE **:</td>
<td>10 days</td>
<td>2</td>
<td>Z</td>
</tr>
<tr>
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<td>GF030</td>
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FIELD COURSE **:

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University of Silesia  Geophysics  ECTS

16
# GEOLOGY: Master`s degree programme ( GF II )

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Course title: INTRODUCTION TO PHYSICS: MECHANICS
Code/course no.: GF001

Course type: lectures + practicals
Semester: GF I/1
Hours per week/sem: 3+2/z
ECTS credits: 7

Course leader: prof.dr hab. Jerzy Zioło
Institute / Department: Institute of Physics
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of physics
Examination method: oral and/or written exam
Registration for course: no

Bibliography:

Course title: INTRODUCTION TO MATHEMATICAL ANALYSIS
Code/course no.: GF002

Course type: lectures + practicals
Semester: GF I/1
Hours per week/sem: 2+2/z
ECTS credits: 7

Course leaders: prof. dr hab. R. Rudnicki, prof. dr hab. Z. Komańek, dr L. Bartłomiejczyk
Institute / Department: Institute of Physics
Status of the course: obligatory for GF I
Course description: elements of mathematical logic and set theory: fundamentals of sentence calculus, quantifiers, algebra of sets, relations, ordered sets. Elements of topology: open and closed sets; continuous functions; connected spaces; compact and Hausdorff spaces. Metric spaces: notion of metric; real and complex sequences and series; Cauchy sequences, complete metric spaces, continuous functions. Differential calculus of one variable: definition of derivative, derivatives of higher order, Taylor’s formula and its applications, graphs of functions, approximate solutions of equations. Differential calculus of functions of several variables: linear and multilinear maps, partial derivatives, derivatives of higher order, Taylor’s formula, an extremum of a function of several variables, theorems on inverse and implicit functions.

Prerequisites: elementary knowledge of mathematics
Examination method: oral and/or written exam
Registration for course: no
Bibliography:

Course title: INTRODUCTION TO ERROR ANALYSIS
Code/course no.: GF003
Course type: lectures
Semester: GF I/1
Hours per week/sem: 1/z
ECTS credits: 2

Course leaders: dr hab. Aleksander Bródka
Institute / Department: Institute of Physics
Status of the course: obligatory for GF I
Prerequisities: elementary knowledge of mathematics
Examination method: final test
Registration for course: no
Bibliography:

Course title: PHYSICAL GEOLOGY I
Code/course no.: GF004
Course type: lectures + practicals
Semester: GF I/1
Hours per week/sem: 2+2 /z
ECTS credits: 6

Course leaders: prof. UŚ dr hab. Lesław Teper, dr Ryszard Kuzak, dr Roman Włodyka
Institute / Department: Department of Applied Geology, Department of General Geology, Department of Geochemistry, Mineralogy & Petrography
Status of the course: obligatory for GF I

University of Silesia ■ Geophysics ■ ECTS

20
Prerequisites: elementary knowledge of physics and chemistry
Examination method: final test
Registration for course: no
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Course leaders: dr Aniela Matuszewska, dr L. Lewińska-Preis
Institute / Department: Department of Geochemistry, Mineralogy & Petrography
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of physics and chemistry
Examination method: final test
Registration for course: no
Bibliography:
Atkins P.W., Podstawy chemii fizycznej, PWN, 2007
Holtzer M., Staronka A., Chemia fizyczna- wprowadzenie, Wyd. AGH, 2000
Pigoń K., Ruziewicz Z., Chemia fizyczna, PWN, 2005

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Course leaders: prof.dr hab. K.Roleder, dr hab. G. Chełkowska
Institute / Department: Institute of Physics
Status of the course: obligatory for GF I

University of Silesia ▪ Geophysics ▪ ECTS
Prerequisites: elementary knowledge of general physics
Examination method: oral and/or written exam
Registration for course: yes

Bibliography:
Szczeniowski Sz.: Fizyka doświadczalna, cz.3, PWN, W-wa 1972.

Course title: PHYSICAL GEOLOGY II
Code/course no.: GF008
Course type: lectures + laboratory
Semester: GF I/2
Hours per week/sem: 2+2/l
ECTS credits: 5

Course leaders: dr Włodzimierz Łapot + team
Institute / Department: Department of Geochemistry, Mineralogy & Petrography
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of general physics and chemistry
Examination method: written exam
Registration for course: no

Bibliography:

Course title: PHYSICS LABORATORY I
Code/course no.: GF009
Course type: laboratory
Semester: GF I/2+3
Hours per week/sem: 3/3+3/3
ECTS credits: 3

Course leaders: groups of experts
Institute / Department: Institute of Physics
Status of the course: obligatory for GF I
Course description: in summer semester students are obliged to carry out approx 12 tasks of experimental work in selected areas of physics: mechanics, thermophysics, molecular physics. In winter semester students are obliged to carry out approx 12 tasks of experimental work in selected areas of physics: electricity, optics.
Students elaborate the task in theory, pass an initial test, make measurements and submit a report including a theoretical introduction, calculations, charts or diagrams, error analysis, biography. The basis for receiving a credit is to get a positive assessment of these tasks.
**Prerequisites:** required knowledge to be well prepared for experimental work

**Examination method:** written report

**Registration for course:** yes

**Bibliography:**
Stasz J., Zestaw instrukcji do I Pracowni Fizycznej Instytutu Fizyki U.Śl.

Instruction is available in laboratory and in the Library of the Institute of Physics.

---

**Course title:** MINERALOGY, PETROLOGY I GEOCHEMISTRY

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**Course leaders:** prof dr hab. Janusz Janeczek + team

**Institute / Department:** Department of Geochemistry, Mineralogy & Petrography

**Status of the course:** obligatory for GF I

**Course description:** the origin of chemical elements (nucleosynthesis), frequency of their occurrence and abundance in earth crust. Minerals: chemical composition, crystal structures, physical and mechanical properties, optical properties, crystallization and stability of minerals. Classification of minerals. Systematic review of mineral classes with the emphasis on ore minerals and rock-forming minerals. The origin of rocks, their classification. Physical and mechanical properties of rocks. Mineralogy and petrology of Earth interior and other planets of the Solar System. Use of minerals and rocks.

**Prerequisites:** elementary knowledge of general physics and chemistry

**Examination method:** oral exam

**Registration for course:** no

**Bibliography:**

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**Course title:** GENERAL GEOLOGY

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**Course leaders:** prof. UŚ dr hab. Lesław Teper, dr Jerzy Cabala, dr Bogdan Żogała, dr Stanisław Ćmiel

**Institute / Department:** Department of Applied Geology

**Status of the course:** obligatory for GF I


**Prerequisites:** elementary knowledge of mineralogy and petrography

**Examination method:** graphical report and final test
Registration for course: no

Bibliography:
+ field notebook

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**Course title:** INTRODUCTION TO PHYSICS: OPTICS AND STRUCTURE OF MATTER
**Code/course no.:** GF011
**Course type:** lectures + practicals
**Semester:** GF I/3
**Hours per week/sem.:** 3+2/z
**ECTS credits:** 5

**Course leaders:** prof. dr hab. Z. Ujma, prof. dr hab. W. Zarek

**Institute / Department:** Institute of Physics

**Status of the course:** obligatory for GF I


**Prerequisites:** elementary knowledge of general physics

**Examination method:** oral and/or written exam

**Registration for course:** yes

**Bibliography:**
Ginter J., Fizyka fal, PWN, W-wa, 1993
Crowford F. S., Fale, PWN, W-wa 1974 (+re-issue)
Course title: PHYSICS OF THE EARTH  
Code/course no.: GF013

| Course type: lectures + practicals | Semester: GF I/3 | Hours per week/sem: 3+2/z | ECTS credits: 6 |

Course leaders: prof. dr hab. inż. Waclaw Zuberek + team
Institute / Department: Department of Applied Geology
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of physics
Examination method: oral exam
Registration for course: no
Bibliography:
**Course title:** INTRODUCTION TO COMPUTER SCIENCE  
**Code/course no.:** GF014

| Course type: lectures | Semester: GF I/3 | Hours per week/sem: 2/z | ECTS credits: 2 |

**Course leaders:** dr Dariusz Malczewski + team  
**Institute / Department:** Department of Applied Geology  
**Status of the course:** obligatory for GF I  

**Prerequisites:** elementary knowledge of mathematics  
**Examination method:** final test  
**Registration for course:** no  
**Bibliography:**  

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**Course title:** APPLY GEOPHYSICS I  
**Code/course no.:** GF015

| Course type: lectures + laboratory | Semester: GF I/3 | Hours per week/sem: 2+2/z | ECTS credits: 5 |

**Course leaders:** prof dr hab. Adam Idziak, dr Iwona Stan-Kleczer  
**Institute / Department:** Department of Applied Geology  
**Status of the course:** obligatory for GF I  
**Course description:** fundamentals of seismic exploration – ray paths in layered materials, wave attenuation, seismic equipment, wave sources. Refraction method – field procedures, interpretation methods, application of the method. Reflection method – common field procedures, computer processing of reflection data, applying of the seismic reflection method.

**Prerequisites:** elementary knowledge of physics  
**Examination method:** final test  
**Registration for course:** no  
**Bibliography:**  
Course title: HISTORICAL GEOLOGY, STRATIGRAPHY AND PALEONTOLOGY
Code/course no.: GF016

<table>
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Course leaders: dr Wojciech Krawczyński + team
Institute / Department: Section of Stratigraphy and Paleontology
Status of the course: obligatory for GF I & GL I

Prerequisites: elementary knowledge of biology and physical geology
Examination method: oral and written exam
Registration for course: no
Bibliography:

Course title: INTRODUCTION TO PHYSICS: THERMODYNAMICS AND STATISTICAL PHYSICS
Code/course no.: GF017

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Course leaders: prof. dr hab.K.Roleder, dr hab. D.Skrzypek
Institute / Department: Institute of Physics
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of physics
Examination method: oral and/or written exam
Registration for course: yes

University of Silesia ■ Geophysics ■ ECTS
Bibliography:
Werle J.: Termodynamika fenomenologiczna, PWN, W-wa 1957

**Course title:** COMPUTER MEDHOTS IN GEOPHYSICS
**Code/course no.:** GF018
**Course type:** laboratory
**Semester:** GF I/4
**Hours per week/sem.:** 3/l
**ECTS credits:** 4

**Course leaders:** dr Dariusz Malczewski + team

**Institute / Department:** Department of Applied Geology

**Status of the course:** obligatory for GF I


**Prerequisites:** elementary knowledge of mathematics

**Examination method:** final test

**Registration for course:** no

**Bibliography:**
Course title: INTRODUCTION TO SOLID STATE PHYSICS

Course type: lectures + laboratory

Semester: GF I/5

Hours per week/sem: 2/L

ECTS credits: 3

Course leaders: Prof. dr hab. A. Ratuszna, prof. dr hab. J. Szade, dr hab. K. Mateja-Kaczmarńska

Institute / Department: Institute of Physics

Status of the course: obligatory for GF I


Prerequisites: elementary knowledge of physics and chemistry

Examination method: oral and/or written exam

Registration for course: yes

Bibliography:
Van Meerssche M., Fenau-Dupont J.: Krystalografia i chemia strukturalna, PWN 1984
Sukiennicki A., Zagórski A.: Fizyka ciała stałego, WNT 1984

Course title: PHYSICS LABORATORY II

Course type: laboratory

Semester: GF I/4

Hours per week/sem: 8/L

ECTS credits: 7

Course leaders: groups of experts

Institute / Department: Institute of Physics

Status of the course: obligatory for GF I

Course description: students are obliged to conduct approx 10 complex measurements of experimental work in selected areas of physics: roentgenography, optics, electricity, molecular physics and nuclear physics; measurements of physical constants, ferroelectric and ferromagnetic material testing.
Students elaborate the task in theory, pass an initial test, make measurements and submit a final report. The basis for receiving a credit is to get a positive assessment of these tasks.

Prerequisites: required knowledge to be well prepared for experimental work

Examination method: written report

Registration for course: yes

Bibliography:
Stasz J., Zestaw instrukcji do I Pracowni Fizycznej Instytutu Fizyki U.Śl.
Instruction is available in laboratory and in the Library of the Institute of Physics.
### Course title: APPLY GEOPHYSICS II

<table>
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<tr>
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<tr>
<td><strong>Course type:</strong> lectures + practicals</td>
<td>Semester: GF I/2</td>
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**Course leaders:** prof dr hab. Adam Idziak, dr Ryszard Dubiel  
**Institute / Department:** Department of Applied Geology  
**Status of the course:** obligatory for GF I  
**Prerequisites:** elementary knowledge of physics and geophysics  
**Examination method:** written and oral exam  
**Registration for course:** no  
**Bibliography:**  

### Course title: GENERAL GEOPHYSICS

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<tr>
<td><strong>Course type:</strong> field trips</td>
<td>Semester: GF I/4</td>
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**Course leaders:** dr Bogdan Żogała  
**Institute / Department:** Department of Applied Geology  
**Status of the course:** obligatory for GF I  
**Course description:** acquaintance the students with the scientific work, research and development, visitation of chosen Polish geophysical research institutions: Central Geophysical Observatory of the Institute of Geophysics of the Polish Academy of Sciences (Belsk), Astronomical and Geodesic Observatory of the Institute of Geodesy and Geodetic Astronomy of the Warsaw University of Technology (Józefosław), The Andrzej Soltan Institute for Nuclear Studies (Świerk), The Institute of Geophysics of the Polish Academy of Sciences (Warszawa), Geological Museum of Polish Geological Institute (Warszawa), Teledetection and Geoinformation Technology Division of the Military Technical Academy (Warszawa), Observatory Geodesy-Geophysics of the Institute of Geodesy and Cartography (Borowa Góra), Polish Geological Institute Marine Geology (Gdańsk), Astronomy Centre of the Nicolaus Copernicus University (Toruń), Radiocarbon Laboratory (Poznań), Astrogaeodynamic Observatory of the Polish Academy of Sciences (Borowicz), Division of Low Temperature Physics (Odonlanów), ‘KRO’ Branch of the Polish Oil and Gas Company (Odonlanów), Observatory of the Institute of Astronomy of the Wrocław University (Białków), Geological Museum of the Institute of Geological Sciences at the Wrocław University (Wrocław), The Institute of Astronomy of the Wrocław University (Wrocław), Geophysical Observatory of the Institute of Geophysics of the Polish Academy of Sciences (Książ).

------------------ University of Silesia ▪ Geophysics ▪ ECTS ------------------

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Prerequisites: elementary knowledge of geophysical methods
Examination method: written report
Registration for course: no
Bibliography:
Selected special publications + field notebook

Course title: APPLIED GEOPHYSICS
Code/course no.: GF041
Course type: field work
Semester: GF I/4
Hours per week/sem.: 10 days/l
ECTS credits: 2

Course leaders: prof. dr hab. Adam Idziak
Institute / Department: Department of Applied Geology
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of physical
Examination method: written graphical report
Registration for course: no
Bibliography:

Course title: PHILOSOPHY OF NATURE
Code/course no.: 08.1/GL005
Course type: lectures
Semester: GL I/5
Hours per week/sem.: 2/z
ECTS credits: 2

Course leader: dr Bogdan Dura
Institute/Department: Institute of Philosophy
Status of the course: obligatory for GL I
Course description: problems and categories of philosophy of nature. Ancient and medieval philosophy of nature (presocratic philosophy of nature and its later development), main problems of the modern philosophy of nature (mechanistic tradition, the problem of casuality). Positivistic and neopositivistic tradition in understanding nature and science, determinism in the traditional and recent philosophy of nature. The main problems of the modern philosophy of science, the transformation of the rationality of science in the perspective of postmodern future (the world as a system and as „chaos”). Philosophy of nature and problems of the modern eco-philosophy. Correlation between changes in understanding of the world and understanding of science.

Prerequisites: elementary knowledge of natural sciences
Examination method: final test

University of Silesia ■ Geophysics ■ ECTS
Registration for the course: no

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<th>Course title: WELL-LOGGING</th>
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<td>Semester: GF I/5</td>
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Course leader: prof. dr hab. inż. Jadwiga Jarzyna

Institute/Department: Department of Physics, Faculty of Geology, Geophysics and Environmental Protection, AGH- University of Sciences and Technology

Status of the course: obligatory for GL II

Course description: environmental of geophysical measurements in well, mud, mud filtrate, invaded zone; resistivity logging-laterlogs-LL3, LLd, LLs, introduction logging-ILd, ILm, HRAI; micrologs-MSFL; self potential logging. SP-resistivity of formation water, shaliness, natural radioactivity logging-GR, spetral GR, litho-density logging, neutron logs, hydrogen index, total porosity; acoustic logging-velocity model, total porosity, acoustic waveform-dynamic elastic parameters of rocks in situ; dipmeter-processing and geological interpretation; comprehensive interpretation of well logging in aspect of porosity and lithological composition, water and hydrocarbon saturation from well logging.

Prerequisites: elementary knowledge of geology and physics

Examination method: oral exam

Registration for the course: no

Bibliography:
## INTRODUCTION TO NUCLEAR PHYSICS

**Course title:** INTRODUCTION TO NUCLEAR PHYSICS  
**Code/course no.:** GF024  
**Course type:** lectures + laboratory  
**Semester:** GF I/5  
**Hours per week/sem:** 2+1/z  
**ECTS credits:** 4

**Course leader:** prof. dr hab. Jan Kisiel  
**Institute/Department:** Institute of Physics  
**Status of the course:** obligatory for GF I  
**Course description:** Scale of nuclear physics, units, discovery of atomic nucleus, the experiment of Rutherford, cross section, scattering cross section, reaction cross section, properties of ground and excited state of nucleus, radioactive decay law, sequential decays, size and shape of nuclei, masses of nuclei, nuclear binding energy, nuclear decay, spontaneous fission, nuclear reactions, kinematics of nuclear reactions, nuclear models, shell model, collective model, liquid drop model, particles interaction with matter and basics of particles detection, nuclear power plant, nuclear physics methods in medicine.  
**Prerequisites:** elementary knowledge of physics  
**Examination method:** oral or/and written exam  
**Registration for the course:** yes  
**Bibliography:**  
- Skrzypczak E., Szefliński Z.: Fizyka jądra atomowego i cząstek elementarnych, PWN, W-wa. 1994

## GEOLOGICAL LEGISLATION IN POLAND

**Course title:** GEOLOGICAL LEGISLATION IN POLAND  
**Code/course no.:** GF025  
**Course type:** lectures  
**Semester:** GF I/5  
**Hours per week/sem:** 2/z  
**ECTS credits:** 2

**Course leader:** prof. UŚ dr hab. Lesław Teper  
**Institute/Department:** Department of Applied Geology  
**Status of the course:** obligatory for GL II and GF II  
**Course description:** law and legislation system, geological and mining regulations within the Polish legislation system, geological and mining state authorities in Poland, contents of the Geological and Mining Law, ownership of mineral wealth, licensing of exploration and extraction of mineral resources, features of concessional system, granting of concessions, rights and duties and redistribution of mineral extraction fee, legal rules of coexistence between operating companies and communities, instruments of environmental protection as important part of geological and mining regulations. Legal regulation connected with selected aspects such as emission of pollutants, its quantity and measurements, permission for using elements of environment and charges, information on environment condition.  
**Prerequisites:** basic knowledge of geology and mining  
**Examination method:** final test  
**Registration for the course:** no  
**Bibliography:**  
Course title: **CLASSICAL AND RELATIVISTIC MECHANICS**

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**Course leader:** prof. dr hab. J. Łuczka, prof. dr hab. K. Kołodziej, dr hab. J. Sładkowski

**Institute/Department:** Institute of Physics

**Status of the course:** obligatory for GF I


**Prerequisites:** elementary knowledge of classical physics and mathematical analysis

**Examination method:** oral and/or written exam

**Registration for the course:** yes

**Bibliography:**
Rubinowicz W., Królikowski W.: Mechanika teoretyczna.
Białkowski G.: Mechanika klasyczna.
Olchowski I. I.: Mechanika teoretyczna.

Course title: **MATHEMATICAL METHODS IN GEOLOGY/IN PHYSICS**

<table>
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<th>Course type:</th>
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**Course leader:** prof. dr hab. Adam Idziak

**Institute/Department:** Department of Applied Geology

**Status of the course:** obligatory for GF I

**Course description:** factor analysis: observation matrix, co-variation and correlation matrixes, linkage analysis, principal component analysis, loading factors, discrimination analysis, decomposition of correlation matrix. Time series analysis; autocorrelation and cross-correlation, fast Fourier transformation, filtration of time series, time-trend analysis, spectra analysis. Geostatistics: statistical parameters of geological objects, geostatistical description of object variability, structural functions models of semivariogram, optimization of measurement network geometry, kriging. Fractal analysis: fractal sets and fractal distributions, fractal measures, estimation of fractal dimension, fractal likelihood distribution, fractal cluster analysis, percolation theory, renormalization methods, deterministic chaos theory and its relation to fractal geometry. Practice in data handling using described methods.

University of Silesia ■ Geophysics ■ ECTS ■■■■■■■■■■■■■■■■

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Prerequisites: elementary knowledge of statistics and mathematical analysis
Examination method: oral and/or written exam
Registration for the course: yes
Bibliography:

Course title: ASTRONOMY
Code/course no.: GF030
Course type: lectures + practicals
Semester: GF I/6
Hours per week/sem: 2+2/l
ECTS credits: 5
Course leader: dr Ilona Bednarek
Institute/Department: Institute of Physics
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of physics
Examination method: oral and/or written exam
Registration for the course: yes
Bibliography:
Mietelski J. Astronomia w geografii
Mietelski J. Ćwiczenia z astronomicznych podstaw geografii
Opolski A. Astronomiczne podstawy geografii
Rybka E. Astronomia ogólna
Artymowicz P.– Astrofizyka układów planetarnych
Roy A. E., Clarke D. – Astronomy, principles and practice

Course title: GEODESY AND CARTOGRAPHY
Code/course no.: GF031
Course type: lectures + laboratory
Semester: GF I/6
Hours per week/sem: 2+2/l
ECTS credits: 5
Course leader: dr inż. Krzysztof Jochymczyk
Institute/Department: Department of Applied Geology
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of physics and mathematics
Examination method: final test
Registration for the course: no
Bibliography:

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Course title: GEODESY AND CARTOGRAPHY
Code/course no.: GF042
Course type: Field work
Semester: GF I/6
Hours per week/sem: 14 dni/l
ECTS credits: 3

Course leader: dr inż. Krzysztof Jochymczyk
Institute/Department: Department of Applied Geology
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of physics and mathematics
Examination method: written raport
Registration for the course: no
Bibliography:
+ notatnik terenowy
GEOPHYSICS: Master`s degree programme ( GF II )

**Course title:** ECONOMIC GEOLOGY
**Code/course no.:** GF050
**Semester:** GF II/1
**Hours per week/sem:** 3/z
**ECTS credits:** 5

**Course leader:** dr hab. Jerzy Cabała

**Institute/Department:** Department of Applied Geology

**Status of the course:** obligatory for GF I

**Course description:** description of the most important ore deposits (Fe, Mn, Cu, Ni, Sn, W, Zn-Pb, Au, Hg), fuel deposits, diamonds and others. Economical aspects of exploitation useful minerals such as coal, copper, zinc, lead, gold. Economics of ore deposits (resources classification, economical criteria of resources classification, calculation and balance-sheet value of mineral deposits, prices policy in mineral industry, losses, protection of mineral resources). Profitability of Polish ore mines and its changeability during a short period as well as a long period of time. Directions of investment in mining. Forecast of production of selected metals (Fe, Cu, Zn-Pb, Ni, Au, Ag, U). Production feasibility of raw materials, fuel and ore deposits in future.

**Prerequisites:** elementary knowledge of mineralogy, geochemistry and geology

**Examination method:** written exam

**Registration for the course:** no

**Bibliography:**

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**Course title:** HYDROGEOLOGY
**Code/course no.:** GF051
**Semester:** GF II/1
**Hours per week/sem:** 2+2/z
**ECTS credits:** 6

**Course leaders:** dr Andrzej Witkowski, dr Marek Sołtysiak

**Institute/Department:** Section of Hydrogeology and Engineering Geology

**Status of the course:** obligatory for GF I

**Course description:** water-bearing horizons and their properties, geological and hydrodynamic classification criteria of aquifers; hydrogeological properties of rocks determining their ability to conduct and accumulate water; principles of groundwater flow; testing methods of aquifers properties; mathematical modelling in hydrogeology; physical properties of groundwater; water chemistry; water quality and groundwater contamination; hydrochemical tests and interpretation of results; groundwater development and management.

**Prerequisites:** elementary knowledge of chemistry and physics

**Examination method:** written exam

**Registration for the course:** no

**Bibliography:**
Course title: INTRODUCTION TO ASTROPHYSICS

Course type: lectures + practicals
Semester: GF II/1
Hours per week/sem: 2+2/z
ECTS credits: 6

Course leaders: dr Ilona Bednarek, dr M.Biesiada
Institute/Department: Institute of Physics
Status of the course: obligatory for GF I

Prerequisites: elementary knowledge of classical physics
Examination method: written or oral exam
Registration for the course: yes
Bibliography:
Demiański M., Astrofizyka relatywistyczna, PWN, Warszawa, 1978

Course title: ENVIRONMENTAL GEOPHYSICS

Course type: lectures
Semester: GF II/2
Hours per week/sem: 2/z
ECTS credits: 3

Course leader: dr Bogdan Żogała
Institute/Department: Department of Applied Geology
Status of the course: obligatory for GF II

Prerequisites: elementary knowledge of geophysics, geochemistry and chemistry
Examination method: written or oral exam
Registration for the course: no
Bibliography:

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<td>SELECTED PROBLEMS IN QUANTUM PHYSICS</td>
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**Course leader:** dr hab. Henryk Czyż  
**Institute/Department:** Institute of Physics  
**Status of the course:** optional  
**Course description:** the physical basis of quantum mechanics. The application of Schrödinger equation to simple systems: hydrogen and alkali atoms; harmonic oscillator. The angular momentum. The approximation methods. Time dependent quantum systems: pictures; conservation laws; time dependent perturbation theory. Elements of scattering theory.

**Prerequisites:** elementary knowledge of classical physics and mathematical analysis

**Examination method:** oral and/or written exam

**Registration for the course:** yes

**Bibliography:**

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**Course leader:** dr Antoni Winiarski  
**Institute/Department:** Institute of Physics  
**Status of the course:** obligatory for GF II  
**Course description:** physical phenomena and environmental alteration: propagation of electromagnetic waves in the circumterrestrial space; optical phenomena in the atmosphere; natural and anthropogenic electromagnetic fields; anthropogenic change in environment –change in the atmosphere, contamination of water, pollution of soil and the problem of waste, radioactive contamination of environment. Methods of investigation and monitoring: spectrometry –visible light, IR and V; photoelectron spectrometry – XPS and UPS; mass spectrometry – SIMS, SNMS; microscopies – optical, electron and tunnelling; lasers, X-ray diffraction.

**Prerequisites:** elementary knowledge of physics, geochemistry and mineralogy
Examination method: oral and/or written exam
Registration for the course: yes
Bibliography:
Cullity B.D., Podstawy dyfrakcji promieni rentgenowskich. PWN. Warszawa.

Course title: INVERSE METHODS IN GEOPHYSICS
Course type: lectures
Semester: GF II/3
Hours per week/sem: 2/2z
ECTS credits: 6

Course leader: dr hab. Wojciech Dębski
Institute/Department: Department of Applied Geology
Status of the course: obligatory for GF II
Course description: The lecture Inverse Methods in Geophysics covers the foundations and selected advanced topics of the modern inverse theory including probabilistic formulation of the theory. The following issues are addressed: inverse task as an indirect measurement, linear inverse problems, classical approach to inverse problems based on optimization techniques, introduction to the probabilistic inverse theory, error analysis.
Prerequisites: elementary knowledge of geophysics and mathematical analysis
Examination method: oral exam
Registration for the course: no
Bibliography:

Course title: ECONOMIC GEOLOGY
Course type: field work
Semester: GF II/2
Hours per week/sem: 7 days
ECTS credits: 2

Course leader: dr hab. J. Cabała
Institute/Department: Department of Applied Geology
Status of the course: obligatory for GF II
**Course description:** Geological survey in mines in the USC region and in the vicinity of Opole. Methods of exploitation of raw material (Zn-Pb ores, limestone, marl, basalt, clayey material); enrichment by floatation, physical aspects of ore enrichment in laboratory and industrial conditions.

**Prerequisites:** elementary knowledge of geology, environmental physics

**Examination method:** test

**Registration for the course:** yes

**Bibliography:**