TABLE OF CONTENTS

DEAN’S WELCOME ........................................................................................................ 3
UNIVERSITY OF DEBRECEN .................................................................................. 4
FACULTY OF SCIENCE AND TECHNOLOGY ......................................................... 5
DEPARTMENTS OF INSTITUTE OF EARTH SCIENCES ....................................... 6
ACADEMIC CALENDAR .......................................................................................... 8
THE GEOGRAPHY BACHELOR PROGRAM .............................................................. 9
  Information about Program .................................................................................. 9
  Completion of the Academic Program ................................................................. 12
    The Credit System ............................................................................................. 12
    Model Curriculum of Earth Sciences BSc ........................................................ 13
    Work and Fire Safety Course ........................................................................... 19
    Internship ........................................................................................................ 19
    Physical Education ............................................................................................ 19
    Pre-degree certification .................................................................................... 20
    Thesis .............................................................................................................. 20
    Final Exam ...................................................................................................... 20
  Diploma ............................................................................................................. 22
Course Descriptions of Geography BSc Program ................................................. 23
DEAN’S WELCOME

Welcome to the Faculty of Science and Technology!

This is an exciting time for you, and I encourage you to take advantage of all that the Faculty of Science and Technology UD offers you during your bachelor’s or master's studies. I hope that your time here will be both academically productive and personally rewarding.

Being a regional centre for research, development and innovation, our Faculty has always regarded training highly qualified professionals as a priority. Since the establishment of the Faculty in 1949, we have traditionally been teaching and working in all aspects of Science and have been preparing students for the challenges of teaching. Our internationally renowned research teams guarantee that all students gain a high quality of expertise and knowledge. Students can also take part in research and development work, guided by professors with vast international experience.

While proud of our traditions, we seek continuous improvement, keeping in tune with the challenges of the modern age. To meet our region’s demand for professionals, we offer engineering courses with a strong scientific basis, thus expanding our training spectrum in the field of technology. Recently, we successfully re-introduced dual training programmes in our constantly evolving engineering courses.

We are committed to providing our students with valuable knowledge and professional work experience, so that they can enter the job market with competitive degrees. To ensure this, we maintain a close relationship with the most important companies in our extended region. The basis for our network of industrial relationships are in our off-site departments at various different companies, through which market participants - future employers - are also included in the development and training of our students.

Prof. dr. Ferenc Kun
Dean
UNIVERSITY OF DEBRECEN

**Date of foundation:** 1912 Hungarian Royal University of Sciences, 2000 University of Debrecen

**Legal predecessors:** Debrecen University of Agricultural Sciences; Debrecen Medical University; Wargha István College of Education, Hajdúböszörmény; Kossuth Lajos University of Arts and Sciences

**Legal status of the University of Debrecen:** state university

**Founder of the University of Debrecen:** Hungarian State Parliament

**Supervisory body of the University of Debrecen:** Ministry of Education

**Number of Faculties at the University of Debrecen:** 14
- Faculty of Agricultural and Food Sciences and Environmental Management
- Faculty of Child and Special Needs Education
- Faculty of Dentistry
- Faculty of Economics and Business
- Faculty of Engineering
- Faculty of Health
- Faculty of Humanities
- Faculty of Informatics
- Faculty of Law
- Faculty of Medicine
- Faculty of Music
- Faculty of Pharmacy
- Faculty of Public Health
- Faculty of Science and Technology

**Number of students at the University of Debrecen:** 26938

**Full time teachers of the University of Debrecen:** 1542

207 full university professors and 1159 lecturers with a PhD.
The Faculty of Science and Technology is currently one of the largest faculties of the University of Debrecen with about 3000 students and more than 200 staff members. The Faculty has got 6 institutes: Institute of Biology and Ecology, Institute of Biotechnology, Institute of Chemistry, Institute of Earth Sciences, Institute of Physics and Institute of Mathematics. The Faculty has a very wide scope of education dominated by science and technology (10 Bachelor programs and 12 Master programs), additionally it has a significant variety of teachers’ training programs. Our teaching activities are based on a strong academic and industrial background, where highly qualified teachers with a scientific degree involve student in research and development projects as part of their curriculum. We are proud of our scientific excellence and of the application-oriented teaching programs with a strong industrial support. The number of international students of our faculty is continuously growing (currently 570 students). The attractiveness of our education is indicated by the popularity of the Faculty in terms of incoming Erasmus students, as well.

THE ORGANIZATIONAL STRUCTURE OF THE FACULTY

Dean: Prof. Dr. Ferenc Kun, University Professor  
E-mail: ttkdekan@science.unideb.hu

Vice Dean for Educational Affairs: Prof. Dr. Gábor Kozma, University Professor  
E-mail: kozma.gabor@science.unideb.hu

Vice Dean for Scientific Affairs: Prof. Dr. Sándor Kéki, University Professor  
E-mail: keki.sandor@science.unideb.hu

Consultant on Economic Affairs: Dr. Sándor Alex Nagy, Associate Professor  
E-mail: nagy.sandor.alex@science.unideb.hu

Consultant on External Relationships: Prof. Dr. Attila Bérczes, University Professor  
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Quality Assurance Coordinator: Dr. Zsolt Radics, Assistant Professor  
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Head of Dean's Office: Mrs. Katalin Csománé Tóth  
E-mail: csomane.toth.katalin@science.unideb.hu

Registrar's Office  
Registrar: Ms. Ildikó Kerekes  
E-mail: kerekes.ildiko@science.unideb.hu

English Program Officer: Mr. Imre Varga  
Address: 4032 Egyetem tér 1., Chemistry Building, A/101  
E-mail: vargainre@unideb.hu
## DEPARTMENTS OF INSTITUTE OF EARTH SCIENCES

### Department of Meteorology (home page: [https://meteo.unideb.hu](https://meteo.unideb.hu))
4032 Debrecen, Egyetem tér 1, Geomathematics Building

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>E-mail</th>
<th>room</th>
</tr>
</thead>
<tbody>
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<td>127</td>
</tr>
</tbody>
</table>

### Department of Mineralogy and Geology (home page: [https://zafir.min.unideb.hu](https://zafir.min.unideb.hu))
4032 Debrecen, Egyetem tér 1, Chemistry Building

<table>
<thead>
<tr>
<th>Name</th>
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<th>room</th>
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<tbody>
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</tr>
</tbody>
</table>

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<table>
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<td>216</td>
</tr>
</tbody>
</table>
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<td>120</td>
</tr>
</tbody>
</table>

### Department of Physical Geography and Geoinformatics
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<tr>
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<td>224</td>
</tr>
</tbody>
</table>

* - Chemistry Building
ACADEMIC CALENDAR

General structure of the academic semester (2 semesters/year):

<table>
<thead>
<tr>
<th>Study period</th>
<th>1st week</th>
<th>Registration*</th>
<th>1 week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2nd – 15th week</td>
<td>Teaching period</td>
</tr>
<tr>
<td>Exam period</td>
<td>directly after the study period</td>
<td>Exams</td>
<td>7 weeks</td>
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</table>

*Usually, registration is scheduled for the first week of September in the fall semester, and for the first week of February in the spring semester.

For further information please check the following link: http://www.edu.unideb.hu/tartalom/downloads/University_Calendars_2019_20/1920_Science.pdf
EARTH SCIENCES BACHELOR PROGRAM

Information about the Program

<table>
<thead>
<tr>
<th>Name of BSc Program:</th>
<th>Earth Sciences BSc Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialization available:</td>
<td>Geology, Meteorology</td>
</tr>
<tr>
<td>Field, branch:</td>
<td>Science</td>
</tr>
<tr>
<td>Qualification:</td>
<td>Earth Scientist</td>
</tr>
<tr>
<td>Mode of attendance:</td>
<td>Full-time</td>
</tr>
<tr>
<td>Faculty, Institute:</td>
<td>Faculty of Science and Technology</td>
</tr>
<tr>
<td></td>
<td>Institute of Earth Sciences</td>
</tr>
<tr>
<td>Program coordinator:</td>
<td>Dr. Péter Rózsa, Associate Professor</td>
</tr>
<tr>
<td>Duration:</td>
<td>6 semesters</td>
</tr>
<tr>
<td>ECTS Credits:</td>
<td>180</td>
</tr>
</tbody>
</table>

Objectives of the BSc program:

The fields of earth sciences study the composition, 5 billion years history, material and energy flows and transformations, utilizable raw materials and hazardous phenomena of Earth as a material evolutionary system with specific and unique endowments. Methods and results of physics, chemistry, biology, mathematics, and geography are used for the above. Earth scientists help in understanding long- and short-term global and regional natural processes and changes. Numerous applied fields of earth sciences (raw material exploration, volcanology, seismology, water base protection, weather forecast, alternative and renewable energy resources, etc.) determine basically our everyday life, technical civilization and relationship with the natural environment.

Hopefully our students have a true interest in natural sciences and would like to learn systems thinking, modelling, utilization and protection of the marvellously complex natural environment.

Our primary aim is to make our students successful in further education as MSc students either in Hungary or abroad and finally become geologists and meteorologists. Not least, we hope that our students will be successful in life with their obtained professional knowledge and skills.
Professional competences to be acquired

An Earth scientist:

a) Knowledge:
- He/she knows the primary relations and laws of earth sciences and the associated simple mathematic and informatic procedures.
- He/she knows the most important theories and models of earth sciences verified on the basis of scientific results.
- He/she knows the potential directions and limits of the development of his/her scientific field.
- He/she has the basics of natural sciences and the knowledge of the elements of practice based on them and is able to systemize them.
- He/she knows and applies field, laboratory and practice material, equipment and methods with which he/she is able to perform his/her professional tasks.
- He/she has the knowledge required to solve practical earth scientific problems related to natural processes, natural resources, organic and inorganic systems.
- He/she knows the most important terminology and nomenclature of natural processes.

b) Abilities:
- He/she is able to identify the problems of his/her professional field.
- He/she is able to apply earth scientific theories, paradigms and principles in practice in the course of which he/she applies the field, laboratory and practical materials, tools and methods with which he/she is able to perform profession at a basic level.
- Based on obtained knowledge in his/her profession, he/she is able to evaluate, interpret and document measurement results.
- He/she understands the processes, networks, scientific problems to be studied that are tested by appropriate methods accepted in scientific practice.
- He/she is able to plot measurement results on a map and to their geoinformatic visualization, to create databases for spatial and relational data, to operate and to analyse databases using statistical methods and earth scientific tools.
- Based on his/her knowledge, he/she can argue on the basis of natural scientific grounds.
- He/she is able to understand natural (primarily earth scientific) and associated anthropogenic processes, related data acquisition, processing the data and using the literature required for the processing.
- He/she is able to apply regularities related to natural and associated anthropogenic processes, and to – as a result of a complex approach – identify problems triggered by the interrelationship between nature and society and to outline them for decision makers.
- He/she is able to perform sub-tasks of research projects, carry out laboratory and field measurements.

c) Attitude:
- He/she controls and evaluates realistically the results of his/her work.
- He/she aims to understand the relationship between nature and mankind.
- He/she acts in an environmentally responsible manner in field and laboratory activities.
- He/she is open to professional discussion.
- He/she is open to professional cooperation with experts working in the fields of social politics, economy and environmental protection.
- He/she knows the example of the disputant and incredulous natural scientist.
- He/she understands the significance and consequences of scientific statements.
- He/she authentically represents the natural scientific view of the world and is able to transfer it for the professional and non-professional public.
- He/she is open to further education in both natural sciences and non-natural sciences.
- He/she is committed to learn new competencies, to increase knowledge of concepts and the professional field.

d) Autonomy and responsibility:
- He/she is able to consider basic professional problems independently and is able to answer on the basis of given sources.
- He/she responsibly accepts the natural scientific view of the world.
- He/she is responsible for cooperating with experts of other scientific fields.
- He/she deliberately accepts the ethical norms of his/her profession.
- He/she evaluates the results of his/her own work realistically and with responsibility.
- He/she independently operates the field and/or laboratory equipment used in research in his/her scientific field.
- He/she works unaided at national and international observation and forecasting services and authorities as employee in the area of earth sciences.
- He/she carries out coordination tasks independently in environmental scientific, resource research, environmental and nature protection positions.
Completion of the BSc Program

The Credit System

Majors in the Hungarian Education System have generally been instituted and ruled by the Act of Parliament under the Higher Education Act. The higher education system meets the qualifications of the Bologna Process that defines the qualifications in terms of learning outcomes: statements of what students know and can do on completing their degrees. In describing the cycles, the framework uses the European Credit Transfer and Accumulation System (ECTS).

ECTS was developed as an instrument of improving academic recognition throughout the European Universities by means of effective and general mechanisms. ECTS serves as a model of academic recognition, as it provides greater transparency of study programs and student achievement. ECTS in no way regulates the content, structure and/or equivalence of study programs.

Regarding each major the Higher Education Act prescribes which professional fields define a certain training program. It contains the proportion of the subject groups: natural sciences, economics and humanities, subject-related subjects and differentiated field-specific subjects.

During the program students have to complete a total amount of 180 credit points. It means approximately 30 credits per semester. The curriculum contains the list of subjects (with credit points) and the recommended order of completing subjects which takes into account the prerequisite(s) of each subject. You can find the recommended list of subjects/semesters in chapter “Model Curriculum of Earth Sciences BSc Program”.
## Model Curriculum of Earth Sciences BSc Program

<table>
<thead>
<tr>
<th>Natural sciences basics I subject group</th>
<th>ECTS credit points</th>
<th>evaluation</th>
</tr>
</thead>
</table>
| 1. Basic mathematics 1  
*István Pink* | 5 | exam and mid-semester grade |
| 28 l / 3cr.  
28 p / 2cr. | | |
| 2. Basic mathematics 2  
*István Pink* | 2 | mid-semester grade |
| 28 p / 2cr. | | |
| 3. Fundamentals of informatics  
*Judit Kiss-Boda* | 2 | mid-semester grade |
| 28 p / 2cr. | | |

<table>
<thead>
<tr>
<th>Natural sciences basics II subject group</th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 4. Fundamentals of physics I  
*Zsolt Galácsi* | 4 | exam |
| 28 l, 14 p / 4cr. | | |
| 5. Fundamentals of physics II  
*András Csehi* | 4 | mid-semester grade |
| 28 l, 14 p / 4cr. | | |
| 6. Meteorology in everyday life  
*Sándor Szegedi* | 2 | mid-semester grade |
| 14 l, 14 p / 2cr. | | |

<table>
<thead>
<tr>
<th>Natural sciences basics III subject group</th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 7. Introduction to chemistry I  
*Gábor Bellér* | 2 | exam |
| 28 l / 2cr. | | |
| 8. Introduction to chemistry I – practice  
*Edina Baranyai* | 2 | mid-semester grade |
| 28 l / 2cr. | | |
| 9. Fundamental biology  
*Ibolya Revák-Markóczy* | 1 | exam |
| 14 l / 1cr | | |
| 10. Basics of ecology  
*Balázs Deák* | 3 | exam |
| 28 l / 3cr | | |
| 11. Basic environmental science  
*Sándor Alex Nagy* | 1 | exam |
| 14 l / 1cr | | |
| 12. EU studies  
*Károly Teperics* | 1 | exam |
| 14 l / 1cr | | |

<table>
<thead>
<tr>
<th>Mineralogy-petrology and hydrogeology subject group</th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 13. Mineralogy and petrology I  
*Péter Rózsa* | 3 | exam |
| 28 l / 3cr | | |

### ECTS credit points

- credit points
- evaluation
- contact hours, types of teaching (l – lecture, p – practice)
<table>
<thead>
<tr>
<th>Course</th>
<th>Lecturer</th>
<th>Credits</th>
<th>Type</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. Mineralogy and petrology I – practice</td>
<td>Tamás Buday</td>
<td>28 p / 2cr</td>
<td></td>
<td>2 mid-semester grade</td>
</tr>
<tr>
<td>15. Mineralogy and petrology II</td>
<td>Péter Rózsa</td>
<td>28 p / 2cr</td>
<td></td>
<td>2 mid-semester grade</td>
</tr>
<tr>
<td>16. Hydrology and hydrogeology</td>
<td>Tamás Buday</td>
<td>28 l / 3cr, 28 p / 2cr</td>
<td></td>
<td>5 exam and mid-semester grade</td>
</tr>
<tr>
<td><strong>Meteorology and astronomy subject group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Meteorology and climatology I</td>
<td>Sándor Szegedi</td>
<td>28 l / 3cr</td>
<td></td>
<td>3 exam</td>
</tr>
<tr>
<td>18. Meteorology and climatology II</td>
<td>Sándor Szegedi</td>
<td>14 l / 1cr, 28 p / 2cr</td>
<td></td>
<td>3 exam and mid-semester grade</td>
</tr>
<tr>
<td>19. The cosmic relations of the Earth</td>
<td>Gergely Szabó</td>
<td>28 l / 3cr</td>
<td></td>
<td>3 exam</td>
</tr>
<tr>
<td><strong>Physical geography I subject group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Structural geography I</td>
<td>Richard William McIntosh</td>
<td>28 p / 2cr</td>
<td></td>
<td>2 mid-semester grade</td>
</tr>
<tr>
<td>21. Fundamentals of physical geography I</td>
<td>Szilárd Szabó</td>
<td>28 l / 3cr</td>
<td></td>
<td>3 exam</td>
</tr>
<tr>
<td>22. Fundamentals of physical geography II</td>
<td>József Löki</td>
<td>28 l / 3cr</td>
<td></td>
<td>3 exam</td>
</tr>
<tr>
<td>23. Fundamentals of physical geography III</td>
<td>József Löki</td>
<td>14 l / 1cr, 28 p / 2cr</td>
<td></td>
<td>3 mid-semester grade</td>
</tr>
<tr>
<td><strong>Physical geography II subject group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Soil geography</td>
<td>Tibor Novák</td>
<td>28 l / 3cr</td>
<td></td>
<td>3 exam</td>
</tr>
<tr>
<td>25. Soil geography practice</td>
<td>György Szabó</td>
<td>28 p / 2cr</td>
<td></td>
<td>2 mid-semester grade</td>
</tr>
<tr>
<td>26. Biogeography</td>
<td>Csaba Tóth</td>
<td>28 l / 3cr</td>
<td></td>
<td>3 exam</td>
</tr>
<tr>
<td>27. Basis of environmental protection</td>
<td>György Szabó</td>
<td>28 l / 3cr</td>
<td></td>
<td>3 exam</td>
</tr>
<tr>
<td><strong>Physical geology, regional earth sciences and mapping subject group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. Physical and historical geology</td>
<td>Richard William McIntosh</td>
<td>28 l / 3cr</td>
<td></td>
<td>3 exam</td>
</tr>
<tr>
<td>29. Climatology of Hungary</td>
<td>Sándor Szegedi</td>
<td>42 l / 3cr</td>
<td></td>
<td>3 exam</td>
</tr>
</tbody>
</table>
### Renewable energy resources subject group

<table>
<thead>
<tr>
<th>Course</th>
<th>Instructor</th>
<th>Credits</th>
<th>Grade Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>33. Geothermics</td>
<td>Tamás Buday</td>
<td>28 l / 3cr</td>
<td>3 exam</td>
</tr>
<tr>
<td>34. Calculations in hydrodynamics and geothermics</td>
<td>Tamás Buday</td>
<td>28 p / 2cr</td>
<td>2 mid-semester grade</td>
</tr>
<tr>
<td>35. Atmospheric energy sources</td>
<td>Tamás Buday</td>
<td>28 l / 3cr, 28 p / 2cr</td>
<td>5 exam and mid-semester grade</td>
</tr>
<tr>
<td>Earth sciences fieldwork</td>
<td>István Lázár</td>
<td>4 days</td>
<td>4 mid-semester grade</td>
</tr>
<tr>
<td>Thesis I</td>
<td>Richard William McIntosh</td>
<td>28 l / 3cr</td>
<td>3 exam</td>
</tr>
<tr>
<td>Thesis II</td>
<td>Richard William McIntosh</td>
<td>28 l / 3cr</td>
<td>3 exam</td>
</tr>
</tbody>
</table>

### Optional courses

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
<th>Grade Type</th>
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</thead>
<tbody>
<tr>
<td>Optional courses</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

### GEOLOGY SPECIALIZATION

#### Geophysics and palaeontology informatics subject group

<table>
<thead>
<tr>
<th>Course</th>
<th>Instructor</th>
<th>Credits</th>
<th>Grade Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Methods in geophysics</td>
<td>Tamás Buday</td>
<td>28 l / 3cr</td>
<td>3 exam</td>
</tr>
<tr>
<td>2. Geophysical data and geological interpretation</td>
<td>Tamás Buday</td>
<td>28 p / 2cr</td>
<td>2 mid-semester grade</td>
</tr>
<tr>
<td>3. Structural geology II</td>
<td>Richard William McIntosh</td>
<td>14 p / 1cr</td>
<td>1 mid-semester grade</td>
</tr>
<tr>
<td>4. Palaeontology I</td>
<td>Árpád Dávid</td>
<td>28 l / 3cr</td>
<td>3 exam</td>
</tr>
<tr>
<td>Course</td>
<td>Instructor(s)</td>
<td>Credits</td>
<td>Grade Type</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------</td>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>5. Palaeontology II – practice</td>
<td>Árpád Dávid</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td><strong>Applied geology subject group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Sedimentology</td>
<td>Árpád Csámer</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>7. Environmental geology</td>
<td>Árpád Csámer</td>
<td>28 l / 3 cr</td>
<td>exam</td>
</tr>
<tr>
<td>8. Applied geology</td>
<td>Árpád Csámer</td>
<td>28 l, 14 p / 4 cr</td>
<td>exam</td>
</tr>
<tr>
<td>9. Geological planning and modelling</td>
<td>Árpád Csámer</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>10. Astrogeology and cosmo-petrography</td>
<td>Árpád Csámer</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td><strong>Geochemistry, mineralogy subject group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Geochemistry</td>
<td>Gábor Dobosi</td>
<td>28 l / 3 cr</td>
<td>exam</td>
</tr>
<tr>
<td>12. Analytical methods in geology</td>
<td>Gábor Dobosi</td>
<td>42 p / 3 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>13. Systematic mineralogy</td>
<td>Gábor Dobosi</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>14. Rock microscopy</td>
<td>Péter Rózsa</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>15. Volcanology and petrology</td>
<td>Árpád Csámer</td>
<td>28 l / 3 cr</td>
<td>exam</td>
</tr>
<tr>
<td><strong>Soil conservation and geoinformatics subject group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Soil conservation</td>
<td>György Szabó</td>
<td>28 l / 3 cr</td>
<td>exam and mid-semester grade</td>
</tr>
<tr>
<td>17. GIS fieldwork and mapping</td>
<td>Gergely Szabó</td>
<td>56 p / 4 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td><strong>Landscape geography subject group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Landscape protection</td>
<td>Tibor Novák</td>
<td>28 l / 3 cr</td>
<td>exam</td>
</tr>
<tr>
<td>Course Title</td>
<td>Instructor</td>
<td>Credits</td>
<td>Grade Type</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>----------------------</td>
<td>---------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Landscape protection – practice</td>
<td>István Fazekas</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>Geology fieldwork</td>
<td>Richard William McIntosh</td>
<td>4 days</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>Geology internship</td>
<td>Péter Rózsa</td>
<td>6 weeks</td>
<td>mid-semester grade</td>
</tr>
</tbody>
</table>

**METEOROLOGY SPECIALIZATION**

**Theoretical physics subject group**

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Instructor</th>
<th>Credits</th>
<th>Grade Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nonlinear phenomena, chaos</td>
<td>Agnes Nagy</td>
<td>28 l / 3 cr</td>
<td>exam</td>
</tr>
<tr>
<td>2. Dynamics of the atmosphere I</td>
<td>Zsolt Schram</td>
<td>42 l, 28 p / 5 cr</td>
<td>exam</td>
</tr>
<tr>
<td>3. Dynamics of the atmosphere II</td>
<td>Zsolt Schram</td>
<td>42 l, 14 p / 4 cr</td>
<td>exam</td>
</tr>
</tbody>
</table>

**Applied meteorology I subject group**

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Instructor</th>
<th>Credits</th>
<th>Grade Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Synoptic meteorology I.</td>
<td>Ferenc Wantuch</td>
<td>28 l / 3 cr</td>
<td>exam</td>
</tr>
<tr>
<td>5. Synoptic meteorology II.</td>
<td>Ferenc Wantuch</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>6. Aviation meteorology</td>
<td>Ferenc Wantuch</td>
<td>28 l / 3 cr</td>
<td>exam</td>
</tr>
<tr>
<td>7. Introduction to programming</td>
<td>Ferenc Wantuch</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
</tbody>
</table>

**Applied meteorology II subject group**

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Instructor</th>
<th>Credits</th>
<th>Grade Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Global climate change</td>
<td>István Lázár</td>
<td>14 l, 14 p / 2 cr</td>
<td>exam</td>
</tr>
<tr>
<td>9. Meteorological field measurements</td>
<td>Sándor Szegedi</td>
<td>14 l, 14 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>10. Meteorological instruments</td>
<td>István Lázár</td>
<td>28 p / 2 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>11. Agrometeorology</td>
<td>Sándor Szegedi</td>
<td>14 l, 28p / 3 cr</td>
<td>mid-semester grade</td>
</tr>
<tr>
<td>12. Climate of the Earth</td>
<td>Sándor Szegedi</td>
<td>28 l / 3cr</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------</td>
<td>------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Climatology subject group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Climate history</td>
<td>Sándor Szegedi</td>
<td></td>
<td>28 l, 14 p / 4cr</td>
</tr>
<tr>
<td>14. Environmental climatology</td>
<td>Sándor Szegedi</td>
<td></td>
<td>28 l / 3cr</td>
</tr>
<tr>
<td>15. Statistical climatology</td>
<td>István Lázár</td>
<td></td>
<td>28 l, 28 p / 5cr</td>
</tr>
<tr>
<td><strong>Geocology and geoinformatics subject group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Geoecology</td>
<td>Tibor Novák</td>
<td></td>
<td>14 l, 28p / 3cr</td>
</tr>
<tr>
<td>17. GIS fieldwork and mapping</td>
<td>Gergely Szabó</td>
<td></td>
<td>56 p / 4cr</td>
</tr>
<tr>
<td>Meteorology internship</td>
<td>István Lázár</td>
<td></td>
<td>6 weeks</td>
</tr>
</tbody>
</table>
**Work and Fire Safety Course**

According to the Rules and Regulations of University of Debrecen a student has to complete the online course for work and fire safety. Registration for the course and completion are necessary for graduation. For MSc students the course is only necessary only if BSc diploma has been awarded outside of the University of Debrecen.

Registration in the Neptun system by the subject: MUNKAVEDELEM

Students have to read an online material until the end to get the signature on Neptun for the completion of the course. The link of the online course is available on webpage of the Faculty.

**Internship**

Students studying in the Earth Sciences BSc have to carry out a 6 weeks internship involved in the model curriculum. The internship course must be signed up for previously via the NEPTUN study registration system in the spring semester (4th semester). Its execution is the criteria requirement of getting the pre-degree certificate (absolutorium).

**Objective of the internship, competences**

Students get acquainted with professional work in conformity with their major at the company or institution and join in the daily working process. They have to resolve tasks independently assigned by their supervisor and gain experiences may be utilized later in the labour market. During the internship common and professional competences may be acquired. Common competences: precise working on schedule either individually or in team, talk shop applying correct technical terms. Professional competences: applying the professional skill gained during the training and acquiring new knowledge.

**Places suitable for internship**

All organizations, institutions and companies in Hungary or abroad, provide students with the opportunity to acquire proficiency in accordance with their specialization in the field of operation, repairing technology, installation, management and development of different machines and vehicles, may be a suitable place.

**Physical Education**

According to the Rules and Regulations of University of Debrecen a student has to complete Physical Education courses at least in two semesters during his/her Bachelor’s training. Our University offers a wide range of facilities to complete them. Further information is available from the Sport Centre of the University, its website: [http://sportsci.unideb.hu](http://sportsci.unideb.hu).
Pre-degree Certification

A pre-degree certificate is issued by the Faculty after completion of the bachelor’s (BSc) program. The pre-degree certificate can be issued if the student has successfully completed the study and exam requirements as set out in the curriculum, the requirements relating to Physical Education as set out in Section 10 in Rules and Regulations, internship (mandatory) – with the exception of preparing thesis – and gained the necessary credit points (180). The pre-degree certificate verifies (without any mention of assessment or grades) that the student has fulfilled all the necessary study and exam requirements defined in the curriculum and the requirements for Physical Education. Students who obtained the pre-degree certificate can submit the thesis and take the final exam.

Thesis

The thesis is based on independent work summarizing the performed activities and the results closing the training and proving that students are able to collect and interpret available literature related to a specific problem and based on well-established methods students are able to solve the problem and interpret the observations and results. The minimum length of the thesis is 30 typewritten pages. The topic of the thesis has to be selected in the 4th semester at the latest, however, students may join any research at the departments earlier. Thesis courses have to be completed in semester 5 and 6 with the total credit points of 10. Thesis has to be composed with A/4 paper size, 2.5 cm margins, 12 points Times New Roman letter size and type with 1.5 spacing. Detailed requirements can be downloaded at https://geo.unideb.hu/hu/szakdolgozatok-diplomamunkak.

Final Exam

Students may take the final exam if they completed the required 180 credits. At the final exam the obtained knowledge is controlled in an oral exam using questions covering the core material (Questions A) and the specialization material (Questions B). Defence of the thesis is part of the final exam in the form of a short presentation of the results obtained in the thesis work.

The grade of the final exam is calculated on the basis of the current Study and Examination Rules. One of the most important specifications is that the exam is only successful if all three grades (two questions and thesis defence) are at least pass.

A final exam can be taken in the forthcoming exam period after obtaining the pre-degree certificate. A final exam has to be taken in front of the Final Exam Board. If a candidate does not pass his/her final exam by the termination of his/her student status, he/she can take his/her final exam after the termination of the student status on any of the final exam days of the relevant academic year according to existing requirements on the rules of the final exam.
Final Exam Board

Board chair and its members are selected from the acknowledged internal and external experts of the professional field. Traditionally, it is the chair and in case of his/her absence or indisposition the vice-chair who will be called upon, as well. The board consists of – besides the chair – at least two members (one of them is an external expert), and questioners as required. The mandate of a Final Exam Board lasts for one year.

Repeating a failed Final Exam

If any part of the final exam is failed it can be repeated according to the rules and regulations. A final exam can be retaken in the forthcoming final exam period. If the Board qualified the Thesis unsatisfactory a student cannot take the final exam and he has to make a new thesis. A repeated final exam can be take twice on each subject.
Diploma

The diploma is an official document decorated with the coat of arms of Hungary which verifies the successful completion of studies in the Earth Sciences Bachelor Program. It contains the following data: name of HEI (higher education institution); institutional identification number; serial number of diploma; name of diploma holder; date and place of his/her birth; level of qualification; training program; specialization; mode of attendance; place, day, month and year issued. Furthermore, it has to contain the rector’s (or vice-rector’s) original signature and the seal of HEI. The University keeps a record of the diplomas issued.

In Earth Sciences Bachelor Program the diploma grade is calculated as the average grade of the results of the followings:

- Weighted average of the overall studies at the program (A)
- Average of grades of the thesis and its defense given by the Final Exam Board (B)
- Average of the grades received at the State Exam for the two subjects (C)

Diploma grade = \( \frac{(A + B + C)}{3} \)

Classification of the award on the bases of the calculated average:

- Excellent 4.81 – 5.00
- Very good 4.51 – 4.80
- Good 3.51 – 4.50
- Satisfactory 2.51 – 3.50
- Pass 2.00 – 2.50
# Course Descriptions of Earth Sciences BSc Program

<table>
<thead>
<tr>
<th>Title of course: Basic mathematics 1</th>
<th>ECTS Credit points: 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code: TTMBE0819_EN</td>
<td></td>
</tr>
</tbody>
</table>

## Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

## Evaluation: exam

## Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 16
- preparation for the exam: 48 hours
Total: 90 hours

## Year, semester: 1st year, 1st semester

## Its prerequisite(s): -

## Further courses built on it: TTMBG0820_EN

## Topics of course

The aims of the course include the acquisition of the basic concepts of boundedness, monotonicity and convergence of real valued sequences. Further aims include to make students familiar with fundamental concepts and theorems from differential and integral calculus (such as derivative of a real valued function, application of the differential calculus, the concept of the primitive function, Riemann integration, Newton-Leibniz formula, application of the Riemann integral). Furthermore, an important goal the understanding of some basic concepts of matrices with real elements (such as operations with matrices, system of linear equations), as well as the acquisition of some computational methods in connection with matrices (e. g. Gaussian elimination).

## Literature


## Schedule:

### 1st week
Real numbers. Monotonicity, boundedness, convergence. Limits of sequences.

### 2nd week

### 3rd week
Continuity and limits of one variable real functions.
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th</td>
<td>Differentiation of one variable real functions. The derivative and its meaning in geometry.</td>
</tr>
<tr>
<td></td>
<td>Differentiation of elementary functions. Rules of derivation.</td>
</tr>
<tr>
<td>5th</td>
<td>Application of differentiation calculus I: solving tasks, L’Hospital rule.</td>
</tr>
<tr>
<td>6th</td>
<td>Application of differentiation calculus I: complete study of one variable real functions.</td>
</tr>
<tr>
<td>7th</td>
<td>Primitive function of one variable real functions. Indefinite integral. Primitive functions</td>
</tr>
<tr>
<td></td>
<td>of elementary functions.</td>
</tr>
<tr>
<td>9th</td>
<td>Riemann (definite) integral of one variable real functions. Some criteria of Riemann</td>
</tr>
<tr>
<td></td>
<td>integration.</td>
</tr>
<tr>
<td>12th</td>
<td>Some application of Riemann integral.</td>
</tr>
<tr>
<td>14th</td>
<td>Linear equation systems. Description of the solutions of a linear equation system using</td>
</tr>
<tr>
<td></td>
<td>Gaussian elimination.</td>
</tr>
</tbody>
</table>

**Requirements:**
- *for a signature*

Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may
evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.

*for a grade*

The final grade is calculated as an average of the three practical grading.

The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
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<tr>
<td>73-84</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Zoltán Muzsnay, associate professor, PhD

**Lecturer:** Dr. Zoltán Muzsnay, associate professor, PhD
**Title of course:** Basic mathematics 1 – practice  
**Code:** TTMBG0819_EN  
**ECTS Credit points:** 2

<table>
<thead>
<tr>
<th>Type of teaching, contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
</tr>
<tr>
<td>- practice: 2 hours/week</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
</tbody>
</table>

| Evaluation: | mid-semester grade |

<table>
<thead>
<tr>
<th>Workload (estimated), divided into contact hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
</tr>
<tr>
<td>- practice: 28 hours</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
<tr>
<td>- home assignment: 8 hours</td>
</tr>
<tr>
<td>- preparation for the exam: -</td>
</tr>
<tr>
<td>- preparation for tests: 24 hours</td>
</tr>
</tbody>
</table>

Total: 60 hours

| Year, semester: | 1st year, 1st semester |

| Its prerequisite(s): | - |

| Further courses built on it: | - |

### Topics of course

The aims of the course include the acquisition of the basic concepts of boundedness, monotonicity and convergence of real valued sequences from the point of view of applications. Further aims include to make students familiar with fundamental concepts and applications of differential and integral calculus (such as application of the differential calculus, application of the Riemann integral). Furthermore, an important goal the understanding of some basic concepts of matrices with real elements (such as operations with matrices, system of linear equations), as well as the application of some computational methods in connection with matrices (e. g. Gaussian elimination).

### Literature


### Schedule:

1st week  
Studying the boundedness, monotonicity and convergence of real sequences.

2nd week  
Injective, surjective and bijective functions. Calculation of the inverse of invertible functions. Depicting functions.

3rd week  
Examples of continuous functions. Examples of functions not continuous at a given point.

4th week  

Calculation of the derivative of one variable real functions at a given point. Applying the derivatives of elementary functions and derivation rules in calculating the derivative functions.

5th week
Application of differential calculations I.

6th week
Application of differential calculations II.

7th week
Test 1

8th week
Primitive functions of elementary functions.

9th week
Practice of more complex versions of integration.

10th week
Application of Newton-Leibniz rule for calculating the Riemann integral of some simple functions.

11th week
Application of Riemann integral.

12th week
Operations with matrixes. Matrix algebra.

13th week
Solving linear equation systems with Gaussian elimination.

14th week
Test 2

Requirements:
- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.
- for a grade
The final grade is calculated as an average of the three practical grading.
The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

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<tr>
<td>85-100</td>
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</tr>
</tbody>
</table>

If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Zoltán Muzsnay, associate professor, PhD

**Lecturer:** Dr. Zoltán Muzsnay, associate professor, PhD
Title of course: Basic mathematics 2
Code: TTMBG0820_EN
ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture:
- practice: 28 hours
- laboratory: -
- home assignment: 16 hours
- preparation for the exam:
- preparation for tests: 16 hours
Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): TTMBE0819

Further courses built on it: -

Topics of course
The aims of the course include the acquisition of the basic concepts of ordinary differential equations. Further aims include to make students familiar with various applications of ordinary differential equations occurring in geography and Earth science. Furthermore, an important goal is the understanding of some basic concepts of probability theory and statistics, as well as the application of some computational methods from probability theory and statistics.

Literature
- Jeffrey R. Chasnov: Introduction to Differential Equations, Hong Kong University of Science and Technology, 2009

Schedule:
1st week

2nd week
Solution of simple first order explicit differential equations.

3rd week
Application of separable differential equations.

4th week
Solution and application of simple first order differential equations.

5th week
Solution and application of first order inhomogeneous linear differential equations in geo-processes.
6th week
Combinatorics.

7th week
Test 1

8th week
Probability calculations.

9th week

10th week
Probability variables, distribution function, density function, discrete and continuous distributions.

11th week
Common probability distributions.

12th week
Elements of mathematical statistics. Statistical tests. The u, t and khi^2 tests and their application in practice.

13th week
Regression calculations.

14th week
Test 2.

Requirements:

- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.

- for a grade
The final grade is calculated as an average of the three practical grading.

The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:
Score     Grade
0-49      fail (1)
50-59     pass (2)
60-72     satisfactory (3)
73-84     good (4)
85-100    excellent (5)

If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Zoltán Muzsnay, associate professor, PhD

Lecturer: Dr. Zoltán Muzsnay, associate professor, PhD

Title of course: Fundamentals of informatics
Code: TTGBL7002_EN

ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -
- practice: -
- laboratory: 2 hours/week

Evaluation: practical grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: -
- laboratory: 28 hours
- home assignment: 16 hours
- preparation for the exam: 16 hours
Total: 60 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Literature
• MS Office Support – https://support.office.com/
• Library And Learning Services: Working With Microsoft Powerpoint. URL: http://www2.eit.ac.nz/library/Documents/Working_With_PowerPoint_Combined.pdf

Schedule:


4th week – Font formatting: font type, style, size, etc. Special options. Formatting paragraphs: alignment, indentations, spacers, spacing, text placement. Page size, margin settings. Styles and Formatting II.


6th week – Insert tables, diagrams, images, size, and characteristics. Spreading and splitting.

7th week – I. practical grading – MS Word.


9th week – References, names, formulas, and functions. Managing Functions and Function Groups. Date management, statistical functions, and database and text management functions.

10th week – Create or modify charts. Subtitles, texts, explanations, links, graphical elements display format (background, dimension, gridlines, axes) Types of charts, parameterization and graphical settings. Representation function. Concept of template.

11th week – II. practical grading – MS Excel.


14th week – III. practical grading – MS PowerPoint.

Requirements:

- for a signature

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another
Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.

*for a grade*

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<tr>
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</tr>
</tbody>
</table>

If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Judit Boda Kissné, assistant lecturer

**Lecturer:** Judit Boda Kissné, assistant lecturer

Dr. Gábor Négyesi, assistant professor, PhD
**Title of course:** Fundamentals of physics I  
**Code:** TTFBE2101  
**ECTS Credit points:** 4

<table>
<thead>
<tr>
<th><strong>Type of teaching, contact hours</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>lecture: 2 hours/week</td>
<td></td>
</tr>
<tr>
<td>practice: 1 hours/week</td>
<td></td>
</tr>
<tr>
<td>laboratory:</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Evaluation:</strong> exam</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Workload (estimated), divided into contact hours:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>lecture: 28 hours</td>
</tr>
<tr>
<td>practice: 14 hours</td>
</tr>
<tr>
<td>laboratory:</td>
</tr>
<tr>
<td>home assignment: 30 hours</td>
</tr>
<tr>
<td>preparation for the exam: 48 hours</td>
</tr>
<tr>
<td>Total: 120 hours</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Year, semester:</strong> 1st year, 1st semester</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Its prerequisite(s):</strong> -</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Further courses built on it:</strong> -TTFBE2103</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Topics of course</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Schedule:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st week</strong></td>
</tr>
<tr>
<td>Relationship between physics and other natural sciences and also mathematics. Quantities and dimensions in physics. SI dimensions, vectors and coordinate systems.</td>
</tr>
<tr>
<td><strong>2nd week</strong></td>
</tr>
<tr>
<td>Mathematical basics, matrixes, functions, differentiation and integral.</td>
</tr>
<tr>
<td><strong>3rd week</strong></td>
</tr>
<tr>
<td>Kinematics. Angular velocity, angular acceleration.</td>
</tr>
<tr>
<td><strong>4th week</strong></td>
</tr>
<tr>
<td><strong>5th week</strong></td>
</tr>
<tr>
<td><strong>6th week</strong></td>
</tr>
<tr>
<td>Work, kinetic energy, performance. Positional and mechanical energy.</td>
</tr>
<tr>
<td><strong>7th week</strong></td>
</tr>
</tbody>
</table>

Angular momentum theorem, the conservation of angular momentum. Kinematic and dynamic characteristics of rigid bodies. Movement equations.

**8th week**

**9th week**
Wave phenomena, Doppler effect. The limits of Newton’s mechanics. Elements and consequences of the special relativity theory.

**10th week**
The term temperature, thermodynamic systems. Ideal gas, temperature scales. First law of thermodynamics, heat capacity, specific heat.

**11th week**

**12th week**
Elements of statistic mechanics, the kinetic gas model. Probability distributions, calculation of expected values. Maxwell-Boltzmann distribution.

**13th week**
Statistical interpretation of entropy. Heterogeneous systems, phase equilibrium.

**14th week**
Summary of the material of the semester, consultation.

**Requirements:**

- **for a signature**
  Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

  During the semester there are three practical grading. Students have to attend.

- **for a grade**
  The final grade is calculated as an average of the three practical grading.

  The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

<table>
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<tr>
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<tr>
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</tbody>
</table>

  If the score of any task is below 50, students can take a retake in conformity with the
<table>
<thead>
<tr>
<th>EDUCATION AND EXAMINATION RULES AND REGULATIONS.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Person responsible for course:</strong> Dr. Ujvári Balázs, assistant professor, PhD</td>
</tr>
<tr>
<td><strong>Lecturer:</strong> Dr. Ujvári Balázs, assistant professor, PhD</td>
</tr>
</tbody>
</table>
Title of course: Fundamentals of physics II  
Code: TTFBE2103  
ECTS Credit points: 4

**Type of teaching, contact hours**
- lecture: 2 hours/week  
- practice: 1 hours/week  
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours  
- practice: 14 hours  
- laboratory: -  
- home assignment: 30 hours  
- preparation for the exam: 48 hours  
Total: 120 hours

**Year, semester:** 1st year, 2nd semester

**Its prerequisite(s):** TTFBE2101

**Further courses built on it:** -

**Topics of course**

**Literature**

**Schedule:**

1st week  
Electrostatics, Coulomb’s law and Gaussian laws.

2nd week  
Conductors and non-conductors, electric polarization, Capacity of condensators, electric susceptibility.

3rd week  
Energy density of the electrostatic field. Electric dipol’s field, potential energy.

4th week  
Stationary electric current, Ohm’s law. Specific resistance, simple circuits.

5th week  
Magnetostatic basic phenomena in vacuum and in materials. Lorentz strength, magnetic momentum.

6th week  

7th week
Electromagnetic vibrations, effective values. Impedance, transformators.  
**8th week**
Formation and movement of electromagnetic waves, Maxwell equations.  
**9th week**
Electromagnetic spectrum. Light as wave, fracture, reflectance. Complementary theory.  
**10th week**
Quantum nature of light, temperature radiation, black body.  
**11th week**
Development of atomic models, Rutherford’s experiment, Bohr’s model. The formation of quantum physics.  
**12th week**
Electron structure of atoms, the periodic table. The formation of x-Ray radiation.  
**13th week**
Radioactive decay, decomposition and fusion, the operation of nuclear power plants. Nuclear power and its risks.  
**14th week**
Elementary parts and their characteristics, basic interactions. Cosmology.

### Requirements:

**- for a signature**
Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

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If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Ujvári Balázs, assistant professor, PhD  
**Lecturer:** Dr. Ujvári Balázs, assistant professor, PhD
**Title of course:** Meteorology in everyday life  
**Code:** TTGBE5504_EN  
**ECTS Credit points:** 2

<table>
<thead>
<tr>
<th>Type of teaching, contact hours</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 1 hours/week</td>
<td></td>
</tr>
<tr>
<td>- practice: 1 hours/week</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
</tbody>
</table>

**Evaluation:** mid-semester grade

<table>
<thead>
<tr>
<th>Workload (estimated), divided into contact hours:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 14 hours</td>
<td></td>
</tr>
<tr>
<td>- practice: 14 hours</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
<tr>
<td>- home assignment: 32 hours</td>
<td></td>
</tr>
<tr>
<td>- preparation for the exam: -</td>
<td></td>
</tr>
<tr>
<td>Total: 60 hours</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year, semester:</th>
<th>1\textsuperscript{st} year, 1\textsuperscript{st} semester</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Its prerequisite(s):</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Further courses built on it:</th>
<th></th>
</tr>
</thead>
</table>

**Topics of course**

The aim of the course is to provide knowledge on the meteorological background, dynamics and impacts of weather and climate phenomena known from everyday life. The course covers the following topics: the Sun as the source of energy of the climate system; „space weather”, solar eruptions, geomagnetic storms and their effects; atmospheric optics: rainbow, fata morgana; atmospheric electronics: lightings; meteorological basics of the utilization of renewable energy sources energy and water cycles; paleo- and historical climatology in brief; fundaments of human meteorology; development of meteorological instruments from barometers to satellites, SODAR, LIDAR and RASS and other modern instruments; development of numeric weather forecasting from the storm of Balaklava till today; air quality and meteorology; extraterrestrial climates.

**Literature**

<table>
<thead>
<tr>
<th>Compulsory literature:</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Additional literature:</th>
<th></th>
</tr>
</thead>
</table>

**Schedule:**

- **1\textsuperscript{st} week** – The Sun as the source of energy of the climate system – „space weather” – solar eruptions, geomagnetic storms and their effects.
- **2\textsuperscript{nd} week** – Atmospheric optics: rainbow, fata morgana.
- **3\textsuperscript{rd} week** – Atmospheric electronics: lightings
- **4\textsuperscript{th} week** – Climate changes and climate fluctuations.
- **5\textsuperscript{th} week** – Paleo- and historical climatology in brief.
6th week – Meteorological basics of the utilization of renewable energy sources 1: energy cycles.
7th week – Meteorological basics of the utilization of renewable energy sources 2: water cycles.
8th week – Weather forecasting 1: Development of numeric weather forecasting from the storm of Balaklava till today.
9th week – Weather forecasting 2: Weather forecasting models.
10th week – Air quality and meteorology.
11th week – Development of meteorological instruments from barometers to satellites, SODAR, LIDAR and RASS instruments.
12th week – Fundaments of human meteorology meteoropathy.
13th week – Extraterrestrial climates 1: climates of the inner planets of the Solar System.
14th week – Extraterrestrial climates 2: climates of the outer planets and moons of the Solar System.

Requirements:
Attendance at lectures is recommended, but not compulsory.

- for a grade
The course ends in an examination. The exam grade is the result of the examination.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
</tr>
<tr>
<td>65-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD

Lecturer: Dr. Sándor Szegedi, associate professor, PhD
<table>
<thead>
<tr>
<th>Title of course: Introduction to chemistry I</th>
<th>Code: TTKBE0141_EN</th>
<th>ECTS Credit points: 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of teaching, contact hours</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- lecture: 2 hours/week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- practice: -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evaluation:</strong> exam</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Workload (estimated), divided into contact hours:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- lecture: 28 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- practice: -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- home assignment:</td>
<td></td>
<td></td>
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<tr>
<td>- preparation for the exam: 62 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: 90 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year, semester:</strong> 1st year, 2nd semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Its prerequisite(s):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Further courses built on it:</strong> TTKBL0141_EN</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Topics of course</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Literature</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Schedule:**

1st week
Atomic structures.

2nd week
First and second order chemical bonds.

3rd week
The periodic system and periodically varying characteristics.

4th week
Gases, liquids and solid material.

5th week
Changes of state, mixtures, description of gas mixtures.

6th week
Solution and concentration, mixtures of liquids.

7th week
Chemical reactions, reaction kinetics, thermochemical terms, reactions resulting in equilibrium.

8th week

9th week
Redox reactions, electric chemistry. Galvanic elements, electrolysis, radiochemistry.

10th week

11th week

12th week
Air pollutants: sulphur oxides, hydrogen sulphide, nitrogen oxides. Useful and hazardous: halogens (chlore, bromide, iodide) and their compounds.

13th week
Most important acids, hydrochloric acid, sulphuric acid, nitric acid, artificial fertilizers. Artificial fertilizing.

14th week
Metals, transitional metals.

Requirements:
- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.

- for a grade
The final grade is calculated as an average of the three practical grading. The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>
If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Gábor Bellér, assistant professor, PhD

**Lecturer:** Dr. Gábor Bellér, assistant professor, PhD
Title of course: Introduction to chemistry I – practice
Code: TTKBE0141

ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32
- preparation for the exam:
Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): TTKBE0141

Further courses built on it: -

Topics of course

The objective of the laboratory work is to introduce first-year students of different background to laboratory work, the use of basic laboratory equipment, simple laboratory operations and measurements. In addition, students are expected to prepare certain simple chemicals and run various basic experiments to familiarize themselves with chemical laboratory work. The seminar involves solving exercises and problems.

General laboratory work will be introduced, such as:

Weighing on analytical and standard laboratory balances. Introduction to the measurement of volume: pipette, burette, volumetric flask. Students will calibrate a volume measurement devise (pipette/burette/volumetric flask) and calculate the percentage difference between the nominal and actual volume. General introduction to grinding and preparation of solution. Density measurement, use of the pycnometer. Preparation of a standard solution from crystalline solid and measuring its density: determination of the density of the prepared solution with pycnometer, calculation of the weight percent composition. General introduction to separation techniques: decantation, centrifuging, filtration. Students will see a demonstration regarding the proper and safe use of laboratory gas cylinders, preparation of gases under laboratory conditions, Kipp’s apparatus. Students will carry out the purification of a benzoic acid sample contaminated with sodium chloride. Students will see a demonstration of an acid-base titration and will carry out the concentration determination of a NaOH solution.

Basic calculation peroblems will be solved considering:

Literature

- Introduction to chemistry laboratory practice (laboratory manual, available at inorg.unideb.hu)
- The collection of calculation problems will be available at inorg.unideb.hu
- Darrell Ebbing, Steven D. Gammon: General Chemistry 10th edition

Schedule:

1\(^{st}\) week
Faults of measurements and calculations, listing and describing,

2\(^{nd}\) week
Stoichiometric calculations related to the mass of atoms and molecules.

3\(^{rd}\) week
Calculation of concentration units and mixed concentration tasks. Formulae and reaction equations.

4\(^{th}\) week
Miscellaneous tasks related to concentration and stoichiometric calculations.

5\(^{th}\) week
Calculation of pH in the solutions of strong acids and basics. Titration.

6\(^{th}\) week

7\(^{th}\) week

8\(^{th}\) week

9\(^{th}\) week

10\(^{th}\) week

11\(^{th}\) week

12\(^{th}\) week

13\(^{th}\) week

14\(^{th}\) week

Requirements:

- for a signature

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may
evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.

*For a grade*

The final grade is calculated as an average of the three practical grading.

The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

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If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Edina Baranyai, assistant professor, PhD

**Lecturer:** Dr. Edina Baranyai, assistant professor, PhD
Title of course: Fundamental biology
Code: TTBE0001
ECTS Credit points: 1

Type of teaching, contact hours
- lecture: 1 hour/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 14 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 16 hours
Total: 30 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course
Founding the learning of knowledge important for obtaining knowledge.

Literature


Schedule:

1st week

2nd week
Plants and plant tissues. Organs and functions of plants. Plant divisions in taxonomy.

3rd week
Elements and compounds composing a living system. Biogenic elements. Physical, chemical and biological specifics of water. Diffusion and osmosis.

4th week

5th week
The term of a cell. Prokaryotes and eukaryotes. Cell core, cell centre, probably cell cycle.
6th week

7th week

8th week
Self-control. Hormones and their effects. Lead and control in life. Somatic and vegetative control.

9th week
Terms of gene, genetic type. DNA duplication. Control of genes.

10th week
Mendel’s equilibrium. Heritance bounded to women.

11th week

12th week

13th week
Bioms. Environmental and nature protective knowledge.

14th week
Evaluation and control.

Requirements:
- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.

- for a grade
The final grade is calculated as an average of the three practical grading.

The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

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<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72</td>
<td>satisfactory (3)</td>
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<tr>
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<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>
If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Revák Gyuláné, associate professor, PhD

**Lecturer:** Dr. Revák Gyuláné, associate professor, PhD
**Title of course**: Basics of Ecology  
**Code**: TTBBE0003_EN  
**ECTS Credit points**: 3

**Type of teaching, contact hours**  
- lecture: 2 hours/week  
- practice: -  
- laboratory: -

**Evaluation**: exam

**Workload (estimated), divided into contact hours**:  
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: -  
- preparation for the exam: 62 hours  
Total: 90 hours

**Year, semester**: 1st year, 1st semester

**Its prerequisite(s)**: -

**Further courses built on it**: -

**Topics of course**

The course provides an introduction to the basic ecological processes and their effects on the environment and nature. The course introduces the state-of-art theoretical background, and provides case studies to each topic in order to reveal practical aspects. The main topics: aspects of vegetation succession; global and local effects of land use changes, habitat loss and fragmentation; ecological processes in urban habitats; ecosystem services and estimation of the ecological footprint; application of remotely sensed data in environmental and conservational projects.

**Literature**


**Schedule**:

1<sup>st</sup> week Introduction to the course

2<sup>nd</sup> week Classical island biogeography

3<sup>rd</sup> week Conservational, cultural importance of habitat islands. Connected ecosystem services.

4<sup>th</sup> week Biological invasions

5<sup>th</sup> week Remote sensing in ecology

6<sup>th</sup> week Ecosystem services and ecological footprint
7th week: Mid-term test

8th week Succession. Primary and secondary succession. Role of succession in conservation.

9th week Conservation and management of grasslands

10th week Urban ecology, global patterns

11th week Ecosystem engineering species

12th week Sustainable land use

13th week Natural habitats in human transformed landscapes

14th week End-term test

Requirements:

- for a signature
Participation at classes is compulsory. A student must attend the classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. In case of more than three absences, a medical certificate needs to be presented.

-an offered grade:
During the semester there are two tests: the mid-term test in the 7th week and the end-term test in the 14th week. The offered grade is the average of them.
The minimum requirement for the tests (and also for the examination) is 60%. The grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-59</td>
<td>fail (1)</td>
</tr>
<tr>
<td>60-69</td>
<td>pass (2)</td>
</tr>
<tr>
<td>70-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

- for a grade
The course ends in a written exam. For the grades please refer the table above.

Person responsible for course: Dr. Deák Balázs, assistant professor, PhD

Lecturer: Dr. Deák Balázs, assistant professor, PhD
Prof. Dr. Tóthméresz Béla, university professor, DSc
Dr. Deák-Valkó Orsolya, assistant professor, PhD
**Title of course:** Basic environmental science  
**ECTS Credit points:** 1

**Type of teaching, contact hours**  
- lecture: 1 hours/week  
- practice: -  
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**  
- lecture: 14 hours  
- practice: -  
- laboratory: -  
- home assignment: -  
- preparation for the exam: 16 hours  
Total: 30 hours

**Year, semester:** 1st year, 2nd semester

**Its prerequisite(s):** -

**Further courses built on it:** -

**Topics of course**  

**Literature**  

**Schedule:**  
1st week  
Environmental science thinking, populations.  
2nd week  
Global environmental systems and problems.  
3rd week  
Local and regional environmental thinking.  
4th week  
Continental and global environmental thinking.  
5th week  
Biotic and abiotic environmental factors.  
6th week  
State and protection of environmental systems  
7th week
Sustainability, energy efficiency, reuse of materials, ecological footprint.

8th week
Effects of global climate change on the biosphere.

9th week
Environmental problems, Environmental load.

10th week
Biological indications, biodiversity.

11th week
Earth as a place to live.

12th week
Air, water, soil.

13th week
Nature and society.

14th week
Consulting.

Requirements:
- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.

- for a grade
The final grade is calculated as an average of the three practical grading.

The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. István Gyulai, assistant professor, PhD

Lecturer: Dr. István Gyulai, assistant professor, PhD
**Title of course:** EU studies  
**Code:** TTTBE0030_EN  
**ECTS Credit points:** 1

### Type of teaching, contact hours
- lecture: 1 hour/week  
- practice: -  
- laboratory: -

### Evaluation:
exam

### Workload (estimated), divided into contact hours:
- lecture: 14 hours  
- practice: -  
- laboratory: -  
- home assignment: -  
- preparation for the exam: 16 hours  
**Total:** 30 hours

### Year, semester:
1st year, 1st semester

### Its prerequisite(s):
- 

### Further courses built on it:
- 

### Topics of course
The aim of the course is to give an overall picture for the students of the history of the development of the Community and the operation of its institutional system. It also aims at introducing the students to the enlargement process and the most important cooperation areas. On the level of EU policies, the issues of agriculture, regional policy, Economic and Monetary Union and the Schengen Area are discussed. The primary goal is that the future diploma holders have realistic knowledge about the functioning of the European Union, and of the international background of the Hungarian EU membership.

### Literature

### Schedule:

#### 1st week

#### 2nd week
3rd week
**Specific features of the enlargements after the turn of the millennium.** Transformation of East Central Europe, and the unique features of its membership. Copenhagen criteria, pre-accession funds, prolonged negotiation process. Brexit.

4th week
**History and principles of the creation of the institutional system.** Taking-over the institutional system of the European Coal and Steel Community. Tasks of the most important institutions, operational mechanism, democratic deficit. Reform process of the institutional system, concepts laid down in the Constitutional Treaty. Decision-making in the EU.

5th week
**Agricultural policy.** History of the development of the CAP. The most important tools and sources of the funds. Horizontal measures. Current state of the common agricultural policy and its expected future. Reform attempts in agriculture. Hungary and common agricultural policy. Sharing the fish stocks of the seas.

6th week

7th week
**Economic and Monetary Union (EMU).** History of the European monetary co-operation. The European Monetary System (EMS). Role of the Maastricht Treaty in the monetary co-operation. Stages on the development of the Monetary Union. Convergence criteria. The euro and the currency market. Hungary and the Monetary Union.

8th week
**Judicial co-operation in the Community.** Legal order in the European Union. Role of the primary EU legislation in the European Community. European Community justice. Institutions serving the needs of judicial co-operation.

9th week
**History of co-operations in home affairs.** Schengen Convention. Regulations related to crossing state borders. Border checks. Checks between state borders, migration policy.

10th week

11th week
**EU Budget: revenue side.** Components of the EU budget and recent changes in the proportions. History of the EU budget. Budget revenues: duties, value-added tax (VAT), gross national product (GNP) sources.

12th week
**Expenditures:** agricultural policy, structural funds, external aid, research and development, pre-accession assistances, administrative expenditures. Economic characteristics. Budget procedure.

13th week
**Migration and the European Union.** Theoretical background to the migration crisis in 2015 and its practical consequences. History of the migration routes and movements. Natural and social (political) causes contributing to the crisis situation.

14th week
**Common vision for the European co-operation.** Possible development paths in the future of

**Requirements:**
- *for a signature*
  Attendance at lectures is recommended, but not compulsory.
- *for a grade*
  The course ends in a written examination.

**Person responsible for course:** Dr. Károly Teperics, associate professor, PhD

**Lecturer:** Dr. Klára Czimre, assistant professor, PhD
**Title of course:** Mineralogy and Petrology I  
**Code:** TTGBE5007_EN  
**ECTS Credit points:** 3

<table>
<thead>
<tr>
<th>Type of teaching, contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 2 hours/week</td>
</tr>
<tr>
<td>- practice: -</td>
</tr>
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<td>- laboratory: -</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Evaluation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>exam</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Workload (estimated), divided into contact hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 28 hours</td>
</tr>
<tr>
<td>- practice: -</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
<tr>
<td>- home assignment: 10 hours</td>
</tr>
<tr>
<td>- preparation for the exam: 52 hours</td>
</tr>
</tbody>
</table>

**Total:** 90 hours

<table>
<thead>
<tr>
<th>Year, semester:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; year, 1&lt;sup&gt;st&lt;/sup&gt; semester</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Its prerequisite(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Further courses built on it:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTGBG5008_EN, TTGBG5014_EN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topics of course</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aims of the course is to introduce crystal system, point groups, symmetry elements and crystal forms; basic s of crystal chemistry (most important ionic crystals, particularly the silicates; the most important covalent and metal bonding crystals; to demonstrate the principal physical features (hardness, optical properties, etc.) of crystals; to introduce to the students the genetic and chemical system of minerals, and the most important minerals of the mineral formation phases.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compulsory:</strong></td>
</tr>
<tr>
<td><strong>Recommended:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Schedule:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; week – Definition of crystal, mineral, rock, and soil; their interconnections. Basic laws of crystallography. Types of unit cells.</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; week – Symmetry elements (reflection, rotation, inversion, and improper rotation); their appearance and identification.</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; week – Definition types of crystal forms.</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; week – Stereographic projection. Crystal classes.</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt; week – Basic crystal chemistry. Ionic lattices. AB, AB₂, ABO₃, AB₂O₄ structures.</td>
</tr>
</tbody>
</table>

7th week – Covalent bonding lattices. Metal bonding lattices.

8th week – Basic crystal physics. Hardness, translation, cleavage.


10th week – Chemical classification of minerals. Native elements, sulphides, oxides, hydroxides.

11th week – Silicate minerals, SiO₂ minerals.

12th week – Halides, carbonates, nitrates, borates.

13th week – Sulphates, phosphates, organic minerals.

14th week – Genetic classification of minerals.

Requirements:

- for a signature

Attendance at lectures is recommended, but not compulsory.

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- for a grade

The course ends in a writing examination.

The minimum requirement for the writing test the examination respectively is 50%. The grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
</tr>
<tr>
<td>65-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of the test is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Péter Rózsa, associate professor, PhD

Lecturer: Dr. Péter Rózsa, associate professor, PhD
<table>
<thead>
<tr>
<th><strong>Title of course:</strong> Mineralogy and petrology I – practice</th>
<th><strong>ECTS Credit points:</strong> 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code:</strong> TTGBG5008_EN</td>
<td></td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: -
- practice: 2 hours/week
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 12 hours
- preparation for the exam: 20 hours
Total: 60 hours

**Year, semester:** 1st year, 1st semester

**Its prerequisite(s):** -

**Further courses built on it:** TTGBG5009_EN, TTGBE5003_EN, TTGBG5010_EN, TTGBG7505_EN, TTGBG5014_EN, TTGBE5017_EN

**Topics of course**
Principal knowledge about crystal morphology – crystallographic axes, types of symmetry, crystal forms. Cognition of the minerals and parageneses which are important by mineralogy, petrology, volcanology, regional geology applied geology and environmental geology. Acquisition of simple mineral identification methods.

**Literature**

**Compulsory:**

**Recommended:**

**Schedule:**

1st week – Concept, properties, inner structure of crystals, unit cells. Practice of identification of unit cell and crystallographic axes on crystal models. Classification the models to crystal systems.

2nd week – Identification the symmetry of crystals. Classification the models to crystal classes. Projection of faces, axes, symmetry elements.

3rd week – Written test about the theoretical content of the previous lessons. Faces identification, Miller-index. Crystal forms and their combination, open and closed forms. Main crystal forms in the classes of triclinic, monoclinic and orthorhombic crystal systems.

4th week – Main crystal forms in the classes of tetragonal, hexagonal, trigonal and isometric crystal systems. Practice on crystal models.
5th week – Written test about the practical content of the previous lessons. Crystal forms in the lower symmetry classes of triclinic, monoclinic and orthorhombic crystal systems.

6th week – Crystal forms in the lower symmetry classes of tetragonal, hexagonal, trigonal and isometric crystal systems.

7th week – Mid-term test about the crystal morphology.

8th week – Basic concepts about bounds, crystal lattices and structures. Ionic structures and silicates. Characteristic crystal forms derived from these structures.

9th week – Metallic structures and structures with complex ions. Characteristic crystal forms derived from these structures.

10th week – Written test about the bounds, lattices and structures. Physical properties of minerals, principals of the identification of minerals.


12th week – Minerals of the hydrothermal phase and their forming processes.

13th week – Sedimentary and metamorphic minerals and their forming processes.

14th week – End-term text about mineral identification.

Requirements:
- for a signature
Attendance at practice is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

- for a grade
During the semester there are five tests. The minimum requirement for each test is 50%. The grade for the tests is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-69</td>
<td>satisfactory (3)</td>
</tr>
<tr>
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<td>good (4)</td>
</tr>
<tr>
<td>80-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 50, students must take a retake test during the semester.

The grade of the practice is the average of the five grade (two tasks and one presentation) modified by the activity of the student in the course (by maximum 1 grade).

Person responsible for course: Dr. Tamás Buday, assistant professor, PhD

Lecturer: Dr. Tamás Buday, assistant professor, PhD
**Title of course:** Mineralogy and Petrology II  
**Code:** TTGBE5009_EN  
**ECTS Credit points:** 2

<table>
<thead>
<tr>
<th>Type of teaching, contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
</tr>
<tr>
<td>- practice: 2 hours/week</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation: mid-semester grade</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Workload (estimated), divided into contact hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
</tr>
<tr>
<td>- practice: 28 hours</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
<tr>
<td>- home assignment: 32 hours</td>
</tr>
<tr>
<td>- preparation for the exam: -</td>
</tr>
</tbody>
</table>

Total: 60 hours

<table>
<thead>
<tr>
<th>Year, semester:</th>
<th>1st year, 2nd semester</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Its prerequisite(s):</th>
<th>-</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Further courses built on it:</th>
<th>TTGBE5007_EN, TTGBE5008_EN</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Topics of course</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aims of the course is to introduce students into the formation processes of rocks, and their system, mineral and major element composition, textural pattern; the course includes the establishment of determination of different basic igneous, sedimentary and metamorphic rock types through their macro- and microscopic features. This way, the students will be familiar with main rock types, and they will be able to identify the most important rock types in the field and the laboratory.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Literature</th>
</tr>
</thead>
</table>
| **Compulsory:**  
| **Recommended:**  

<table>
<thead>
<tr>
<th>Schedule:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st week</strong> – Definition of magma; its composition and principal physical properties. Texture of igneous rocks, intrusive and extrusive igneous rocks. Chemical and mineralogical classification of igneous rocks. QAPF and TAS diagrams.</td>
</tr>
<tr>
<td><strong>2nd week</strong> – Main features of ultrabasic and basic rocks. Peridotite, gabbro, basalt. Intermediate igneous rocks. Diorite, andesite.</td>
</tr>
<tr>
<td><strong>3rd week</strong> – Felsic rocks. Granite, granodiorite, rhyolite. Alkali and tholeiitic rocks.</td>
</tr>
<tr>
<td><strong>4th week</strong> – Pyroclastic rocks. Their textures, and classification.</td>
</tr>
<tr>
<td>Week</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>8&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>9&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>10&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>11&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>12&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>13&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>14&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**Requirements:**

- **for a signature**
  Attendance at lectures is recommended, but not compulsory.

  Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- **for a grade**
  The minimum requirement for the writing tests the examination respectively is 50%. The grade for the tests is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
</tr>
<tr>
<td>65-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Péter Rózsa, associate professor, PhD

**Lecturer:** Prof. Dr. Gábor Dobosi, university professor, DSc
  Dr. Péter Rózsa, associate professor, PhD
  Dr. Richard William McIntosh, assistant professor, PhD
  Dr. Árpád Csámer, assistant professor, PhD.
**Title of course:** Hydrology and hydrogeology  
**Code:** TTGBE5005_EN  
**ECTS Credit points:** 3

**Type of teaching, contact hours**
- lecture: 2 hours/week
- practice: -
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

**Year, semester:** 2nd year, 2nd semester

**Its prerequisite(s):** -

**Further courses built on it:** -

**Topics of course**
Water types, its principal physical, chemical, structural properties. Basic concepts of hydrostatics and hydrodynamics by practical aspects. Important hydrometeorological and hydrogeographic concepts connecting water resource determination and water management with its measuring and calculation methods. Laws of water-rock interactions, run-off, infiltration, storage, karst forming processes, water movement in the surface and under the surface. Concept of porosity, hydraulic conductivity, permeability, portion of infiltration and contamination sensitivity. Groundwater including shallow groundwater, water source protection, thermal and medical waters. Production, utilization and supply from water resource. Regional water management.

**Literature**

*Compulsory:*

*Recommended:*

**Schedule:**

*1st week* – Basic concepts of hydrology, its subjects and role. Origin, importance of the hydrosphere, distribution of water on the Earth and hydrologic cycle. Water reserves, water types and global challenges. Relationship between the mankind and water.

*2nd week* – Chemical properties of the water (structure, constituent parts), isotopes in hydrology. Phase change, dissociation, pH. Constituent parts and behaviour of natural solutions.

*3rd week* – Physical and physicochemical properties of water: density, melting point, boiling point, enthalpy of melting and boiling, specific heat capacity, thermal conductivity, dynamic and
kinematic viscosity. Surface tension and connecting phenomena.

4th week – Basic concepts of hydrostatics. Pascal’s law, hydrostatic and absolute pressure, communicating vessels, buoyancy and Archimedes’ principle.

5th week – Basic concepts of hydrodynamics. Mass continuity, Bernoulli’s equation in theory and practice. Laminar and turbulent flow.

6th week – Elements of hydrometeorology and water budget (conditions, measurement, seasonal changes etc.), precipitation and evapotranspiration. Characterization of drainage basins.

7th week – Run-off and infiltration (conditions, measurement, seasonal changes etc.). Stream processes. Lakes.


11th week – Water production from different sources - historical and technological aspects. Water production from surface water bodies. Springs of different geological units. Dug wells, driven wells, drilled wells and collector wells: installation and operation.

12th week – Hydrogeology of Europe: the extent and characteristic of the most important aquifers. Mineral and medical waters.

13th week – Water Framework Directive and river basin management plans, European and national level.

14th week – Hydrological and hydrogeological modelling: theoretical and practical considerations.

**Requirements:**
- *for a signature*
  Attendance at lectures is recommended, but not compulsory.

- *for a grade*
  The course ends in a written examination.

The minimum requirement for the examination is 60%. The grade for the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-59</td>
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</tr>
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<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 60 %, students can take a retake test in conformity with the Education and examination rules and regulations.

**Person responsible for course:** Dr. Tamás Buday, assistant professor, PhD

**Lecturer:** Dr. Tamás Buday, assistant professor, PhD
**Title of course:** Hydrology and hydrogeology – practice  
**Code:** TTGBG5006_EN  
**ECTS Credit points:** 2

<table>
<thead>
<tr>
<th>Type of teaching, contact hours</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
<td></td>
</tr>
<tr>
<td>- practice: 2 hours/week</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation: mid-semester grade</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Workload (estimated), divided into contact hours:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
<td></td>
</tr>
<tr>
<td>- practice: 28 hours</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
<tr>
<td>- home assignment: 12 hours</td>
<td></td>
</tr>
<tr>
<td>- preparation for the exam: 20 hours</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong> 60 hours</td>
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</table>

<table>
<thead>
<tr>
<th>Year, semester:</th>
<th>2nd year, 2nd semester</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Its prerequisite(s):</th>
<th>-</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Further courses built on it:</th>
<th>-</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Topics of course</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Literature</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compulsory:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Recommended:</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Schedule:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st week</strong> – Introduction to the course, task discussion. Sampling in hydrology and hydrogeology.</td>
<td></td>
</tr>
<tr>
<td><strong>2nd week</strong> – The most important measurable physical and chemical parameters. Presentation of the hydrological, hydrogeological data, type and dimension of data, type of diagrams.</td>
<td></td>
</tr>
<tr>
<td><strong>3rd week</strong> – Basic concepts of hydrostatics. Pressure, hydrostatic pressure, buoyancy and related calculations.</td>
<td></td>
</tr>
<tr>
<td><strong>4th week</strong> – Basic concepts of hydrodynamics. Bernoulli’s principle and its practical applications.</td>
<td></td>
</tr>
<tr>
<td><strong>5th week</strong> – Reynolds number, flow patterns. Determination of flow velocity in tubes and open</td>
<td></td>
</tr>
</tbody>
</table>
channels.

6th week – Mid-term test.

7th week – Hydrological, hydrogeological aspects of catchment analysis, principals of run-off and infiltration.

8th week – Basic concepts describe the presence of water under the surface. Shallow and deep groundwater, karstic water. Calculation and laboratory determination of the porosity, effective porosity, water content and saturation.

9th week – Depth and height of groundwater level.

10th week – Movement of the groundwater. Measuring hydraulic conductivity and permeability in field and laboratory. Well hydraulics.

11th week – Measuring with permeameter, hydraulic conductivity of samples with different grain size distribution.

12th week – Oral presentations.

13th week – End-term test.

14th week – Oral presentations. Close of the practice.

Requirements:

- for a signature
  Attendance at practice is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

- for a grade
  During the semester there are two tests: the mid-term test in the 6th week and the end-term test in the 13th week. The course contains an oral presentation also about themes discussed with the lecturer.

  The minimum requirement for each test is 50%. Based on the score of the tests separately, the grade for the tests is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
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<td>good (4)</td>
</tr>
<tr>
<td>80-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

  If the score of any test is below 50, students must take a retake test during the semester.

  The grade of the practice is the average of the three grades (two tasks and one presentation).

Person responsible for course: Dr. Tamás Buday, assistant professor, PhD

Lecturer: Dr. Tamás Buday, assistant professor, PhD
<table>
<thead>
<tr>
<th><strong>Title of course:</strong> Meteorology and Climatology 1</th>
<th><strong>ECTS Credit points:</strong> 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code:</strong> TTGBE5501_EN</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Type of teaching, contact hours</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 2 hours/week</td>
<td></td>
</tr>
<tr>
<td>- practice: -</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
</tbody>
</table>

| **Evaluation:** exam                            |                          |

<table>
<thead>
<tr>
<th><strong>Workload (estimated), divided into contact hours:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 28 hours</td>
<td></td>
</tr>
<tr>
<td>- practice: -</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
<tr>
<td>- home assignment: -</td>
<td></td>
</tr>
<tr>
<td>- preparation for the exam: 62 hours</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong> 90 hours</td>
<td></td>
</tr>
</tbody>
</table>

| **Year, semester:** 1st year, 1st semester           |                          |

| **Its prerequisite(s):**                            |                          |

| **Further courses built on it:** TTGBE5502_EN       |                          |

<table>
<thead>
<tr>
<th><strong>Topics of course</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The series of lectures are based on the topics of technical drawing and mechanics. It reviews the fundamental relations of the sizing procedure of machineries (stress analysis for static combined loads; dimensioning on strength at harmonically varying loads, fatigue and life of members) and the concept of manufacturing tolerance and fitting. After that it deals with connections between components (connection with force transmission by friction, positive connections, bolted joints, weldings), gaskets, elastic connections (metal springs, rubber springs) beds for machine eg. rolling bearings, plain journal bearings. In the laboratory, being connected with the lectures machine elements are studied and tests of them are carried out. In seminars there are two design tasks to elaborate: a welded machinery base, and a hydraulic cylinder.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compulsory literature:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Recommended literature:</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Schedule:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1st week – Introduction: definition of meteorology; its development position within the system of sciences and its terminology.</td>
<td></td>
</tr>
<tr>
<td>2nd week – The structure and composition of the atmosphere. Alterations in the composition of the atmosphere. The atmospheric aerosol and its meteorological effects.</td>
<td></td>
</tr>
<tr>
<td>3rd week – Fundaments of actinometry: basic physical laws of electromagnetic radiation.</td>
<td></td>
</tr>
<tr>
<td>4th week – Thermodynamics of dry air and its vertical movements. Changes in the physical parameters of dry air with height</td>
<td></td>
</tr>
</tbody>
</table>
5th week – Adiabatic processes of moist air. Stability conditions in the atmosphere.
6th week – Condensation in the atmosphere. Cloud types
7th week – Processes and types of precipitation. Acid precipitation
8th week – Horizontal movements of the air in the free atmosphere
9th week – Effects of friction on wind, wind profile.
10th week – Air masses, atmospheric fronts 1
11th week – Air masses, atmospheric fronts 2
12th week – Isobar maps.
13th week – Fundamental forms of barometric field 1.
14th week – Fundamental forms of barometric field 2.

Requirements:
- for a signature
Attendance at lectures is recommended, but not compulsory.
- for a grade
The course ends in an examination. The exam grade is the result of the examination.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
</tr>
<tr>
<td>65-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD

Lecturer: Dr. Sándor Szegedi, associate professor, PhD
**Title of course:** Meteorology and Climatology II  
**Code:** TTGBE5502_EN  
**ECTS Credit points:** 1

**Type of teaching, contact hours**
- lecture: 1 hours/week
- practice: -
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 14 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 16 hours

Total: 30 hours

**Year, semester:** 1st year, 2nd semester

**Its prerequisite(s):** TTGBE5501_EN

**Further courses built on it:** TTGBE5502_EN

**Topics of course**
The series of lectures are based on the topics of technical drawing and mechanics. It reviews the fundamental relations of the sizing procedure of machineries (stress analysis for static combined loads; dimensioning on strength at harmonically varying loads, fatigue and life of members) and the concept of manufacturing tolerance and fitting. After that it deals with connections between components (connection with force transmission by friction, positive connections, bolted joints, weldings), gaskets, elastic connections (metal springs, rubber springs) beds for machine eg. rolling bearings, plain journal bearings. In the laboratory, being connected with the lectures machine elements are studied and tests of them are carried out. In seminars there are two design tasks to elaborate: a welded machinery base, and a hydraulic cylinder.

**Literature**

**Compulsory literature:**  

**Additional literature:**  

**Schedule:**

1st week – Introduction: definition of climatology; its position within the system of sciences and its terminology.

2nd week – Climate forming factors 1.1, extraterrestrial factors: radiation output of the sun.

3rd week – Climate forming factors 1.2: effects of the changing position of the Sun and the Earth. Impacts of the modifications in the elements of Earth’s orbit.

4th week – Climate forming factors 1.3. Terrestrial effects: impacts of latitude on the angle and length of irradiation.
5th week – Climate forming factors 2. Factors that influence energy and material transport processes between the surface and atmosphere: material and cover types of the surface.

6th week – Climate forming factors 3.1. Material and energy transport processes in the ocean-atmosphere system: the global circulation system.

7th week – Climate forming factors 3.2. Climate forming effects of Ocean currents and monsoon circulations.

8th week – Climate forming factors 4. Relief as a climate modifying factor: the impacts of elevation and relief forms on climate.

9th week – Climate forming factors 5. Human impacts on climate.

10th week – Anomalies in the functioning of the climate system: the El Niño (ENSO) phenomenon, climate changes and fluctuations.

11th week – Temporal patterns of climate elements on the Earth1. Annual courses and geographic types of solar irradiance, temperature, air pressure and winds.

12th week – Temporal patterns of climate elements on the Earth 2. Annual courses and geographic types of evaporation, cloud cover and precipitation.

13th week – Spatial patterns of climate elements on the Earth1. Spatial patterns of solar irradiance, temperature, air pressure and winds.

14th week – Temporal patterns of climate elements on the Earth 2. Spatial patterns of evaporation, cloud cover and precipitation.

Requirements:

- for a signature
  Attendance at lectures is recommended, but not compulsory.

- for a grade
  The course ends in an examination. The exam grade is the result of the examination.

The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
</tr>
<tr>
<td>65-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD

Lecturer: Dr. Sándor Szegedi, associate professor, PhD
Title of course: Meteorology and Climatology II – practice 
Code: TTGBG5503_EN

ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -
Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): TTGBE5501_EN

Further courses built on it: -

Topics of course
The aim of the course is to introduce the students of the course into the methods of climatological data collection, data base building and management; data processing, analyses and presentation. The course enables students to prepare and analyze climate diagrams, to recognize climate types and characterize the climate zones of the Earth.
The following topics are discussed in the frame of the course: collection of climatological data; data base building and management; data processing, data screening methods, conversions between measures, presentation of datasets in diagrams; preparation and analyses climate diagrams; identification of climate types using Walter-Lieth diagrams; description of the climate zones of the Earth.

Literature
Compulsory literature:

Additional literature:

http://www.klimadiagramme.de

Schedule:
1st week – Climatological data collection,
2nd week – Data base building and management; data screening methods, conversions between measures.
3rd week – Calculation of base climate statistics.
4th week – Presentation of datasets in diagrams 1.
5th week – Presentation of datasets in diagrams 2.
6th week – Preparation and analyses climate diagrams; Walter-Lieth climate diagrams.
7th week – Identification of climate types using Walter-Lieth diagrams.
8th week – Climate classification systems.
9th week – The Köppen climate classification system 1.
10th week – The Köppen climate classification system 2.
13th week – Description of the climate zones of the Earth 1.
14th week – Description of the climate zones of the Earth 2.

Requirements:
- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- for a grade
The course ends in a practice grade.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
</tr>
<tr>
<td>65-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD
Lecturer: Dr. István Lázár, assistant professor, PhD
| **Title of course**: The cosmic relations of the Earth |
| **Code**: TTGBE7003_EN |
| **ECTS Credit points**: 3 |

**Type of teaching, contact hours**
- lecture: 2 hours/week
- practice: -
- laboratory: -

**Evaluation**: exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

**Year, semester**: 1st year, 1st semester

**Its prerequisite(s)**: -

**Further courses built on it**: -

**Topics of course**
The aim of the course to gain comprehensive knowledge of the narrower and wider cosmic environment of the Earth as well as our planet as part of the Solar System to reveal the identities and differences of the characteristics and evolution of the cosmic bodies.

**Literature**

**Schedule**:
1st week – Introduction
2nd week – Altering of point of view of the society, during the ceturies
3rd week – The structure of the Solar System
4th week – The Venus
5th week – The Mars – I.
6th week – The Mars – II.
7th week – Common features of outer planets. The Jupiter and it’s moons
8th week – The Saturn and it’s moons
9th week – Uranus, Neptune, and their moons
10th week – The Pluto
11th week – The dwarf planets and other minor bodies
12th week – The Moon
13th week – Comets and meteorites
14th week – The evolving Solar System

Requirements:

Attendance at lectures is recommended, but not compulsory.

The course ends in an examination.

The minimum requirement for the examination is 60%. Based on the score of the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-59</td>
<td>fail (1)</td>
</tr>
<tr>
<td>60-69</td>
<td>pass (2)</td>
</tr>
<tr>
<td>70-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Gergely Szabó, assistant professor, PhD

Lecturer: Dr. Gergely Szabó, assistant professor, PhD
**Title of course**: Structural geology I  
**Code**: TTGBG5004_EN  
**ECTS Credit points**: 2

<table>
<thead>
<tr>
<th><strong>Type of teaching, contact hours</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
</tr>
<tr>
<td>- practice: 2 hours/week</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
</tbody>
</table>

| **Evaluation**: mid-semester grade |

<table>
<thead>
<tr>
<th><strong>Workload (estimated), divided into contact hours:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
</tr>
<tr>
<td>- practice: 28 hours</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
<tr>
<td>- home assignment: -</td>
</tr>
<tr>
<td>- preparation for the tests: 32 hours</td>
</tr>
</tbody>
</table>

**Total: 60 hours**

| **Year, semester**: 2nd year, 1st semester |

| **Its prerequisite(s)**: Introduction to geology |

| **Further courses built on it**: Structural geology II |

<table>
<thead>
<tr>
<th><strong>Topics of course</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The aims of the course include the establishment of a modern dynamic view for the students that make the understanding of the difficult and variable material and crust development system of the earth and the recognising of the processes of general and local significance. Further aims include to make students familiar with structural geological features, to make them capable of measuring the most important structural elements in the field and understanding illustration techniques used in the literature, reading the structural geological figures and diagrams. Over the practicals the students will learn the formation of earth type planets and the most important structural and geophysical conditions of the earth. The general interior structure of our planet is discussed together with the structural results (faults and folds) of the movements occurring in the mantle. In the second half of the semester the major phases of plate tectonics (riftogenesis, tectogenesis, orogenesis, cratonisation) are discussed reflecting on the associated volcanism and formation of igneous rocks. The relationship between orogenic mega-cycles and sedimentary depositional environments are also interpreted. Finally, a general outline of the structural conditions and tectonic development of the Alp-Carpathian region and the Pannonian Basin is also given.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compulsory:</strong></td>
</tr>
<tr>
<td><strong>Recommended:</strong></td>
</tr>
<tr>
<td>McIntosh R.W. – Püspöki Z. (2005): Chapters from structural geology – textbook, Department of Mineralogy and Geology, University of Debrecen, 100 p.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Schedule:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>1st week</em> – Tectonics and structural geology as scientific fields. Geotectonics, global tectonics, regional tectonics and microtectonics. Development of Earth like planets. The role of element migration and differentiation in the formation of a spherical structure.</td>
</tr>
<tr>
<td><em>2nd week</em> – Interior structure of Earth. Ways to explore the interior structure and composition.</td>
</tr>
</tbody>
</table>
Characteristics and material conditions of the core, mantle and the crust. The magnetic field of Earth.

3rd week – Parts and behaviour of the lithosphere and its relationship with the mantle. Mechanical behaviour of minerals and rocks. Forms of stress and resultant deformations. Compression, tension and shear stress fields, elastic modulus, Poisson’s ratio and other strength conditions.

4th week – Stress, its forms and calculation. Types of strain, its measurement and calculation. Relationship between deformation and stress and deformation and passed time. Inner (material, grain size, crystal water content and oriented texture) and outer (pressure, temperature, water content in fractures and velocity of deformation) factors influencing deformation.


7th week – Measurement, description, illustration and reconstruction of structural elements. Identification and measurement of dip direction, dip angle and strike using a geological compass. Rose diagrams and stereograms.

8th week – Test I


11th week – Development of subduction zones along convergent plate boundaries. Formation and structure of island-arc systems, typical subduction zones on Earth.


13th week – Structural conditions and development of the Alpine-Carpathian region. Formation and structural conditions of the Pannonian Basin.

14th week – Test II

Requirements:
- for a signature
  Attendance at practicals is compulsory, absence of students shall not exceed three occasions.
- for a grade
  Grades are given on the basis of two tests in the study period. Both tests are composed of two parts the scores of which are calculated a bit differently:
  - basic terms I: 20%          basic terms II: 20%
  - test I:              30%          test II:              30%
  The grade for the course is given according to the following table:

<table>
<thead>
<tr>
<th>Test Score (%)</th>
<th>Grade</th>
<th>basic terms Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>fail (1)</td>
<td>0-65</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
<td>65-74</td>
<td>pass (2)</td>
</tr>
</tbody>
</table>
60-74 satisfactory (3) 75-84 satisfactory (3)
75-87 good (4) 85-94 good (4)
88-100 excellent (5) 95-100 excellent (5)

If the score of student result is below 50, students can re-take the tests in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Richard William McIntosh, assistant professor, PhD

**Lecturer:** Dr. Richard William McIntosh, assistant professor, PhD
**Title of course:** Fundamentals of physical geography 1. (Hydrogeography)  
**Code:** TTGBE7008_EN  
**ECTS Credit points:** 3

<table>
<thead>
<tr>
<th>Type of teaching, contact hours</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 2 hours/week</td>
<td></td>
</tr>
<tr>
<td>- practice: -</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>exam</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Workload (estimated), divided into contact hours:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 28 hours</td>
<td></td>
</tr>
<tr>
<td>- practice: -</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
<tr>
<td>- home assignment: -</td>
<td></td>
</tr>
<tr>
<td>- preparation for the exam: 62 hours</td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 90 hours

<table>
<thead>
<tr>
<th>Year, semester</th>
<th>1st year, 2nd semester</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Its prerequisite(s):</th>
<th>-</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Further courses built on it:</th>
<th>-</th>
</tr>
</thead>
</table>

### Topics of course


### Literature


### Schedule:

1\(^{st}\) week  Water cycle and water courses of the Earth.  
2\(^{nd}\) week  Horizontal and vertical structure of seas.  
3\(^{rd}\) week  Geographical distribution of the chemical characteristics, temperature and the ice.  
4\(^{th}\) week  Movements of the seas: waves.  
5\(^{th}\) week  Movement of the seas: currents, tidal waves.  
6\(^{th}\) week  Rivers, wells, estuaries.  
7\(^{th}\) week  Catchments, watersheds, morphometrical indices, network-patterns.
8th week Runoff, floods.
9th week Genetical lake types.
10th week Water budget types for lakes.
11th week Geometric and attribute data collection and extraction.
12th week Types of undersurface waters.
13th week Remote sensing in hydrology.
14th week Grade-offering exam.

Requirements:
Lecture:
The minimum requirement for the examination is 50% from the midterm and closing tests. Based on the summarized score of the test the grade for the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49%</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59%</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72%</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84%</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100%</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Prof. Dr. Szilárd Szabó, university professor, DSc

Lecturer: Prof. Dr. Szilárd Szabó, university professor, DSc
| **Title of course:** | Fundamentals of physical geography II. (Geomorphology) | **ECTS Credit points:** | 3 |
|----------------------|--------------------------------------------------------|------------------------|

| **Code:** | TTGBE7009_EN |

| **Type of teaching, contact hours** | | |
|-------------------------------------|-----------------|
| - lecture: 2 hours/week             | |
| - practice: -                        | |
| - laboratory: -                      | |

| **Evaluation:** | exam |

<table>
<thead>
<tr>
<th><strong>Workload (estimated), divided into contact hours:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 28 hours</td>
<td></td>
</tr>
<tr>
<td>- practice: -</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
<tr>
<td>- home assignment: -</td>
<td></td>
</tr>
<tr>
<td>- preparation for the exam: 62 hours</td>
<td></td>
</tr>
</tbody>
</table>

Total: 90 hours

| **Year, semester:** | 2nd year, 1st semester |

| **Its prerequisite(s):** | - |

| **Further courses built on it:** | - |

| **Topics of course** | | |
|----------------------|-----------------|

<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
<th></th>
</tr>
</thead>
</table>

| **Schedule:** | |

<table>
<thead>
<tr>
<th><strong>Requirements:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lecture:</strong></td>
<td>The minimum requirement for the examination is 50% from the midterm and closing tests. Based on the summarized score of the test the grade for the examination is given according to the following table:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>0-49%</td>
<td>fail (1)</td>
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<tr>
<td>50-59%</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72%</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84%</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100%</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>
If the score of any test is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

<table>
<thead>
<tr>
<th>Person responsible for course:</th>
<th>Prof. Dr. József Lóki, university professor, DSc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecturer:</td>
<td>Prof. Dr. Szilárd Szabó, university professor, DSc</td>
</tr>
<tr>
<td><strong>Title of course:</strong> Fundamentals of physical geography III. (Anthropogenic geomorphology)</td>
<td><strong>ECTS Credit points:</strong> 3</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: 1 hours/week  
- practice: 2 hours/week  
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: 14 hours  
- practice: 28 hours  
- laboratory: -  
- home assignment: 7 hours  
- preparation for the exam: 41 hours  
Total: 90 hours

**Year, semester:** 2nd year, 2nd semester

**Its prerequisite(s):** -

**Further courses built on it:** -

**Topics of course**
The system based approach of the anthropogenic geomorphological processes and forms. Types and tipization of the processes and forms. Industry initiated forms. forms initiated by agricultural activity. Connection to the landscape. Risks. Surveying techniques.

**Literature**

**Schedule:**

**1st week**
Lecture: History of fluvial geomorphology
Practice: Measures in fluvial geomorphology I. Impoundment of watersheds. Morphometrical analyses on maps: drainage density and maturity examinations of channels.

**2nd week**
Lecture: Movement and sediment transport of channels.
Practice: Measures in fluvial geomorphology II. Ordering examinations, channel shape measures.

**3rd week**
Lecture: Erosional and depositional forms along channels.
Practice: Measures in fluvial geomorphology III. Channel shape measures. Hydrological measures on the field.

4th week
Lecture: River terraces, formation and types of fluvial valleys.
Practice: Fluvial laboratory experiments.

5th week
Lecture: Physical foundation of wind erosion.
Practice: Examinations of alluvial and eolian sediments. Sample collection on the field,

6th week
Lecture: Sand transport by the wind.
Practice: Examination of physical properties of sediments. Methods of measuring of grains size, grain size nomenclatures. Graphical representation and evaluation of grains size distribution.

7th week
Lecture: Morphology and morphometry of major dune types.
Practice: Morphometrical analyses of grains, properties of grain surface, application of microscopes in sediment analyses.

8th week
Lecture: Paleoenvironments and dunes.
Practice: Examination of chemical properties of sediments: measuring the pH-value, CaCO3- and organic matter content in laboratory

9th week
Practice: I. writing test. Wind tunnel measurements.

10th week
Practice: Examination of organic matters in sediments. Application of malacology in geomorphology.

11th week
Practice: Applications of palynology in geomorphology.

12th week
Lecture: The study and system of anthropogenic geomorphology I.
Practice: Application of dendrology in geomorphology.

13th week
Lecture: The study and system of anthropogenic geomorphology II.
Practice: Determining the age of sediments. Relative and absolute age-dating methods.

14th week
Lecture: Grade-offering exam.
Practice: 2. writing test.

Requirements:
Practice:
Participation at classes is compulsory. A student must attend the courses and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

During the semester there is one practical test. It can be completed in the 14th week.
The minimum score is 50%. Based on the score of the test, the grade for the test is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Lecture:
The minimum requirement for the examination is 50% from the midterm and closing tests. Based on the summarized score of the test the grade for the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49%</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59%</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72%</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84%</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100%</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
<table>
<thead>
<tr>
<th><strong>Person responsible for course:</strong></th>
<th>Prof. Dr. Lóki József, emeritus professor, DSc</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lecturer:</strong></td>
<td>Prof. Dr. Szilárd Szabó, university professor, DSc</td>
</tr>
<tr>
<td></td>
<td>László Bertalan, assistant lecturer</td>
</tr>
</tbody>
</table>
Title of course: Soil geography
Code: TTGBE6001_EN
ECTS Credit points: 3

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 12 hours
- preparation for the exam: 50 hours
Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it:

Topics of course
The aim of the course is to get acquainted with the main areas of the science of soil geography. The course deals with the following topics: The concept of soil, soil forming factors, the history of the soil research. The importance and functions of soils. Composition of soils, soil-forming rocks. Soil-forming minerals. Physical, chemical and biological features, pedogenic minerals. Organic materials in soil, the process of humus formation. Colloids in soil. Physical properties of soils. The concepts of genetic and diagnostic soil classification. The soils of Central Europe: skeletal soils, lithogenic soils, soils with clay illuviation, chernozems, meadow soils, salt affected soils, fluvial soils, marshes, forested bogs soils.

Literature
Compulsory:

Recommended:

Schedule:
1st week
The pedosphere. Definition, extent, genesis and functions.

2nd week
Methods for study of soils. The base concept of the pedon.
3\textsuperscript{rd} week
The components of soils. Soil as a three phase system.

4\textsuperscript{th} week

5\textsuperscript{th} week
Fluid phase of soils. Moisture state and water regime of soils.

6\textsuperscript{th} week
The gas phase of the soils. Pore volume, bulk density.

7\textsuperscript{th} week
Physical characteristics of soils: texture, structure, colour, skeletal parts, pore volume.

8\textsuperscript{th} week

9\textsuperscript{th} week
Organic matter in soils. Forms, quantification, relevance.

10\textsuperscript{th} week
The soil forming factors and their spatial distribution. Soil forming processes.

11\textsuperscript{th} week
Taxonomy of soils. Diagnostic and genetic conceptions.

12\textsuperscript{th} week
Classification of soils. US Soil Taxonomy, WRB and national classifications.

13\textsuperscript{th} week
Distribution of soil types around the Earth.

14\textsuperscript{th} week
Conservation and reclamation of soils. Endangering factors of soil resources.

\textbf{Requirements:}
- for a signature
Attendance at lectures is recommended, but not compulsory.

- for a grade
During the semester students have to write an essay dealing with a selected subject of course focusing attention on their home country.

The course ends in a written examination. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:

- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>Score Range</td>
<td>Grade</td>
</tr>
<tr>
<td>-------------</td>
<td>---------</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

**Person responsible for course:** Dr. Tibor Novák, associate professor, PhD

**Lecturer:** Dr. Tibor Novák, associate professor, PhD
**Title of course:** Soil geography - practice
**Code:** TTGBG6002_EN

**ECTS Credit points:** 2

**Type of teaching, contact hours**
- lecture: -
- practice: 2 hours/week
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: -
- practice: 22 hours
- laboratory: 6 hours
- home assignment: 10 hours
- preparation for the exam: 22 hours

Total: 60 hours

**Year, semester:** 1st year, 2nd semester

**Its prerequisite(s):** -

**Further courses built on it:** -

**Topics of course**
Students will get acquainted with field soil sampling and testing methods, they will be able to take soil samples and prepare soil profiles. They are familiar with the physical, chemical properties required for the characterization of soils (e.g. soil texture, structure, pH) and field methods (e.g. Finger test) and tools (e.g. Munsell scale). They will be able to delineate these by field definition and name the genetic horizons, to recognize different concretions. They familiarize and apply different laboratory tests to determine basic soil properties (e.g. pH, Humus and OC content, CaCO₃ content, texture) and water management properties. Based on field and laboratory test results, students are able to draw conclusions on the use and management of soils.

**Literature**

**Compulsory:**

**Recommended:**

**Schedule:**

1st week
Description of the semester theme. Presentation of the theoretical background of the fieldwork. Soil sampling methods and establishment of soil profiles. Methods of preparation soil reports.

2nd week
Physical and chemical properties of soils. Theoretical background of the determination of these properties on the field. Methods and tools required for the measurements. Methodological preparation of field work.

3rd week
Fieldwork. Practical application of soil sampling methods.

4th week
Fieldwork. Field test methods (Finger test, determination of Munsell color, field pH measurement, estimation of CaCO3 content with 10% HCl solution, humus quality estimation).

5th week
First written examination. Methodological preparation of laboratory practices. Creating 3 student groups that will perform laboratory exercises in the following weeks.

6th week
Getting acquainted with the Geography Institute's lab. Preparation of soil samples for laboratory measurements. Acquire the use of tools for preparation (eg analytical balance).

7th week
Laboratory test for determination of soil texture. Evaluating results, deducting conclusions.

8th week
Testing the water resistance of the structural elements in flowing water and still water. Evaluating results, deducting conclusions.

9th week
Investigating the water management properties of the soil. Evaluating results, deducting conclusions.

10th week
Determination of soil pH (H2O, KCl) under laboratory conditions. Evaluating results, deducting conclusions.

11th week
Determination of the CaCO3 content of soils in laboratory conditions. Exercise the use of Scheibler’s calcimeter, measuring the CaCO3 content of soil samples. Evaluating results, deducting conclusions.

12th week
Determination of the humus content of soils under laboratory conditions. Description and practical application of the Tyurin method. Performing and practicing titration. Evaluating results, deducting conclusions.

13th week
Second written examination. Submitting protocols.

14th week
The evaluation of the semester work, description and justification of the practice notes.

Requirements:
- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- for a grade
During the semester there are two tests. The final grade is calculated as an average of the grades of
the tests.
Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-59</td>
<td>fail (1)</td>
</tr>
<tr>
<td>60-69</td>
<td>pass (2)</td>
</tr>
<tr>
<td>70-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

**Person responsible for course:** Dr. György Szabó, associate professor, PhD

**Lecturer:** Tamás Mester, assistant lecturer
**Title of course:** Biogeography  
**Code:** TTGBE7011_EN  
**ECTS Credit points:** 3

**Type of teaching, contact hours**  
- lecture: 2 hours/week  
- practice: -  
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**  
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: 12 hours  
- preparation for the exam: 50 hours  
Total: 90 hours

**Year, semester:** 2nd year, 1st semester

**Its prerequisite(s):** -

**Further courses built on it:** -

**Topics of course**

The aim of the course to introduce the ecological and geographical background of the biogeography as an interdisciplinary science. The course provide knowledge on the relationship between wildlife and its geographical environment, tolerance, adaptation, spread of species, distribution patterns of wildlife, vikarism, pseudovikarism, zonality, biodiversity, flora and fauna empires and biogeographical empires. Besides this the aim of the course the characterization of the environmental conditions and the zonal, intrazonal wildlife of the individual biomes: tropical rainforest, savannah, tropical monsoon, tropical deserts, Mediterranean hardwood forest, subtropical monsoon forest, deciduous forest, steppe, moderate desert and semi-desert, taiga and tundra. Finally, the course introduces the vertical zonality of tropical and moderate zone mountains.

**Literature**


**Schedule:**  
1st week – Introduction to the course.  
2nd week – Place of biogeography in the system of the sciences.  
3rd week – Ecological and biogeographical basics.  
4th week – Relationship between wildlife and its geographical environment, tolerance, adaptation.  
5th week – Spread of species, distribution patterns of wildlife.
6th week – Vikarism, pseudovikarism. Vertical and horizontal distribution of the wildlife on Earth, zonality, intra- and extrazonality, biodiversity.

7th week – The vertical zonality of tropical and moderate zone mountains.

8th week – Flora and fauna empires, biogeographical empires.

9th week – Characterization of the environmental conditions and the zonal wildlife of the tropical rainforest and savannah.

10th week – Characterization of the environmental conditions and the zonal wildlife of the tropical monsoon forest and tropical deserts.

11th week – Characterization of the environmental conditions and the zonal wildlife of the Mediterranean hardwood forest, subtropical monsoon forest and deciduous forest.

12th week – Characterization of the environmental conditions and the zonal wildlife of the steppe, moderate semi-desert and desert.

13th week – Characterization of the environmental conditions and the zonal wildlife of the tajga and tundra.

14th week – Test. Questions.

Requirements:
Attendance at lectures is recommended, but not compulsory.

- for a grade
The course ends in an examination. The minimum requirement for the examination is 50%. The grade for the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Students can take a retake test in conformity with the education and examination rules and regulations.

- an offered grade:
It may be offered for students if the test written in the 14th week is at least satisfactory (3).

Person responsible for course: Dr. Csaba Albert Tóth, associate professor, PhD

Lecturer: Dr. Csaba Albert Tóth, associate professor, PhD
<table>
<thead>
<tr>
<th><strong>Title of course</strong></th>
<th>Bases of environmental protection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td>TTGBE6003-EN</td>
</tr>
<tr>
<td><strong>ECTS Credit points</strong></td>
<td>3</td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: 2 hours/week
- practice: -
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours
Total: 90 hours

**Year, semester:** 1st year, 2nd semester

**Its prerequisite(s):** -

**Further courses built on it:** -

**Topics of course**
The basis of the system theory, the Earth as a unified system. The basic environmental problem and environmental protection. Sustainable development and environmental protection. The role of sciences in environmental protection. The relationship between demographical processes and the natural environment. The ecological footprint and the carrying capacity of the Earth. The urban environment, the city as a system, green cities. The impact of production on the environment and human health. The impact of consumption on the environment and human health. Environmental pollution. Waste management. The destruction of wildlife. Environmental Principles.

**Literature**

**Compulsory literature:**

**Recommended literature:**
https://www.intechopen.com/books/environmental-change-and-sustainability

**Schedule:**

1st week Introduction to the course

2nd week The basis of the system theory, the Earth as a unified system.

3rd week The basic environmental problems and environmental protection.

4th week Sustainable development and environmental protection.
**5th week** The role of sciences, economy and education in environmental protection.

**6th week** The relationship between demographical processes and the natural environment.

**7th week** Carrying capacity of the Earth.

**8th week** The city as an environmental system. The main characteristics and problems of the urban environment. The green cities.

**9th week** The impact of production and consumption on the environment and human health.

**10th week** The pollution of the atmosphere, hydrosphere and pedosphere.

**11th week** The environmental consequences of the waste management.

**12th week** The destruction of wildlife.

**13th week** Environmental Principles in practice.

**14th week** Evaluation of the course, instructions for the exam.

### Requirements:

Attendance at **lectures** is recommended, but not compulsory.

The minimum requirement for the examination is 51%. Based on the score of the test, the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50%</td>
<td>fail (1)</td>
</tr>
<tr>
<td>51-60%</td>
<td>pass (2)</td>
</tr>
<tr>
<td>61-70%</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>71-85%</td>
<td>good (4)</td>
</tr>
<tr>
<td>86-100%</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 51%, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. György Szabó, associate professor, PhD

**Lecturer:** Dr. György Szabó, associate professor, PhD
**Title of course:** Physical and historical geology  
**Code:** TTGBE5003_EN  
**ECTS Credit points:** 3

<table>
<thead>
<tr>
<th>Type of teaching, contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 2 hours/week</td>
</tr>
<tr>
<td>- practice: -</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
</tbody>
</table>

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: -  
- preparation for the exam: 62 hours  
Total: 90 hours

**Year, semester:** 1<sup>st</sup> year, 2<sup>nd</sup> semester

**Its prerequisite(s):** Introduction to geology

**Further courses built on it:** -

<table>
<thead>
<tr>
<th>Topics of course</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aims of the course include the establishment of a modern dynamic view for the students that make the understanding of the difficult and variable material and crust development system of the earth and the recognising of the processes of general and local significance. Further aims include making students familiar with structural geological features, making them capable of measuring the most important structural elements in the field and understanding illustration techniques used in the literature, reading the structural geological figures and diagrams. Over the practicals the students will learn the formation of earth type planets and the most important structural and geophysical conditions of the earth. The general interior structure of our planet is discussed together with the structural results (faults and folds) of the movements occurring in the mantle. In the second half of the semester the major phases of plate tectonics (riftogenesis, tectogenesis, orogenesis, cratonisation) are discussed reflecting on the associated volcanism and formation of igneous rocks. The relationship between orogenic mega-cycles and sedimentary depositional environments are also interpreted. Finally, a general outline of the structural conditions and tectonic development of the Alp-Carpathian region and the Pannonian Basin is also given.</td>
</tr>
</tbody>
</table>

**Literature**

**Compulsory:**

**Recommended:**
- -

**Schedule:**

1<sup>st</sup> week – Discussing the terms of sedimentology, bedding and facies. Methods of facies correlation.

2<sup>nd</sup> week – Fundamentals of stratigraphy, age determinations, principles of lithostratigraphy and biostratigraphy. Formation, taxon, Oppel zone, micropalaeontology, chronostratigraphy.
3rd week – Siliciclastic sedimentary systems. Walther’s facies law, parasequences, sequence stratigraphy.

4th week – Carbonaceous sedimentary systems. Textural variations, Wilson’s facies belts.

5th week – Orogenie megacycles. Plate tectonics, early divergence, rifting, early convergence, subduction, tectogenesis, orogenesis, cratonisation.

6th week – Development of the crust and life in the Precambrian.

7th week – Development of the crust and the flora in the Palaeozoic.

8th week – Development of animals in the Palaeozoic I.

9th week – Development of animals in the Palaeozoic II.

10th week – Development of the crust in the Mesozoic.

11th week – Development of life in the Mesozoic.

12th week – Development of the crust and the flora in the Cenozoic.

13th week – Development of animals in the Cenozoic.

14th week – Development and events in the Quaternary.

Requirements:
- for a signature
  Attendance at lectures is recommended, but not compulsory.

- for a grade
  The course ends in a written and oral complex examination that is composed of two parts: 10 basic questions, out of a list given to the students at the start of the semester and an oral examination based on a randomly chosen topic. The final grade is calculated as below:
  
  - the result of the basic questions: 20%
  - the result of the oral examination (80%)

  The grade for the course is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

  If the score of student result is below 50, students can re-take the exam in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Richard William McIntosh, assistant professor, PhD

Lecturer: Dr. Richard William McIntosh, assistant professor, PhD
<table>
<thead>
<tr>
<th>Title of course: Climatology of Hungary</th>
<th>ECTS Credit points: 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code: TTGBE5505_EN</td>
<td></td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: 3 hours/week
- practice: -
- laboratory: -

**Evaluation**: exam

**Workload (estimated), divided into contact hours:**
- lecture: 42 hours
- practice: -
- laboratory: -
- home assignment:
- preparation for the exam: 48 hours
Total: 90 hours

**Year, semester**: 2nd year, 2nd semester

**Its prerequisite(s)**:

**Further courses built on it**: -

**Topics of course**
The aim of the course is to provide knowledge passive and active climate forming factors that shape the climate of Hungary; the temporal and spatial patterns of climate parameters of the country; special characteristics of the climate in the regions of Hungary and the climate change scenarios for the country.

**Literature**

**Compulsory literature:**


**Additional literature:**


**Schedule:**

1st week – General characteristics, active and passive forming factors of the climate of Hungary. Synoptic weather types.

2nd week – Spatial and temporal (diurnal and seasonal) variability of climate parameters in Hungary 1: spatial and temporal characteristics of radiation in Hungary; potential and effective irradiance, photosynthetically active irradiation, albedo, radiation balance.

3rd week – Spatial and temporal (diurnal and seasonal) variability of climate parameters in Hungary 2: soil temperatures. Annual and diurnal courses of temperatures in different depths in the soil.
frost.

4th week – Spatial and temporal (diurnal and seasonal) variability of climate parameters in Hungary: Characteristics of air temperatures. Annual and monthly mean temperatures in the coldest and warmest months, annual course of temperatures. Air temperature extremes; spatial pattern in the number of winter and summer threshold days.

5th week – Spatial and temporal (diurnal and seasonal) variability of climate parameters in Hungary: Evapotranspiration, air humidity fog and cloudiness. Spatial and temporal patterns of potential and effective evapotranspiration, fog and cloudiness.

6th week – Spatial and temporal (diurnal and seasonal) variability of climate parameters in Hungary: precipitation 1. Seasonal and spatial patterns of the intensity of summer period precipitation and the number of rainy days, droughts, hails, thunderstorms. Relationships between precipitation and soil erosion.

7th week – Spatial and temporal (diurnal and seasonal) variability of climate parameters in Hungary: precipitation 2. Characteristics of winter precipitation. Spatial patterns in the number of snowy and snow cover days, the thickness of snow cover. Characteristics of hoar-frost.

8th week – Spatial and temporal (diurnal and seasonal) variability of climate parameters in Hungary: Diurnal and seasonal changes, spatial pattern of atmospheric pressure, relationships between spatial patterns of air pressure and formation of winds.

9th week – Spatial and temporal (diurnal and seasonal) variability of climate parameters in Hungary: Diurnal and seasonal changes, spatial pattern of wind directions and wind speeds. Dominant wind directions and wind direction regions of the country.

10th week – Climatic regions of Hungary according to the Köppen, Trewartha, the Kakas and the Péczely system.

11th week – Characteristics of the macro regions of Hungary 1: the climate of the great Hungarian Plain, the Little Hungarian Plain, and the Foothills of the Alps.

12th week – Characteristics of the macro regions of Hungary 2: the climate of the Transdanubian hills, the Transdanubian mountain ranges and the North Hungarian Mountains.

13th week – The global warming and Hungary 1: monitoring and forecasting climate change; global climate warming scenarios and their down scaling to the Carpathian basin.

14th week – The global warming and Hungary 2: The global warming in the Carpathian basin so far. Possible developments till the end of the 21st century on the base of the scenarios. Mitigation measures.

Requirements:
Attendance at lectures is recommended, but not compulsory.

- for a grade
The course ends in an examination. The exam grade is the result of the examination.

The minimum requirement is 50%. The grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
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<tr>
<td>65-79</td>
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<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
<tr>
<td><strong>Person responsible for course:</strong></td>
<td>Dr. Sándor Szegedi, associate professor PhD</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td><strong>Lecturer:</strong></td>
<td>Dr. Sándor Szegedi, associate professor PhD</td>
</tr>
<tr>
<td>Title of course</td>
<td>Geological mapping</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Code</td>
<td>TTGBG5010_EN</td>
</tr>
<tr>
<td>ECTS Credit points</td>
<td>2</td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: -
- practice: 2 hours/week
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: -
- practice: 28 hours
- laboratory: 8 hours
- home assignment: 8 hours
- preparation for the test: 24 hours

Total: 60 hours

**Year, semester:** 2nd year, 2nd semester

**Its prerequisite(s):** Mineralogy and petrology II

**Further courses built on it:** -

**Topics of course**

The aims of the course include the presentation of the most important tasks and methods of geological, applied geological and geophysical research, the knowledge of the construction principles of maps and profiles to be drawn based on the databases obtained via the above research, and also of their important information content and application possibilities.

Thematic, target research, regional geological, geophysical and other issues are discussed for the solution of which traditional and modern mapping and profiling, borehole and aerial photo interpretation techniques can be applied. Students become familiar with national and international mapping scales, the most important data requirements according to scale, construction principles and legend basics. Students also models the basics of map and profile drawing, practices the techniques of map reading and interpretation together with their applicability via test tasks.

Special focus is also given to derived, applied and engineering geological map types.

**Literature**

*Compulsory:*


*Recommended:*


**Schedule:**

1st week – History of geological mapping, the system of geological and geology related maps. Traditional, resultant and applied geological maps.

2nd week – Traditional geological maps and map series of Hungary. Steps, preparations, devices and results of practical geological mapping. Using the geological compass for measuring dip direction, dip angle, strike and calculating apparent dip. Sampling in the course of geological mapping, the use of shallow geological mapping boreholes.

3rd week – Basic examination methods used in the course of geological mapping, their limits of application and possibilities in Hungary.
4th week – The system of legends for traditional geological maps. Numbers, colours and symbols used in geological mapping, especially in representing geological formations.


8th week – Applied geological maps: considered factors, their weighing in relation to pollution sensitivity maps. General and specific pollution sensitivity maps, vulnerability maps.

9th week – Geophysical map (e.g. magnetic anomaly, Bouguer anomaly, seismic) classification, basic conditions, parameters, and construction, their application and reliability.

10th week – Geochemical map classification, basic conditions, parameters, and construction, their application and reliability.

11th week – Test in writing

12th week – Geological profile and section construction at a given scale on the basis of three observation points in colour.

13th week – Drawing of a folded structure in colour on the basis of observations and measurements made at ten points.

14th week – Drawing of the lithology sequence of a borehole and preparing a cross section based on several borehole lithology series at a given scale using graphical symbols.

Requirements:

- for a signature
Attendance at practicals is compulsory, absence of students shall not exceed three occasions.

- for a grade
Grades are given on the basis of one test and at least two drawings in the study period. The share of the tasks in the final grade is the following:

<table>
<thead>
<tr>
<th>Test</th>
<th>40%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing I</td>
<td>35%</td>
</tr>
<tr>
<td>Drawing II</td>
<td>25%</td>
</tr>
</tbody>
</table>

The grade for the test is given according to the following table:

<table>
<thead>
<tr>
<th>Test Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of student result is below 50, students can re-take the test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Richard William McIntosh, assistant professor, PhD

Lecturer: Dr. Richard William McIntosh, assistant professor, PhD
<table>
<thead>
<tr>
<th><strong>Title of course:</strong> Cartography</th>
<th><strong>ECTS Credit points:</strong> 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code:</strong> TTGBE7001_EN</td>
<td></td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: 2 hours/week
- practice: 2 hours/week
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours
- practice: 28 hours
- laboratory: -
- home assignment: 24 hours
- preparation for the exam: 70 hours
Total: 150 hours

**Year, semester:** 1st year, 1st semester

**Its prerequisite(s):** -

**Further courses built on it:** Geoinformatics I.

<table>
<thead>
<tr>
<th><strong>Topics of course</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Students learn the main coordinate reference systems (world and national projections) and the fundamental knowledge for map editing, map reading, map types and the possibilities of digital cartography. Map elements, frame, legend, scale bar, northing, searching net, scale number. Map types: topographic, thematic; new map types: dynamic maps, story map.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
</tr>
</thead>
</table>
| Compulsory literature:  

| **Schedule:** |

<table>
<thead>
<tr>
<th><strong>Requirements:</strong></th>
</tr>
</thead>
</table>
| - for a signature  
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class. During the semester there are three practical grading. Students have to attend. |
- for a grade
The final grade is calculated as an average of the three practical grading.

The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Szilárd Szabó, university professor, DSc

**Lecturer:** Dr. Szilárd Szabó, university professor, DSc
**Title of course:** Digital terrain modelling  
**Code:** TTGBG7020-EN  
**ECTS Credit points:** 2

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**Type of teaching, contact hours**
- lecture: -
- practice: 2 hours/week  
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: -
- practice: 28 hours  
- laboratory: -
- home assignment: 16 hours  
- preparation for the exam: 16 hours  
Total: 60 hours

**Year, semester:** 3rd year, 1st semester

**Its prerequisite(s):** -

**Further courses built on it:** -

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**Topics of course**

The course aims to give the students an overview of DEM applications and analysis in geoscientific research and investigation. You will gain experience in working with different digital tools for geographical information handling. This course focuses on the generation, analysis, classification and application of digital elevation models (DEMs) in combination with remotely sensed data on environmental topics like landform distribution, slope hazards and other processes, both terrestrial and sub-marine. The course gives specialised lectures and training in: geomorphometrical description of the earth surface, generation of DEMs and interpolation procedures, terrain parameterisation, topographic classification, applications of topographic analysis on geomorphological processes and slope hazard.

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**Literature**

**Compulsory:**

**Recommended:**

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**Schedule:**

1st week
Introduction, theoretical background. Study and aims of geomorphometrical analyses, clarify of fundamental concepts, trends and aspects in terrain analyses.

2nd week
Morphometrical parameters, choosing and combination of parameters, relative qualifying methods, operations with sets, choosing of resolutions. Types of status, process and potential maps. Classical,
one-factor morphometrical mapping.

3rd week
Types, analyses and legend of geomorphological maps. Evaluating geomorphological maps (morphometrical, morphogenetical).

4th week
Special (derived and complex) geomorphological maps (hydrological, forecast about meander wandering, geomorphological relief qualification).

5th week
Landscape and field rating (methods, factors, agricultural and forestry rating maps).

6th week
Interpretation of digital terrain models, possible types of DTM-s. Visualization possibilities of DTM-s (contour maps, hypsometrical representation, shaded relief, 3D-visualization). Preparing of digital terrain models.

7th week
Global database of DTM-s (SRTEN, ASTER, AUDAM) and their features.

8th week
Software applications I. Introduction to applied software and basic user steps. Downloading DTM-s from the WEB. Visualization of DTM-s, implementation raster and topological analyses.

9th week
Software applications II. Visualization of basic morphometrical parameters (aspect, slope), reclassifying parameters. The connection between geomorphic features and derived parameters. Preparing path profile.

10th week
Software applications III. Raster analyses: area and perimeter calculations, examination of elevation data distribution with histogram. Visibility analyses. Using of different neighborhood filters (max., min., median).

11th week
Software application IV. Hydrological analyses (generating streamline structure, watershed analyses, 3D visualisation and analyses, flood modeling).

12th week
Software applications V. Computing of complex geomorphometrical parameters (Hammond-index, HWI-index, TPI-index).

13th week
Practice, systematization of knowledge, discussing of problems.

14th week
Written exam.

**Requirements:**
- *for a grade*

Attendance at **lectures** is compulsory.

A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent to an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor.

Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Students have to **submit all the two designing tasks** as scheduled minimum on a sufficient level.

During the semester there are two tests: the mid-term test in the 8th week and the end-term test in the 15th week. Students have to sit for the tests.

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

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<tbody>
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<td>fail (1)</td>
</tr>
<tr>
<td>60-69</td>
<td>pass (2)</td>
</tr>
<tr>
<td>70-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 60, students can take a retake test in conformity with the **EDUCATION AND EXAMINATION RULES AND REGULATIONS**.

**Person responsible for course:** Dr. Gábor Négyesi, assistant professor, PhD

**Lecturer:** Dr. Gábor Négyesi, assistant professor, PhD

Dr. Boglárka Balázs, assistant professor, PhD
Title of course: Geothermics  
Code: TTGBE5011_EN  
ECTS Credit points: 3

Type of teaching, contact hours  
- lecture: 2 hours/week  
- practice: -  
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:  
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: -  
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 3rd year, 1st semester

Its prerequisite(s): TTGBG5004_EN

Further courses built on it: -

Topics of course

Physical definition of energy, heat, temperature and its measurement, principal phenomena of thermodynamics, heat generation, specific heat capacity, heating value, thermal expansion, heat transfer, heat flux density. Source of heat on the Earth, the role of heat in the energy transfer and particle movement of outer and inner geospheres, in forming of minerals, rock, raw materials, Relation between the magmatism, tectonism and geothermal energy. Temperature and heat flux density field of the Earth. Geothermal methods in geological and geophysical research. Hyperthermal areas, areas with high enthalpy and low enthalpy, geothermal systems, thermal karst areas, thermal water fields, geysers, thermal springs, etc. Possibilities of the heat production from deep reservoirs, hot dry rocks and springs. Thermal wells, borehole heat exchangers, heat pumps, geothermal power plants, heating and warming sanitary hot water, heat losses, communal and agricultural utilization in domestic and international examples.

Literature

Compulsory:  

Recommended:  

Schedule:  
1st week – Subject of geothermics, the role of the renewable energy sources of the primary energy
demand of the World. Global problems of the energy usage and possible answers.

2\(^{nd}\) week – The most important thermodynamic state quantities, laws of thermodynamics. Usage of different fuels and sources, depend on its energy density.


4\(^{th}\) week – Heat convection in geothermics. Local and global heat balance. Radiogenic heat production

5\(^{th}\) week – Thermodynamic phenomena in geology: stability, crystal lattice, phase diagram. Thermal expansion, heating value and specific heat capacity in geological aspect.

6\(^{th}\) week – Possible definition of geothermal energy (temperature distribution, geothermal gradient, heat flux density) and its relation with the plate tectonics. Geothermal characteristics of divergent plate boundaries and hot spots.

7\(^{th}\) week – Geothermal characteristics of convergent plate boundaries, environments with sedimentary rocks and sediments. Classification of geothermal reservoirs. Geological exploration for geothermal energy utilization.

8\(^{th}\) week – Technological conditions of the geothermal energy production in closed and open systems. Geothermal resource assessment.

9\(^{th}\) week – Methods for utilization of geothermal energy I: Lindal diagram, geological condition and realization of installation of geothermal power plant types. Heating, balneological, agricultural use of thermal water.


11\(^{th}\) week – Presentation of the most important geothermal energy using countries: Italy, New Zealand, United States of America, Iceland.

12\(^{th}\) week – Geology of Europe in the aspects of geothermal energy utilization. Realized geothermal energy usage, statistics. Possible ways of progress and their terms.

13\(^{th}\) week – Effects of geothermal energy utilization on the environment in closed and open systems. Sustainable geothermal energy utilization.

14\(^{th}\) week – Anthropogenic thermal pollution and their reduction: effective industrial and residential energy use. Future of the geothermal energy utilization.

**Requirements:**

* - for a signature
  Attendance at lectures is recommended, but not compulsory.

* - for a grade
  The course ends in a written examination.

The minimum requirement for the examination is 60%. The grade for the examination is given according to the following table:

<table>
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</tr>
<tr>
<td>--------</td>
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</tr>
</tbody>
</table>

If the score of the test is below 60 %, students can take a retake test in conformity with the Education and examination rules and regulations.

**Person responsible for course:** Dr. Tamás Buday, assistant professor, PhD

**Lecturer:** Dr. Tamás Buday, assistant professor, PhD
Title of course: Calculations in hydrodynamics and geothermics  
Code: TTGBG5030_EN  
ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 13 hours
- preparation for the exam: 19 hours
Total: 60 hours

Year, semester: 3rd year, 1st semester

Its prerequisite(s): TTGBG5006_EN

Further courses built on it: -

Topics of course
Introduction to hydrodynamic and geothermal problems. Main equations (Darcy’s law, Fourier’s law) and its analytical resolutions in special cases. Numerical modelling in hydrogeology, heat flow, water and heat production. Introduction to MODFLOW, SHEMAT, FEFLOW modelling software.

Literature
Compulsory:

Recommended:

Schedule:
1st week – Basic concepts of model building. Solid models in hydrogeology and geothermics. Principles of analytical, numerical, finite difference and finite element methods.
2nd week – Basic relations of the movement of groundwater, hydrodynamics equations, Darcy’s law. One dimensional steady-state seepage.
3rd week – Groundwater movement around producing and injection wells (analytical solutions).
4th week – Groundwater movement determined by numerical methods – data collection and management, model building.
5th week – Groundwater movement determined by numerical methods – calibration of the models, running of the models

6th week – Mid-term test. Elaboration of the student’s research plans in the topic of solid models and hydrodynamic models.

7th week – Basic relations of the heat transport, phenomena of heat conduction and heat convection, role of heat transfer coefficient in calculations.

8th week – Analytical solution of simple heat conduction processes.

9th week – Heat transfer in pipes (producing wells, borehole heat exchangers, etc.)

10th week – Numerical modelling of heat transfer I. – data collection and management, model building

11th week – Numerical modelling of heat transfer II. – calibration of the models, running of the models

12th week – End-term test. Elaboration of the student’s research plans in the topic of heat transport models.

13th week – Analytical or numerical calculations in the chosen topic.

14th week – Presentations of the students’ tasks.

Requirements:
- for a signature
  Attendance at lectures is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

- for a grade
  During the semester there are two tests: the mid-term test in the 6th week and the end-term test in the 12th week. The course contains a practice task (model building) also.

  The minimum requirement for each tests is 60%. Based on the score of the tests separately, the grade for the tests is given according to the following table:

<table>
<thead>
<tr>
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</thead>
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<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

  If the score of any test is below 60, students can take a retake test during the semester.

  The grade of the practice is the average of the three grade (two tasks and one presentation).

Person responsible for course: Dr. Tamás Buday, assistant professor, PhD

Lecturer: Dr. Tamás Buday, assistant professor, PhD
**Title of course:** Atmospheric energy sources  
**Code:** TTGBE5506_EN  
**ECTS Credit points:** 3

**Type of teaching, contact hours**  
- lecture: 2 hours/week  
- practice: -  
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**  
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: -  
- preparation for the exam: 62 hours  
Total: 90 hours

**Year, semester:** 2nd year, 1st semester

**Its prerequisite(s):** -

**Further courses built on it:** -

### Topics of course

The aim of the course is to introduce students into theoretical issues of the utilization of atmospheric energy sources. Types and main features of different atmospheric energy sources are discussed. Natural basics and technologies of their utilization are discussed in the frame of the course. Students learn how to evaluate feasibility of renewable energy projects from financial and social aspects. Students gain comprehensive knowledge on theoretical issues of solar, wind, hydropower and biomass energy production and utilization.

### Literature

**Compulsory literature:**  
ISBN-10: 0199545332

**Additional literature:**  
ISBN-10: 1482263998  
ISBN-10: 1467745553  

### Schedule:

1st week – Definition of atmospheric energy sources, their types and position within the system of renewable energy sources. General characteristics, ways of utilization and tendencies in the World, in Europe and in Hungary with special respect to the possibilities of utilization of solid biomass.

2nd week – Definition of biogenic energy sources, their types and position within the system of renewable energy sources. General characteristics, ways of utilization and tendencies in the World, in Europe and in Hungary.


5th week – Development of air flows. General characteristics of wind from the aspect of energy production. Instruments of energetic wind speed measurements, analyses of wind energy maps

6th week – History and development of the instruments and technologies of wind energy production. Legal conditions of the establishment of wind turbines. Characteristics of windmills, wind generators and wind turbine types.


8th week – Physical characteristics of the Sun. Forms of solar radiation, its energetic characteristics, losses of solar radiation in the atmosphere.


10th week – Opportunities for heat production from solar energy. Types forms and technical characteristics of solar collectors. Application opportunities of different solar collector types.

11th week – Opportunities for electric power production from solar energy. Types forms and technical characteristics of photovoltaic panels. Application opportunities of different photovoltaic panel types.

12th week – Meteorological-climatological basics of hydropower utilization. Hydropower plant types and the most important technologies applied.


14th week – Socio-economic characteristics of atmospheric energy sources; perspectives of their utilization in the World, in Europe and in Hungary. Review on the tenders available for the utilization of atmospheric energy sources.

Requirements:
Attendance at lectures is recommended, but not compulsory.
- for a grade
The course ends in an examination. The exam grade is the result of the examination.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

<table>
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<tr>
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<tbody>
<tr>
<td>0-49</td>
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</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Person responsible for course: Dr. István Lázár, assistant professor, PhD

Lecturer: Dr. István Lázár, assistant professor, PhD
Title of course: Atmospheric energy sources – practice
Code: TTGBG5507_EN

ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -
Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course
The aim of the course is to introduce students into practical issues of the utilization of atmospheric energy sources. Types and main features of different atmospheric energy sources are discussed. Natural basics and technologies of their utilization are discussed in the frame of the course. Students learn how to calculate renewable energy potentials, evaluate feasibility of renewable energy projects from financial and social aspects. Students gain comprehensive knowledge on practical issues of solar, wind, hydropower and biomass energy production and utilization.

Literature
Compulsory literature:
ISBN-10:0199545332

Additional literature:
ISBN-10: 1482263998
ISBN-10: 1467745553

Schedule:
2nd week – Technologies of the chopped wood, wooden fuel cake and pellet production. Opportunities of their application on household and local scales.
3\textsuperscript{rd} week – Opportunities for the use of solid biomass for energy production. Review on the projects materialized, and analyses of the tendencies in that field.

4\textsuperscript{th} week – Workplaces created by biomass production transportation and procession. Spared cost 1.

5\textsuperscript{th} week – Workplaces created by biomass production transportation and procession. Spared cost 2.

6\textsuperscript{th} week – Mathematical formulas for the determination of wind speeds at different heights. Determination of the Hellman index and specific wind power, exercises for calculation of efficiency.

7\textsuperscript{th} week – Comprehension of technical parameters of wind turbines according to producer, types and size. Legal conditions of the establishment of wind turbine projects.

8\textsuperscript{th} week – Impacts of wind turbines on living and inert environment via Hungarian and international examples with a special respect to animals, noise and landscapes.

9\textsuperscript{th} week – Review on the meteorological background of solar energy. Calculation methods of solar energy potential for different expositions.

10\textsuperscript{th} week – Technical characteristics and structures of solar collector systems. Application issues of different solar collector types.

11\textsuperscript{th} week – Technical characteristics and structures of photovoltaic panels systems. Application issues of different photovoltaic panel types.

12\textsuperscript{th} week – Methods for the determination of natural and technical hydropower potentials.

13\textsuperscript{th} week – Natural, economic and social impacts of hydropower utilization 1. Environmental hazards during the construction and working of different technology, size and capacity hydropower plants.

14\textsuperscript{th} week – Natural, economic and social impacts of hydropower utilization 2. Evaluation of advantages disadvantages and hazards during the construction and working different technology, size and capacity hydropower plants.

\textbf{Requirements:}

- \textit{for a signature}

Participation at \textbf{practice classes} is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- \textit{for a grade}

The course ends in a \textbf{practice grade}.

The minimum requirement is 50\%. the grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
</tr>
<tr>
<td>65-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>Score</td>
<td>Grade</td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

**Person responsible for course:** Dr. István Lázár, assistant professor, PhD  
**Lecturer:** Dr. István Lázár, assistant professor, PhD
**Title of course:** Earth sciences fieldwork  
**Code:** TTGBG7505_EN  
**ECTS Credit points:** 4

**Type of teaching, contact hours**
- lecture: -
- practice: 4 days
- laboratory: -

**Evaluation:** one tests towards the end of the fieldwork

**Workload (estimated), divided into contact hours:**
- lecture: -
- practice: 48 hours
- laboratory: -
- home assignment: -
- preparation for the tests: 72 hours
Total: 120 hours

**Year, semester:** 1st year, 2nd semester

**Its prerequisite(s):** Mineralogy and petrology I, Meteorology and climatology I

**Further courses built on it:** -

### Topics of course

The aim of the course is to enable students to test the learnt earth scientific methods and to get to know and study the geological, geographical and meteorological conditions of northeastern Hungary.

### Literature

**Compulsory:**

**Recommended:**

### Schedule:

*not relevant*

### Requirements:

- **for a signature**  
  Attendance at the **fieldwork** is compulsory.

- **for a grade**  
  Grades are given on the basis of active participation and one test.

The grade for the course is given according to the following table:

<table>
<thead>
<tr>
<th>Test Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>fail (1)</td>
</tr>
<tr>
<td>Score Range</td>
<td>Grade</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of student result is below 50, students can improve the result of their test by the quality of their rock collection and also by answering additional test questions in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course**: Dr. Richard William McIntosh, assistant professor, PhD

**Lecturer**: Dr. Richard William McIntosh, assistant professor, PhD
Title of course: Methods in geophysics  
Code: TTGBE5012_EN  
ECTS Credit points: 3

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours
Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: TTGBG5013_EN

Topics of course
Subject of geophysics. Theoretical base of the geophysical methods and general steps of analysis of geophysical data. Physical base of gravity method, possible applications, separation the regional and local anomalies. Physical base of seismic methods, possible applications of reflected and refracted waves. Magnetic and electrical field of the Earth, its temporal and spatial changes. Electromagnetic methods, base of vertical electric sounding, constant separation traversing, multi-electrode arrays. Theoretical base of well-logging, borehole and its surrounding, connection to the surface geophysical surveys, the most important logs. Complex geophysical surveys, the position of the geophysics in the researches in the field of structure geology, mineral resources, engineering geology and environmental geology.

Literature
Compulsory:

Recommended:

Schedule:

1st week – Subject, aim and subdivisions of geophysics. Steps of geophysical survey (data collection, analysis and interpretation).

2nd week – Basic physical concepts of gravity methods. Measurement of gravity, role of Eötvös in
the early geophysics. Corrections to gravity observations, interpretations. Gravity in the studies of Earth structure.

3\textsuperscript{rd} week – Basic physical concepts of seismic methods. Seismic wave types, reflection and refraction. Seismic energy sources, detection of seismic waves. Seismic records.

4\textsuperscript{th} week – Reflection data processing and interpretation. Seismic profiles and geological settings.

5\textsuperscript{th} week – Studies of the Earth’s structure by seismology and seismic tomography.

6\textsuperscript{th} week – Basic physical concepts of geoelectrical methods. Presentation of the measurement ways and applicability of the most important active and passive methods.

7\textsuperscript{th} week – Aim and role of electrical resistivity methods in geological research. Modes of deployment and their applicability (VES, CST, scanned array).

8\textsuperscript{th} week – Basic physical concepts of geomagnetic methods. Magnetic field of the Earth. Magnetic surveying and interpretation. Electromagnetic methods.

9\textsuperscript{th} week – Basic physical properties of radiation. Radioactive decay, particles and radiation. Measuring and geological interpretation of radiation. Radiation in historical geology and geothermics.

10\textsuperscript{th} week – Conditions of using well-logs and relation between the surface and subsurface geophysical methods. Effects of the drilling on the geological medium. Measuring and interpretation of resistivity, self-potential and radioactivity logs.

11\textsuperscript{th} week – Technological measurements in wells. Temperature, porosity and density determination in wells.

12\textsuperscript{th} week – Case studies: geoelectrical resistivity measurements in coal industry; magnetic measurements for archaeological purposes.

13\textsuperscript{th} week – Seismic sections and basin analysis - theory and case studies.

14\textsuperscript{th} week – Case studies: well-logs in sequence stratigraphy based basin analysis and water resource management.

\textbf{Requirements:}
- \textit{for a signature}
  Attendance at \textbf{lectures} is recommended, but not compulsory.

- \textit{for a grade}
  The course ends in a written \textbf{examination}.

The minimum requirement for the examination is 50\%. The grade for the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-69</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>70-79</td>
<td>good (4)</td>
</tr>
<tr>
<td>80-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of the test is below 50 \%, students can take a retake test in conformity with the Education and examination rules and regulations.

\textbf{Person responsible for course:} Dr. Tamás Buday, assistant professor, PhD

\textbf{Lecturer:} Dr. Tamás Buday, assistant professor, PhD
**Title of course:** Geophysical data and geological interpretation  
**Code:** TTGBG5013_EN  
**ECTS Credit points:** 2

**Type of teaching, contact hours**
- lecture: -  
- practice: 2 hours/week  
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: 21 hours  
- preparation for the exam: 11 hours

Total: 60 hours

**Year, semester:** 3rd year, 2nd semester

**Its prerequisite(s):** TTGBE5012_EN

**Further courses built on it:** -

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**Topics of course**
Processing of gravity data, its usability in geology. Interpretation of the seismic data, drawing ray path, data processing. Geological interpretation of seismic sections (structural geology, basin analysis). Processing of surface geoelectrical data: pseudo sections, maps. Quick method of well-log analysis. Shape of the electrical and radiometric logs showing different palaeoenvironments. Determining the lithological column based on well-log data. Correlation between well-logs. Complex analysis of seismic and well-log data (depth-time transformation). Complex geophysical surveys, the position of the geophysics in field of structure geology, mineral resources, engineering geology and environmental geology.

**Literature**

**Compulsory:**

**Recommended:**

**Schedule:**

1st week – Subject and structure of the course. Forming working groups. Basin analysis by gravity methods.

2nd week – Interpretation of seismic reflection surveying data, raypath analysis.
3rd week – Software for analysis the seismic reflection surveying data. Preparing simple task on digital seismic database.

4th week – Seismic stratigraphy, sequence stratigraphy in basin analysis.

5th week – Data analysis based on vertical electrical sounding, determining the possible geological strata.

6th week – Data analysis based on vertical electrical sounding and automated array scanning in environmental geophysics, engineering geophysics and archaeology.

7th week – Studying magnetic anomalies in detailed geophysical and geological maps.

8th week – Well-log analysis based on archive (printed or drawn) logs.

9th week – Well-log analysis based on digital database.

10th week – Electrofacies and sedimentary structure in fluvial and delta environments.

11th week – Correlation between boreholes based on well-log data.

12th week – Relationship between seismic and well-log data. Velocity determination and vertical seismic profiling.

13th week – Geophysical background of complex geological researches. Summary of the tasks.

14th week – End-term test.

Requirements:

- for a signature
  Attendance at practice is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

- for a grade
  During the course the students have to prepare tasks, which are graded.

The course ends in a written examination.

The minimum requirement for the examination is 50%. Based on the score of the tests separately, the grade for the tasks and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-69</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>70-79</td>
<td>good (4)</td>
</tr>
<tr>
<td>80-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of the test is below 50, students can take a retake.

The grade of the course is the average of the obtained grades.

Person responsible for course: Dr. Tamás Buday, assistant professor, PhD

Lecturer: Dr. Tamás Buday, assistant professor, PhD
<table>
<thead>
<tr>
<th>Title of course: Structural geology II</th>
<th>ECTS Credit points: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code: TTGBG5024_EN</td>
<td></td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: -
- practice: 1 hour/week
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: -
- practice: 14 hours
- laboratory: -
- home assignment: -
- preparation for the tests: 16 hours

Total: 30 hours

**Year, semester:** 3rd year, 1st semester

**Its prerequisite(s):** Structural geology I

**Further courses built on it:** -

**Topics of course**

The most important topics of structural geology are overviewed in the practicals: data forming the basis of structural analysis, deformation, stress and strain, brittle deformation, joints, faults, ductile deformation, folds, foliation, schistosity, lineation and boudins, shear zones and horizontal faults and finally microtectonic features and palaeosoic reconstructions are discussed.

**Literature**

**Compulsory:**

**Recommended:**

**Schedule:**

1st week – Structural geological view, identification of the problem, structural analysis, structural data, databases, field data, seismic data, numerical modelling, other data sources. Visualisation of data, diagrams.


3rd week – Brittle deformation. Conditions of failure, reactivation of faults, deformed belts in porous rock. Fault orientation, fault distribution and fault density. Faults and fluid flow.

4th week – Practicing the identification and description of joints and faults on images and practical tasks.

5th week – Folds and the mechanism of folding. Interference fold, re-folded folds. Development and
identification of foliation and schistosity.

6th week – Lineation terminology, basic features, appearance in the cases of brittle and ductile deformation. Development and identification of boudins.

7th week – Occurrence of shear zones and mylonites. Studying mylonites in core samples and in thin section. Sigma and delta clasts, pressure solution, pressure shadow zones.

8th week – Test I

9th week – Horizontal faults. Transfer faults, characteristics of transpression and transtension, the development of positive and negative flower structures.

10th week – Studying structural features and elements in seismic profiles. Acquisition of seismic profiles, their visualisation and analysis.

11th week – Studying structural features and elements under the microscope. Crystal transformations, pressure twinning, micro-structures.


13th week – Test II

14th week – Measurement of rock strength parameters and rock mass strength parameters together with spacing characteristics in the field.

Requirements:

- for a signature
Attendance at practicals is compulsory, absence of students shall not exceed three occasions.

- for a grade
Grades are given on the basis of two tests in the study period. Both tests have an equal share in the final grade.

The grade for the course is given as follows:

<table>
<thead>
<tr>
<th>Test Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of student result is below 50, students can re-take the tests in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Richard William McIntosh, assistant professor, PhD

Lecturer: Dr. Richard William McIntosh, assistant professor, PhD
<table>
<thead>
<tr>
<th>Title of course: Palaeontology I</th>
<th>Code: TTGBE5018_EN</th>
<th>ECTS Credit points: 3</th>
</tr>
</thead>
</table>

### Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

### Evaluation:
exam

### Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 20 hours
- preparation for the exam: 42 hours
Total: 90 hours

### Year, semester:
2nd year, 2nd semester

### Its prerequisite(s):
General and Historical Geology

### Further courses built on it:
-

### Topics of course
The aim of the course is to introduce the students to the basics of Paleontology. It contains introduction to fossils; the conditions and processes of fossilization. Topics include advances in paleoecology, taphonomy, paleopathology, paleoichnology, paleobiogeography, biostratigraphy, history of extinctions, macroevolutionary patterns in fossil record, significant fossil finding localities in Hungary and in abroad, the activity of famous Hungarian and foreign paleontologists.

### Literature

**Compulsory:**

**Recommended:**

### Schedule:

1st week – Fossils and fossilization

126
2nd week – Palaeoecology 1.

3rd week – Palaeoecology 2.

4th week – Taphonomy

5th week – Palaeopathology

6th week – Palaeoichnology

7th week – Palaeobiogeography

8th week – Biostratigraphy

9th week – History of Extinctions

10th week – Macroevoolutionary patterns in fossil record

11th week – Significant fossil finding localities in Hungary

12th week – Significant fossil finding localities in abroad

13th week – The activity of famous Hungarian palaeontologists

14th week – The activity of famous foreign palaeontologists.

Requirements:
- for a signature
Attendance at lectures is recommended, but not compulsory.

Person responsible for course: Dr. Árpád Dávid, assistant professor, PhD

Lecturer: Dr. Árpád Dávid, assistant professor, PhD
Title of course: Palaeontology II – practice
Code: TTGBG5019_EN
ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -
Total: 60 hours

Year, semester: 3rd year, 1st semester

Its prerequisite: Palaeontology I

Further courses built on it: -

Topics of course
Methods of fossil collecting, preparation, determination and description. Fossil classification and
determination. Examination of the selected representatives of the fossil plants, fungi, and animals
on the basis of the following characteristics: systematic order, structure, way of life, phylogeny,
geological significance, important finding places in Hungary.

Literature

Compulsory:
ISBN 0-632-05637-1
  Clarkson, E. N. K. - Twitchett, R. - Smart, C. (2016): Invertebrate Palaeontology and
  Evolution, Blackwell Science, Oxford, p. 463

Recommended:
  Bloomington, p. 483.

Schedule:
1st week – Methods of fossil collecting and preparation
2nd week – Methods of fossil classification and determination
3rd week – Development of biogenic structures
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th</td>
<td>The evolution of plants I.</td>
</tr>
<tr>
<td>5th</td>
<td>The evolution of plants and fungi</td>
</tr>
<tr>
<td>6th</td>
<td>The Protozoa</td>
</tr>
<tr>
<td>7th</td>
<td>Porifera, Archaeocyatha, Cnidaria</td>
</tr>
<tr>
<td>8th</td>
<td>Vermes</td>
</tr>
<tr>
<td>9th</td>
<td>Mollusca</td>
</tr>
<tr>
<td>10th</td>
<td>Arthropoda</td>
</tr>
<tr>
<td>11th</td>
<td>Tentaculata</td>
</tr>
<tr>
<td>12th</td>
<td>Echinodermata and Hemicordata</td>
</tr>
<tr>
<td>13th</td>
<td>Vertebrata I</td>
</tr>
<tr>
<td>14th</td>
<td>Vertebrata II</td>
</tr>
</tbody>
</table>

**Requirements:**
- for a signature
Attendance at lectures is recommended, but not compulsory.

**Person responsible for course:** Dr. Árpád Dávid, assistant professor, PhD

**Lecturer:** Dr. Árpád Dávid, assistant professor, PhD
Title of course: Sedimentology  
Code: TTGBG5016_EN

ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: term mark

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -
Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course
The course discusses the definition of sediment, sedimentary geology, principals of sediment generation, processes of erosion, transport and deposition of sediments by water, ice and wind. During the course the main types of sedimentary basin will be reviewed, in addition, the roles of global plate tectonics, production and transport of clastic material, the topography and climate also will be discussed. The student will be able to recognize the sedimentary palaeo-environments by the textural and structural features. Basics of the sedimentary fluid dynamics and the processes of sediment gravity flows also will be introduced. The distribution of sedimentary processes in space and time, and the nature of sediment supply, finally the depositional facies, e.g. alluvial, deltaic, coastal, shallow-marine, slope, deep-marine glacial and aeolian settings are all discussed.

Literature
Compulsory:

Recommended:
Leyrite, H., Montenat, C. (eds.) 2000: Volcaniclastic rocks from magmas to sediments. Gordon and Breach Science Publisher

Schedule:
1st week – Term and topic of sedimentology. Rock cycle, sediment and sedimentary rock. Weathering, diagenesis, cementation, compaction.
2nd week – Facies, lithofacies, biofacies Bedding and lamination.
4th week – Parallel non-parallel and cross-beddings. Types of grading. Depositional features, wavy, lenticular and flaser laminations. Deformation structures, bioturbation.


6th week – Shallow and deep marine environments.


9th week – Determination of grain-size: sieve analysis.

10th week – Determination of grain-size: hydrometer analysis.

11th week – Grain-size distribution, grain-size distribution curves, grading characteristics.


13th week – Cherts and siliceous sediments, phosphates, ironstones, evaporates, coal and oil.

14th week – End-term test.

**Requirements:**

*for a signature*

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring a notebook to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are two tests, roughly at the half time and the end of the semester.

*for a grade*

The course ends in a term mark based on the average of the tests.

The minimum requirement for the tests is 50%. Based on the score of the tests the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-61</td>
<td>pass (2)</td>
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<tr>
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<td>satisfactory (3)</td>
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<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of test is below 50, students can take a retake test in conformity with the education and examination rules and regulations.

*an offered grade:*

grade cannot be offered for students during the course.
| **Person responsible for course:** Dr. Árpád Csámer, assistant professor, PhD |
| **Lecturer:** Dr. Árpád Csámer, assistant professor, PhD |
**Title of course:** Environmental Geology  
**Code:** TTGBE5020_EN  
**ECTS Credit points:** 3

**Type of teaching, contact hours**  
- lecture: 2 hours/week  
- practice: -  
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**  
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: 20 hours  
- preparation for the exam: 42 hours  
Total: 90 hours

**Year, semester:** 3rd year, 1st semester

**Its prerequisite(s):** -

**Further courses built on it:** TTGBG5026_EN

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**Topics of course**

The environmental geology, as a discipline is dealing with the interactions between human population and the physical environment (the spheres of the Earth). The aim of the course is to provide comprehensive knowledge about the environmental problems of the Earth crust and surface, and their geological background. The students are introduced to geological and geophysical investigation methods during the process of the examination and resolving of environmental problems, in addition, current researches focusing on areas of metal and hydrocarbon pollutions, landslide and earthquake predictions and mitigations are emphasized.

**Literature**

*Compulsory:*

*Recommended:*
US. EPA 2007: Introduction to Environmental Geophysics (165.20) Student Manual  

**Schedule:**

2*nd* week – Weathering processes and sedimentary rocks. Metamorphosis and metamorphic rocks.  
3*rd* week – Rock cycle. Earth’s interior. Plate tectonics, deformation of lithosphere.  
4*th* week – Hazardous Earth processes. Volcanoes and volcanic hazards.  
5*th* week – Earthquakes and related hazards.  


9th week – Pollution and contamination. Various types of contaminants, their physical-chemical properties and effects on human health and ecosystem.


11th week – Soil, soil gas, surface water and groundwater sampling techniques and strategies. Drilling techniques, well installing. Investigation methods in field and laboratory.


13th week – Remediation techniques and technologies for cleaning up contaminated sites.

14th week – Solid and liquid wastes. Waste disposal regarding geological and hydrogeological backgrounds. Effects of mining.

Requirements:

- for a signature
  Attendance at lectures is recommended, but not compulsory.

  Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

  Students have to submit a course paper as scheduled minimum on a sufficient level.

- for a grade
  The course ends in an examination. Based on the grades of the course paper and the examination, the exam grade is calculated as follows:

  - written exam in 90%,
  - course paper in 10%

  The minimum requirement for the written exam is 50%. Based on the score the grade for the written exam is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-61</td>
<td>pass (2)</td>
</tr>
<tr>
<td>62-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Person responsible for course: Dr. Árpád Csámer, assistant professor, PhD

Lecturer: Dr. Árpád Csámer, assistant professor, PhD
Title of course: Applied Geology
Code: TTGBE5021_EN
ECTS Credit points: 4

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: 1 hour/week
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: 14 hours
- laboratory: -
- home assignment: 40 hours
- preparation for the exam: 38 hours
Total: 120 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course
The aims of the course are to introduce the student to various fields of applied geology, which were not trained during the programme yet. Hence, the student will make familiar with economic geology, mining geology, non-metallic and ore mineral deposits and geology of fossil energy resources. The most important field, analytical and statistical methods of geological exploration also will be taught. Another emphatic part of the course is the principals of the engineering geology, which are essential to develop and maintain built environment. Syllabus of the course will be enriched with the basics of the archaeometry, which can be regarded as a fruitful and progressive section of the archaeology and earth sciences.

Literature

Compulsory:

Recommended:

Schedule:
1st week – Mineral resources, ores, non-metallic minerals, fossil energy materials.
2nd week – Main types of magmatic ore occurrences.
3rd week – Main types of sedimentary ore occurrences.
4th week – Non-metallic mineral resources and industrial minerals.
5th week – Petroleum and natural gas.
6th week – Basics of mineral exploration.
7th week – Mid-term test. Geological examinations in fields.
8th week – Exploration drillings. Rotary, RAB, RC etc. drilling techniques.
9th week – Sample handling and QA/QC of ore, rock, water and soil samples. Geochemical analysis and assay of geological samples. Well and downhole logging.
11th week – Analysis of stress and strain. Special stress and strain states. Slope stability, foundation design.
12th week – Groundwater and its effects on soil.
14th week – End-term test.

Requirements:
- for a signature
Attendance at lectures is recommended, but not compulsory. Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are two tests, roughly at the half time and the end of the semester.
- for a grade
The course ends in an exam.

Based on the average of the grades of the tests and the examination, the exam grade is calculated as follows:

- the average grade of the two tests in 33%
- the result of the examination in 66%

The minimum requirement for the tests and exam is 50%. Based on the score of the tests the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-61</td>
<td>pass (2)</td>
</tr>
<tr>
<td>62-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of test is below 50, students can take a retake test in conformity with the education and examination rules and regulations.
<table>
<thead>
<tr>
<th>Person responsible for course:</th>
<th>Dr. Árpád Csámer, assistant professor, PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecturer:</td>
<td>Dr. Árpád Csámer, assistant professor, PhD</td>
</tr>
</tbody>
</table>
Title of course: Geological planning and modelling  
Code: TTGBG5026_EN  
ECTS Credit points: 2

Type of teaching, contact hours  
- lecture: -  
- practice: 2 hours/week  
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:  
- lecture: -  
- practice: 28 hours  
- laboratory: -  
- home assignment: 32 hours  
- preparation for the exam: -  
Total: 60 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s): Environmental Geology TTGBE5020_EN

Further courses built on it: -

Topics of course

The aim of the course is to introduce the main steps of the geological modelling used in the process of geological planning. The syllabus includes specialist knowledge acquired from case studies and project works coming from various parts of mineral exploration and exploitation campaigns and environmental geological projects. The modelling exercises will be resolved using by modelling software widely used in the geosciences, as well as the process will also require team work and individual research.

Literature

Compulsory:  

Recommended:  

Schedule:

2nd week – Geological, hydrogeological maps, borehole and well logs 
4th week – Changes in land use based on 1st 2nd, 3rd military surveys, Corine Land Cover and Copernicus Land Monitoring Programmes. Public utility maps. 
5th week – Topographical maps. Digital Terrane Models. Usage of topography and DTM data,
georeferencing and digitizing.


7th week – Exercises in Surfer: volume calculation based on simple models.

8th week – Exercises in Surfer: data processing, statistical evaluation, layout. Examples for hydrogeological application.

9th week – Exercises in Surfer: data processing, statistical evaluation, layout. Examples for mass and concentration calculation based on simple models.

10th week – Utilization of geological, geochemical, geophysical datasets in RockWorks.

11th week – Grid-based and solid models. Interpolation techniques.

12th week – Mass, volume and concentration calculations using RockWorks.

13th week – Solution of hydrogeological exercises in RockWorks.

14th week – End-term test.

Requirements:

- for a signature
  Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring a notebook to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.
  Students have to submit two modelling exercises as scheduled minimum on a sufficient level.
  During the semester there is one test at the end of the semester (end-term test in the 14th week).

- for a grade
  The course ends in a term mark based on the average of the modelling exercises and the end-term test.
  The minimum requirement for the exercises and the test respectively is 50%. Based on the score of the test the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
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<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of test is below 50, students can take a retake test in conformity with the education and examination rules and regulations.

Person responsible for course: Dr. Árpád Csámer, assistant professor, PhD

Lecturer: Dr. Árpád Csámer, assistant professor, PhD
**Title of course:** Astrogeology and Cosmopetrography  
**Code:** TTGBE5114_EN  
**ECTS Credit points:** 2

**Type of teaching, contact hours**
- lecture: -
- practice: 2 hours/week
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -
Total: 68 hours

**Year, semester:** 3rd year, 2nd semester

**Its prerequisite(s):** Rock microscopy TTGBG5014_EN

**Further courses built on it:** -

**Topics of course**
The course discusses the main and miscellaneous objects of the Solar System (planets, moons, comets, asteroids, dwarf planets). The astrogeology or so called exogeology is one of the most progressive interdisciplinary subject of earth and planetary science. During the course the main features of terrestrial planets, gas and icy giants and their moons and their surfaces’ evolution are reviewed. The evolution, geochemical properties and rock types of the Moon also are introduced. Main types, characteristics of extraterrestrial rock and their analytical methods are all discussed.

**Literature**

**Compulsory:**

**Recommended:**

**Schedule:**

1st week – Introduction to the evolution of astronomy and space research.
2nd week – Formation and parts of the Solar System.
4th week – Geology of terrestrial planets: characteristics of inner planets. Mercury and Venus
5th week – Geology of Mars.
6<sup>th</sup> week – Similarities and differences in the structure of gas giants. Geology of Jupiter and Galilean moons.

7<sup>th</sup> week – Geology of Saturn and its moons.

8<sup>th</sup> week – Geology of Uranus and its moons.

9<sup>th</sup> week – Geology of Neptune and its moons.

10<sup>th</sup> week – Main types and characteristics of meteorites. ‘Fallen stars’: famous meteorites of the world.

11<sup>th</sup> week – Main types and chemical-mineralogical composition of impactites. Formation of tectites and spherules. Impact craters on Earth.

12<sup>th</sup> week – Geology of the Moon. Mineralogy and geochemistry of the Moon’s rocks.

13<sup>th</sup> week – Geology of minor planets: dwarf planets, asteroids, trojans.

14<sup>th</sup> week – The past, the present and the future of the space research. Missions to the Moon, Mars and other celestial objects. Exoplanet explorations.

### Requirements:

- **for a signature**

  Attendance at lectures is recommended, but not compulsory.

  Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

  Students have to prepare an oral presentation about a chosen topic in the field of astrogeology and cosmolpetrography.

  During the semester there is one test (end-term test at the end of the semester).

- **for a grade**

  The course ends in a term mark. Based on the grade of the end-term test and the oral presentation the term grade is calculated as follows:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-59</td>
<td>fail (1)</td>
</tr>
<tr>
<td>60-69</td>
<td>pass (2)</td>
</tr>
<tr>
<td>70-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

  The minimum requirement for the written exam is 50%. Based on the score the grade for the written exam is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-59</td>
<td>fail (1)</td>
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<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

  If the score of test is below 50, students can take a retake test in conformity with the education and examination rules and regulations.

### Person responsible for course:
Dr. Árpád Csámer, assistant professor, PhD

### Lecturer:
Dr. Árpád Csámer, assistant professor, PhD
**Title of course:** Geochemistry I  
**Code:** TTGBE5017_EN  
**ECTS Credit points:** 3

**Type of teaching, contact hours**
- lecture: 2 hours/week  
- practice: -  
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: 12 hours  
- preparation for the exam: 50 hours  
Total: 90 hours

**Year, semester:** 2nd year, 2nd semester

**Its prerequisite(s):** TTGBG5009_EN, TTGBE5007_EN, TTGBE5008_EN

**Further courses built on it:** -

**Topics of course**
Students will have a basic insight to the origin, abundance and distribution of the elements in the solar system and in the different spheres of the Earth (core, mantle, crust, hydrosphere and atmosphere). The course provide a theoretical and practical insights into the geochemical classification and properties of the elements and their fractionation during igneous and sedimentary processes. Students will learn about the trace elements, the stable isotope and radiogenic isotope ratios and different age determination methods. Anthropogenic influences and mineralization processes are briefly discussed.

**Literature**

- **Compulsory:**  

- **Recommended:**  

**Schedule:**

1st week – The subject and brief history of geochemistry. Electronic structure of the atoms and the periodic properties of the elements. The Periodic Table. Ionic and covalent bonding and crystal lattices.

2nd week – The formation of the chemical elements. Meteorites and the solar system abundance of the elements.


6th week – The geochemistry of the most important elements. Alkali and alkali earth metals, high field strength elements and rare earth elements.


8th week – Radiogenic isotope geochemistry. Radioactive decay. Rb-Sr and Sm-Nd isotope systems in geology.

9th week – Age determination and geochronology. K/Ar method, zircon dating and radiocarbon dating.

10th week – The chemical weathering of minerals and rocks. Formation of secondary minerals, sedimentary rocks and soils.

11th week – The origin of the atmosphere and hydrosphere. The geochemistry of oceans.

12th week – The geochemical cycles of the biogenic elements. The carbon, nitrogen and sulphur cycles.

13th week – Principles of environmental geochemistry. Anthropogenic effects and climate change.


Requirements:
- for a signature
  Attendance at lectures is recommended, but not compulsory.

- for a grade
  The course ends in an oral examination. The grade for the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-59</td>
<td>fail (1)</td>
</tr>
<tr>
<td>60-69</td>
<td>pass (2)</td>
</tr>
<tr>
<td>70-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score is below 60 (grade fail), students can take a retake examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Prof. Dr. Gábor Dobosi, university professor, DSc

Lecturer: Prof. Dr. Gábor Dobosi, university professor, DSc
**Title of course:** Analytical methods in geology  
**Code:** TTGBG5022_EN  
**ECTS Credit points:** 3

| **Type of teaching, contact hours** |  
| - lecture: - |  
| - practice: 3 hours/week |  
| - laboratory: - |  

| **Evaluation:** | mid-semester grade |

| **Workload (estimated), divided into contact hours:** |  
| - lecture: - |  
| - practice: 42 hours |  
| - laboratory: - |  
| - home assignment: 30 hours |  
| - preparation for the exam: 18 hours |  
| **Total:** | 90 hours |

| **Year, semester:** | 2nd year, 2nd semester |

| **Its prerequisite(s):** | TTGBG5009_EN |

| **Further courses built on it:** | - |

| **Topics of course** |  
| Students will have a basic insight into the instrumental methods used in the practice of geology in form of interactive seminars/laboratory practices. Topics to be discussed are the followings: Thermal analytical methods, TG, DTG, DTA, DSC, their principals, usage in geology. Aspects and rules of sampling, sample preparation methods. Types of measurement errors and ways of their elimination. Precision, accuracy, representation of measurement results. Spectroscopy. Emission and absorption techniques (UV-Vis, ICP-AES, AAS), application of X-ray fluorescence spectroscopy (XRF) for the determination of concentration of major and minor elements. Electron microprobe. Nuclear techniques (neutron activation). Application of mass spectrometric techniques for the determination of ratios of stable and radiogen isotopes and for geological chronology. Coupled techniques (LA-ICP-MS, EGA-MS). |

| **Literature** |  

| **Schedule:** |  
| **1st week** – Introduction to the course, discussion of the requirements. Thermal analysis. The most important methods in thermal analysis (TG, DTG, DTA, DSC), theoretical principles, possible applications in geological analytics. |  
| **2nd week** – Thermal analysis (practice). Introduction to derivatograph. Way of measurement, thermal study of real and model samples, the evaluation and discussion of the results. |  
| **3rd week** – Elemental analysis, major, minor and trace elements, isotope ratios and their determinations. Ways of sampling, sample preparation methods. Error of measurement, precision, |
accuracy.

4th week – Electromagnetic radiation, spectroscopy. Development of UV-vis spectra, emission spectra, absorption spectra from atoms, ions, molecules. Optical emission spectroscopy, ICP-AES.

5th week – Atomic absorption spectroscopy. Other spectroscopical techniques.


8th week – X-Ray fluorescent spectroscopy (practice). Powder pellet pressing, measurement, data evaluation, discussion.

9th week – Methods based on electron beams, electron microprobe. Evaluation of X-Ray and electron imaging spectra. Calculation of molecular formula from the electron microprobe measurement data.

10th week – Nuclear methods, neutron activation technique, PIXE measurements.

11th week – Mass spectrometry, determination of stable and radiogen isotopes, geological applications.

12th week – ICP-MS. Evaluation of trace element reports, calculations for conversion of concentration units. LA-ICP-MS. SIMS.


14th week – End-term test covering thermal analysis, spectroscopy (based on interaction of matter and electromagnetic radiation), mass spectroscopy, geological applications

Requirements:
- for a signature

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there is one test, the end-term test, that is in the 14th week. Students have to sit for the tests

- for a grade

The final grade for the course will be determined according to the followings: it is based on the grade of end-term test in 90 %, and based on the class-activity and performance of students, (the quality of practice reports) in 10 %.

The minimum requirement for the end-term tests is 50%. The examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-87</td>
<td>good (4)</td>
</tr>
</tbody>
</table>
If the score of the test is below 49, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

- an offered grade: it may be offered for students if the grade is at least satisfactory (3).

**Person responsible for course:** Prof. Dr. Gábor Dobosi, university professor, DSc

**Lecturer:** Dr. Dávid Nagy, assistant professor, PhD
<table>
<thead>
<tr>
<th>Title of course:</th>
<th>Systematic mineralogy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code:</td>
<td>TTGBG5025_EN</td>
</tr>
<tr>
<td>ECTS Credit points:</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of teaching, contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
</tr>
<tr>
<td>- practice: 2 hours/week</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation:</th>
<th>mid-semester grade</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Workload (estimated), divided into contact hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: -</td>
</tr>
<tr>
<td>- practice: 28 hours</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
<tr>
<td>- home assignment: 20 hours</td>
</tr>
<tr>
<td>- preparation for the exam: 12 hours</td>
</tr>
<tr>
<td>Total: 60 hours</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year, semester:</th>
<th>3rd year, 2nd semester</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Its prerequisite(s):</th>
<th>TTGBE5007_EN, TTGBE5008_EN</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Further courses built on it:</th>
<th>-</th>
</tr>
</thead>
</table>

### Topics of course

The course will introduce the students into the classification of minerals based on their crystal structures and chemical composition. They will learn about the properties, crystallization conditions, occurrences and associations of different groups of minerals, as sulphides, oxydes, silicates and carbonates. The most important rock-forming minerals and economic minerals will be discussed in details.

### Literature

**Compulsory:**

**Recommended:**

### Schedule:


3rd week – Sulphides, selenides, tellurides and arsenides.

4th week – Sulphosalts. Sulphide paragenesis.

5th week – Oxides and hydroxides. Spinel and perovskites.

6th week – Hydroxides, bauxite minerals. Silicate structures and classification.

7th week – Orthosilicates or nesosilicates. Olivine, garnet group, zircon, titanite and epidote group.

8th week – Sorosilicates and cyclosilicates. Turmaline and melilite group. Chain silicates.
(inosilicates). Pyroxene structure, composition and classification.

9th week – Phase relations of pyroxenes. Amphibole structure, composition and classification.


11th week – Clay minerals.


13th week – Phosphates, sulphates and carbonates. Halogenides and evaporites.

14th week – Minerals in space and time.

**Requirements:**
- for a signature

Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Active participation is evaluated by the teacher.

During the semester there several (more than 10) short tests, and a final test in the 15th week. Students have to sit for the tests

- for a grade

The minimum requirement for the mid-term short and end-term tests is 60%. The grade for the tests is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-59</td>
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<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Prof. Dr. Gábor Dobosi, university professor, DSc

**Lecturer:** Prof. Dr. Gábor Dobosi, university professor, DSc
<table>
<thead>
<tr>
<th><strong>Title of course:</strong></th>
<th>Rock microscopy</th>
<th><strong>ECTS Credit points:</strong></th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code:</strong></td>
<td>TTGBG5014_EN</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type of teaching, contact hours</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lecture:</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>practice:</td>
<td>2 hours/week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>laboratory:</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evaluation:</strong></td>
<td>mid-semester grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Workload (estimated), divided into contact hours:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lecture:</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>practice:</td>
<td>28 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>laboratory:</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>home assignment:</td>
<td>32 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>preparation for the exam:</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>60 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year, semester:</strong></td>
<td>2nd year, 2nd semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Its prerequisite(s):</strong></td>
<td>TTGBE5007_EN, TTGBE5008_EN, TTGBG5009_EN</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Further courses built on it:</strong></td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Topics of course**

The aims of the course is to introduce basic optical elements, principal optical features of rock-forming minerals; to demonstrate main igneous, sedimentary, and metamorphic rock types (their mineralogical composition and texture) in thin section under the microscope. The students will learn protocol of basic determination methods of main rock types by using polarizing microscope.

**Literature**

*Compulsory:

*Recommended:

**Schedule:**

1st week – Elements of optical mineralogy. Optical properties of crystals. The polarizing microscope.

2nd week – Study on minerals in thin section by using single nicol prism. Pleochroism and pseudo-pleochroism; cleavage and fracture.

3rd week – Study on minerals in thin section by using crossed nicol prisms. Types of extinction. Axial figures.

4th week – Optical properties of rock-forming minerals I (olivine, pyroxene, amphibole, biotite, muscovite, plagioclase, potassium feldspars, quartz, calcite, etc.); their identification in polarizing microscope.
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th</td>
<td>Elements of ore microscopy.</td>
</tr>
<tr>
<td>6th</td>
<td>Test 1</td>
</tr>
<tr>
<td>7th</td>
<td>Texture of igneous rocks: glassy, hyalopilitic, pilotaxitic, microholocrystalline, granitic</td>
</tr>
<tr>
<td>8th</td>
<td>Intrusive and extrusive igneous rocks under the microscope.</td>
</tr>
<tr>
<td>9th</td>
<td>Study on pyroclastic rocks in thin section.</td>
</tr>
<tr>
<td>10th</td>
<td>System of sedimentary rocks. Microscopy in sediment petrology.</td>
</tr>
<tr>
<td>11th</td>
<td>Siliciclastic and carbonate rocks under the microscope.</td>
</tr>
<tr>
<td>12th</td>
<td>Metamorphic textures; the most important metamorphic minerals.</td>
</tr>
<tr>
<td>13th</td>
<td>Study on some metamorphic rocks under the microscope.</td>
</tr>
<tr>
<td>14th</td>
<td>Test 2</td>
</tr>
</tbody>
</table>

**Requirements:**

- **for a signature**
  Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- **for a grade**
  The minimum requirement for the writing tests the examination respectively is 50%. The grade for the tests is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
</tr>
<tr>
<td>65-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Péter Rózsa, associate professor, PhD

**Lecturer:** Dr. Péter Rózsa, associate professor, PhD; Dr. Richard William McIntosh, assistant professor, PhD; Dr. Árpád Csámer, assistant professor, PhD
Title of course: Volcanology and Petrology
Code: TTGBE5015_EN

ECTS Credit points: 3

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 20 hours
- preparation for the exam: 42 hours
Total: 90 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s): Structural geology TTGBG5004_EN

Further courses built on it: -

Topics of course
The aim of the course is to provide information about the volcanism as a global geological phenomenon. During the course the types of the volcanic activities, the circumstances of development and formation of volcanoes, as well as the main types of volcanic rocks are introduced. Principal applied investigation methods (field and laboratory methods) of lava and volcaniclastic rock, volcanic activity, volcanic hazard and mitigation also are presented.

Literature

Compulsory:
McPhie, J., M. Doyle, R. Allen 1993: Volcanic Textures, A guide to the interpretation of textures in volcanic rocks. Centre for Ore Deposit and Exploration Studies, University of Tasmania

Recommended:
Fisher, R.V. and H-U. Schmincke 1984: Pyroclastic rocks. Springer-Verlag

Schedule:

1st week – Term of volcanism. History of volcanology.


3rd week – Main minerals and rocks with igneous origin. Classification of volcanic rocks by their chemical and mineralogical compositions. Streckeisen and TAS diagrams. Classification of pyroclastics and pyroclastic rocks.

4th week – Global plate tectonics and volcanism. The structure of Earth’s interior: chemical, mineralogical compositions and P/T conditions of the core, the mantle and the crust.

5th week – Divergent plate boundaries and volcanic activity. Rifts, rift valley, mid-oceanic ridges,
continental rift valley and ophiolite succession.

6th week – Convergent plate boundaries and volcanic activity: subduction and arc volcanism.

7th week – Convergent plate boundaries and volcanic activity: subduction and arc volcanism. Ocean islands and seamounts. Volcanic activity and climate change.

8th week – Silicate magma as molten rock. Physical and chemical properties of magma and lava. Magma differentiation and magma mixing.

9th week – Volcanic Eruption Index. Effusive volcanic activity. Mafic and intermediate lavas and lava flows.


14th week – Block and ash flow deposits: nuée ardente. Origin and characteristics of pyroclastic surge deposits.

**Requirements:**

- **for a signature**
  Attendance at lectures is recommended, but not compulsory.
  Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.
  Students have to submit a course paper as scheduled minimum on a sufficient level.

- **for a grade**
  The course ends in an examination. Based on the grades of the course paper and the examination, the exam grade is calculated as follows:
  - written exam in 90%,
  - course paper in 10%
  The minimum requirement for the written exam is 50%. Based on the score the grade for the written exam is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-61</td>
<td>pass (2)</td>
</tr>
<tr>
<td>62-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

**Person responsible for course:** Dr. Árpád Csámer, assistant professor, PhD

**Lecturer:** Dr. Árpád Csámer, assistant professor, PhD
<table>
<thead>
<tr>
<th><strong>Title of course:</strong> Soil conservation</th>
<th>ECTS Credit points: 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code:</strong> TTGBE6012</td>
<td></td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: 2 hours/week
- practice: -
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 22
- preparation for the exam: 40

Total: 90 hours

**Year, semester:** 2\(^{nd}\) year, 2\(^{nd}\) semester

**Its prerequisite(s):** -

**Further courses built on it:** TTGBG6013

**Topics of course**


**Literature**

**Schedule:**
1\(^{st}\) week
Significance and subject of soil protection.

2\(^{nd}\) week
Degradation factors threatening soils. Compaction and deterioration of soil structure.

3\(^{rd}\) week
Acidification and possible protection methods.

4\(^{th}\) week
Secondary sodification and possible protection methods.

5\(^{th}\) week
Major soil pollution sources. Effects of pollution on life in soils and the productivity of soils. Possible protection methods against pollution.

6\(^{th}\) week
Deflation and possible protection methods.

7\(^{th}\) week
Factors enhancing soil erosion. The role of the quantity, length, and intensity of precipitation, drop size and slope parameters in erosion.

8\(^{th}\) week
Types of areal erosion and also of linear erosion.
9th week
Role of geological and pedological conditions in erosion.

10th week
Role of vegetation cover, and humans in erosion.

11th week
Biological soil protection.

12th week
Agrotechnological methods in soil protection.

13th week
Technological soil protection.

14th week
Consulting.

Requirements:
- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.

- for a grade
The final grade is calculated as an average of the three practical grading.

The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Prof. József Posta, emeritus professor, DSc

Lecturer: Prof. József Posta, emeritus professor, DSc
<table>
<thead>
<tr>
<th><strong>Title of course:</strong> Soil conservation – practice</th>
<th>ECTS Credit points: 1</th>
</tr>
</thead>
</table>

**Type of teaching, contact hours**
- lecture: 
- practice: 1 hours/week 
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: 
- practice: 14 hours 
- laboratory: - 
- home assignment: 16 
- preparation for the exam: 
  Total: 30 hours

**Year, semester:** 2nd year, 2nd semester

**Its prerequisite(s):** -

**Further courses built on it:** -

**Topics of course**

**Literature**

**Schedule:**

1st week
- Basic legislation related to soil protection.

2nd week
- Rules of soil protection monitoring and sampling. TIM system.

3rd week
- Soil protection plan.

4th week
- Soil protection databases, laboratories.

5th week
- Soil protection institutions, expert background in Hungary.

6th week
- Effects, indicators of water erosion, its measurement methods. Water erosion in Hungary, in Europe and in the world.

7th week
- Effects, indicators of wind erosion, its measurement methods. Wind erosion in Hungary, in Europe and in the world.
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&lt;sup&gt;th&lt;/sup&gt; week</td>
<td>Effects, indicators of secondary sodification, its measurement methods. Secondary sodification in Hungary, in Europe and in the world.</td>
</tr>
<tr>
<td>9&lt;sup&gt;th&lt;/sup&gt; week</td>
<td>Effects, indicators of soil compaction, its measurement methods. Soil compaction in Hungary, in Europe and in the world.</td>
</tr>
<tr>
<td>10&lt;sup&gt;th&lt;/sup&gt; week</td>
<td>Effects, indicators of organic matter reduction, its measurement methods. Organic matter reduction in Hungary, in Europe and in the world.</td>
</tr>
<tr>
<td>11&lt;sup&gt;th&lt;/sup&gt; week</td>
<td>Effects of soil cover because of building-up, road construction. Effects, indicators of soil cover, its measurement methods. Soil cover in Hungary, in Europe and in the world.</td>
</tr>
<tr>
<td>12&lt;sup&gt;th&lt;/sup&gt; week</td>
<td>Effects of soil pollution because of building-up, road construction. Effects, indicators of soil pollution, its measurement methods. Soil pollution in Hungary, in Europe and in the world.</td>
</tr>
<tr>
<td>13&lt;sup&gt;th&lt;/sup&gt; week</td>
<td>Soil protection relations, effects, indicators of irrigation, its measurement methods. Irrigation in Hungary, in Europe and in the world.</td>
</tr>
<tr>
<td>14&lt;sup&gt;th&lt;/sup&gt; week</td>
<td>Nature protection of soils. Soil as a source of data, natural and cultural value.</td>
</tr>
</tbody>
</table>

**Requirements:**

- **for a signature**
  Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

  During the semester there are three practical grading. Students have to attend.

- **for a grade**
  The final grade is calculated as an average of the three practical grading.

  The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any task is below 50, students can take a retake in conformity with the **EDUCATION AND EXAMINATION RULES AND REGULATIONS**.
<table>
<thead>
<tr>
<th><strong>Person responsible for course:</strong></th>
<th>Dr. Tibor Novák, associate professor, PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lecturer:</strong></td>
<td>Dr. Tibor Novák, PhD, associate professor, PhD</td>
</tr>
</tbody>
</table>
Title of course: GIS fieldwork and mapping
Code: TTGBL7023_EN
ECTS Credit points: 4

Type of teaching, contact hours
- lecture: -
- practice: 4 hours/week
- laboratory: -

Evaluation: practical grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 56 hours
- laboratory: -
- home assignment: 64 hours
- preparation for the exam: -
Total: 120 hours

Year, semester: 3rd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course
The theory of the geoid and its important measurable parameters. Overview of national and international map projections. Horizontal measurements, the theory of triangulation, the structure of the horizontal baseline network. Types of altitude measurements. Structure of the elevation baseline network and persistence of the points. The main parts of geodetic field surveyor instruments for horizontal and altitude measurements, the principle of their operation, their practical use. Processing, mapping and analysis of field data in a software environment. Theory and practice of Global Positioning System.

Literature

Schedule:
1st week – Introduction
2nd week – Basics of field surveying
3rd week – Field survey methods – the classical methods
4th week – Field survey with classical surveying equipment – the levelling surveyor
5th week – Field survey with classical surveying equipment – the theodolite
6th week – Field survey methods – contemporary methods
7th week – Field survey with modern surveying equipment – the GPS
8th week – Mid-term test. Field survey with modern surveying equipment – the total station
9th week – Field survey with modern surveying equipment – the terrestrial laser scanner
10th week – Processing of collected data – I.
11th week – Processing of collected data – II.
12th week – Editing maps from collected data – I.
13th week – End-term test. Editing maps from collected data – II.
14th week – Questions

Requirements:
- for a signature
Attendance at classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks, drawing instruments and calculator of the course to each practice class.
- for a grade
Students have to submit a homework, which contains a self-surveyed and mapped area or object with description, in a document. The grade based on the quality of this paper.
During the semester there are two tests: the mid-term test in the 8th week and the end-term test in the 13th week. The final grade is calculated as an average of the grades of the tests. The minimum requirement for the mid-term and end-term respectively is 50%. Based on the score of the tests separately, the grade for the tests is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-86</td>
<td>good (4)</td>
</tr>
<tr>
<td>87-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 50, students can take a retake test in the 14th week. If the score of test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Gergely Szabó, assistant professor, PhD

Lecturer: Dr. Gergely Szabó, assistant professor, PhD
<table>
<thead>
<tr>
<th><strong>Title of course:</strong> Principles of database management in earth sciences</th>
<th><strong>ECTS Credit points:</strong> 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code:</strong> TTGBL7012_EN</td>
<td></td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: -
- practice: 2 hours/week
- laboratory: -

**Evaluation:** exam, practical grade

**Workload (estimated), divided into contact hours:**
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 16 hours
- preparation for the exam: 16 hours
Total: 60 hours

**Year, semester:** 2<sup>nd</sup> year, 1<sup>st</sup> semester

**Its prerequisite(s):** -

**Further courses built on it:** -

### Topics of course

### Literature
- [http://web.mef.hr/web/images/pdf/ms_o_exc.pdf](http://web.mef.hr/web/images/pdf/ms_o_exc.pdf)
- [https://www.saylor.org/site/textbooks/How%20to%20Use%20Microsoft%20Excel.pdf](https://www.saylor.org/site/textbooks/How%20to%20Use%20Microsoft%20Excel.pdf)

### Schedule:
1<sup>st</sup> week – Introduction to the course
2<sup>nd</sup> week – Introduction to the methods of hydrological and hydro-meteorological data collection.
3<sup>rd</sup> week – Data collection from yearbooks
4<sup>th</sup> week – Joint data
5<sup>th</sup> week – Grouping, debugging and fixing. Use of debugging statements I.
6<sup>th</sup> week – Grouping, debugging and fixing. Use of debugging statements II.
7<sup>th</sup> week – Application of enhanced conditional statements
8<sup>th</sup> week – Data analysis tools, validation menu, drop-down lists, error messages.
9<sup>th</sup> week – Practical test I.
10<sup>th</sup> week – Cross-reference between data sheets
11<sup>th</sup> week – Data tabulation, sub-total compositions
12th week – Complex and special filtering. Diagram templates.
13th week – Summary of the semester knowledge. Practice for the Practical test II.
14th week – Practical test II.

Requirements:
Participation at classes is compulsory. A student must attend the courses and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

During the semester there is two practical test. First is at 9th week then second is at 14th week.
The minimum score is 50%. Based on the score of the test, the grade for the test is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
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<tr>
<td>75-86</td>
<td>good (4)</td>
</tr>
<tr>
<td>87-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Person responsible for course: Judit Kissné-Boda, assistant lecturer

Lecturer: Judit Kissné-Boda, assistant lecturer
          László Bertalan, assistant lecturer
<p>| <strong>Title of course:</strong> Landscape protection                                                                 |
| <strong>Code:</strong>                                                                                                  |
| <strong>ECTS Credit points:</strong> 3                                                                                     |
| <strong>Type of teaching, contact hours</strong>                                                                         |
| - lecture: 2 hours/week                                                                                       |
| - practice:                                                                                                 |
| - laboratory: -                                                                                              |
| <strong>Evaluation:</strong> exam                                                                                         |
| <strong>Workload (estimated), divided into contact hours:</strong>                                                        |
| - lecture: 28 hours                                                                                           |
| - practice:                                                                                                  |
| - laboratory: -                                                                                              |
| - home assignment:                                                                                            |
| - preparation for the exam: 62                                                                                 |
| Total: 90 hours                                                                                              |
| <strong>Year, semester:</strong> 3rd year, 1st semester                                                                     |
| <strong>Its prerequisite(s):</strong> -                                                                                    |
| <strong>Further courses built on it:</strong> -                                                                             |
| <strong>Topics of course</strong>                                                                                          |
| Most important terms in landscape protection and landscape ecology basics. Landscape element types and functions. Tasks of landscape protection in different landscape types. |
| <strong>Literature</strong>                                                                                               |
| <strong>Schedule:</strong>                                                                                               |
| <strong>1st week</strong> Subject of landscape protection: natural and cultural landscapes. Landscape protection as a social activity. |
| <strong>2nd week</strong> Landscapes as ecological systems. Material and energy flows in a landscape. Structure and operation of landscapes. Landscape forming elements and factors. Landscape functions. Landscape ecological principles and their application in landscape protection. |
| <strong>3rd week</strong> Landscapes as patch mosaics. Patches, corridors and matrixes. Types and operation of landscape ecological patches. Types and operation of landscape ecological corridors. |
| <strong>4th week</strong> Diversity of landscapes. Landscape structure and landscape diversity as values to be protected. |
| <strong>5th week</strong> Management, maintenance and handling for landscape protection. Landscape protection relations of the management of forests. Most frequent landscape protection problems related to forests. |
| <strong>6th week</strong> Landscape protection management, maintenance and handling. Management of grasslands and wetlands. Handling grasslands and wetlands. |
| <strong>7th week</strong> Landscape potential and its term. The theory of multi-functional landscapes. |</p>
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>8th</td>
<td>Fragmentations and the effects of margins. Conflicts of anthropogenic potential and landscape ecological networks.</td>
</tr>
<tr>
<td>9th</td>
<td>Landscape matrix, modelling the ecological operation of patch complexes.</td>
</tr>
<tr>
<td>10th</td>
<td>Analysis and interpretation of landscape changes. Indicators, typical processes and regional differences of landscape changes.</td>
</tr>
<tr>
<td>11th</td>
<td>Typifying landscapes. Landscape types and landscape changing tendencies in Hungary.</td>
</tr>
<tr>
<td>12th</td>
<td>Landscape as an aesthetic value. Landscape protection based on landscape architecture and aimed at aesthetics.</td>
</tr>
<tr>
<td>13th</td>
<td>Landscape in practice and national institutes responsible for landscape protection. Consulting.</td>
</tr>
<tr>
<td>14th</td>
<td>Case-studies and landscape protection projects.</td>
</tr>
</tbody>
</table>

**Requirements:**

- **for a signature**
  Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class. During the semester there are three practical grading. Students have to attend.

- **for a grade**
  The final grade is calculated as an average of the three practical grading. The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-72</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>73-84</td>
<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Tibor Novák, associate professor, PhD

**Lecturer:** Dr. Tibor Novák, associate professor, PhD
<table>
<thead>
<tr>
<th><strong>Title of course:</strong></th>
<th>Landscape protection – practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code:</strong></td>
<td>TTGBG6016</td>
</tr>
<tr>
<td><strong>ECTS Credit points:</strong></td>
<td>2</td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: -
- practice: 2 hours/week
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture:
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

**Year, semester:** 3rd year, 1st semester

**Its prerequisite(s):** -

**Further courses built on it:** -

**Topics of course**
Legal framework of landscape protection and related institutions. Practice of sustainable landscape use and land-use for landscape protection (forest, grassland, arable land, wetlands) and land-use optimisation.

**Literature**

**Schedule:**

1st week
Aims of landscape protection in practice and its place in decision making processes. Landscape protection basic terms, standards.

2nd week
Legal regulations of landscape protection. Content of standards related to landscape protection.

3rd week
Natura 2000 network and its landscape protection relations.

4th week
Individual landscape values and their cadastre.

5th week
Basic documents of landscape protection: urban plans, nature protection management plans, impact assessment.

6th week
Specifications for areas to be built-up and those to be not built-up.

7th week
Databases related to landscape protection in Hungary and their application in practice.

8th week
Application of landscape metric indicators in practice.
9th week
Case-studies: increasing intensity of landscape use: expanding settlements, expanding areas for industrial operations and transport.

10th week
Case studies: increasing intensity of the use of mostly agricultural areas.

11th week
Case-studies: landscape protection problems of mining and industrial areas.

12th week
Case-studies: landscape protection issues of abandoned areas and those with reduced intensity land-use.

13th week
Case-studies: landscape protection and landscape management issues of protected areas and nature reserves.

14th week
Institutes associated with landscape protection. Landscape protection planning and authority tasks in practice.

Requirements:
- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are three practical grading. Students have to attend.
- for a grade
The final grade is calculated as an average of the three practical grading.

The minimum requirement for the examinations respectively is 50%. Based on the score of the grading separately the grade is given according to the following table:

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<thead>
<tr>
<th>Score</th>
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</tr>
</thead>
<tbody>
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<td>good (4)</td>
</tr>
<tr>
<td>85-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any task is below 50, students can take a retake in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Tibor Novák, associate professor, PhD

Lecturer: Dr. Tibor Novák, associate professor, PhD
**Title of course:** Geology fieldwork  
**Code:** TTGBG5027_EN  
**ECTS Credit points:** 3

**Type of teaching, contact hours**  
- lecture: -  
- practice: 4 days  
- laboratory: -

**Evaluation:** mid-semester grade (one test towards the end of the fieldwork)

**Workload (estimated), divided into contact hours:**  
- lecture: -  
- practice: 48 hours  
- laboratory: -  
- home assignment: -  
- preparation for the tests: 42 hours  
Total: 90 hours

**Year, semester:** 2nd year, 2nd semester

**Its prerequisite(s):** Structural geology I

**Further courses built on it:** -

**Topics of course**  
The aim of the course is to enable students to test the learnt earth scientific methods and to get to know and study the geological conditions of northeastern Hungary and to visit professional companies carrying our geological work.

**Literature**

**Compulsory:**

**Recommended:**

**Schedule:**
*not relevant*

**Requirements:**
- *for a signature*  
  Attendance at the fieldwork is compulsory.

- *for a grade*  
  Grades are given on the basis of active participation, giving lectures focusing on certain stops during the fieldwork and one test.

  The grade for the course is given according to the following table:

<table>
<thead>
<tr>
<th>Test Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score Range</td>
<td>Grade</td>
</tr>
<tr>
<td>-------------</td>
<td>------------</td>
</tr>
<tr>
<td>0-50</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of student result is below 50, students can improve the result of their test by the quality of their rock collection and also by answering additional test questions in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Richard William McIntosh, assistant professor, PhD

**Lecturer:** Dr. Richard William McIntosh, assistant professor, PhD
<table>
<thead>
<tr>
<th><strong>Title of course</strong></th>
<th>Nonlinear phenomena, chaos</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td>TTFBE2201_EN</td>
</tr>
<tr>
<td><strong>ECTS Credit points</strong></td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Type of teaching, contact hours</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>lecture: 2 hours/week</td>
</tr>
<tr>
<td>practice: -</td>
</tr>
<tr>
<td>laboratory: -</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Evaluation</strong></th>
<th>exam</th>
</tr>
</thead>
</table>

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 7 hours
- preparation for the exam: 55 hours
Total: 90 hours

<table>
<thead>
<tr>
<th><strong>Year, semester</strong></th>
<th>3rd year, 2nd semester</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Its prerequisite(s):</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Further courses built on it:</strong></th>
</tr>
</thead>
</table>

**Topics of course**

**Literature**

**Compulsory:**
- Tél, T – Gruiz, M., Chaotic Dynamics. An IntroductionBased on Classical mechanics (Cambridge University, Cambridge, 2006)

**Recommended:**
- McCauley J. L., Chaos, Dynamics and Fractals, an algorithmic approach to deterministic chaos (Cambridge Univ. Press.,1994)

**Schedule:**


2nd week – Canonical formalism, Hamiltonian equations. Conservative systems. Phase space. Trajectory. Liouville theorem.


4th week – Motion around stable and instable singular points. Examples: pendulum, damped harmonic oscillator. Bifurcation.


6th week – Probability in chaotic systems. Information. Shannon information. Fractals. Fractal
dimension. Selfsimilarity.


11th week – Examples for chaotic attractors, Henon and Lorentz models.

12th week – Chaos in conservative systems. Integrable and non-integrable Hamiltonian systems.

13th week – Quasi-periodic motion on torus. KAM theorem.


**Requirements:**

- **for a signature**
  Attendance at lectures is recommended, but not compulsory.

- **for a grade**
  The course ends with an examination.

**Person responsible for course:** Prof. Dr. Ágnes Nagy, university professor, DSc

**Lecturer:** Prof. Dr. Ágnes Nagy, university professor, DSc
**Title of course:** Dynamics of the Atmosphere I  
**Code:** TTFBE2202_EN  
**ECTS Credit points:** 5

<table>
<thead>
<tr>
<th><strong>Type of teaching, contact hours</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 3 hours/week</td>
<td></td>
</tr>
<tr>
<td>- problems: 2 hours/week</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
</tbody>
</table>

| **Evaluation:** | exam |

<table>
<thead>
<tr>
<th><strong>Workload (estimated), divided into contact hours:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 42 hours</td>
<td></td>
</tr>
<tr>
<td>- problems: 28 hours</td>
<td></td>
</tr>
<tr>
<td>- laboratory: -</td>
<td></td>
</tr>
<tr>
<td>- home assignment: 40 hours</td>
<td></td>
</tr>
<tr>
<td>- preparation for the exam: 40 hours</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>150 hours</td>
</tr>
</tbody>
</table>

**Year, semester:** 3rd year, 1st semester

**Its prerequisite(s):** Fundamentals of physics II

**Further courses built on it:** Dynamics of the Atmosphere II

<table>
<thead>
<tr>
<th><strong>Topics of course</strong></th>
<th></th>
</tr>
</thead>
</table>
| The course gives a theoretical background for describing atmospheric dynamics. In particular, the basics of thermodynamics, the properties of static atmosphere and the kinematics of atmospheric motion are discussed as listed in the following topics:  

<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compulsory:</strong></td>
<td></td>
</tr>
<tr>
<td>- Holton, J.R.: An Introduction to Dynamic Meteorology, Elsevier 2004</td>
<td></td>
</tr>
<tr>
<td><strong>Recommended:</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Schedule:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st week</strong> – Physical and mathematical concepts of describing atmospheric processes. Vector algebra and vector analysis, tensors.</td>
<td></td>
</tr>
<tr>
<td><strong>3rd week</strong> – The basics of atmospheric thermodynamics. The equation of state, ideal gas, gas mixtures. The first law of thermodynamics and its form used in meteorology. Internal energy, heat</td>
<td></td>
</tr>
</tbody>
</table>
capacity, specific heat.


5th week – Thermodynamic processes of ideal gases. Piezotropic fluids, polytropic processes. Specific thermodynamic changes (isobaric, adiabatic, etc.), as particular cases of polytropy.


7th week – Adiabatic changes in dry air, potential temperature.


9th week – Water vapor and moist air. The thermodynamic properties of moist air, moisture variables. Adiabatic processes of moist air, model assumptions.

10th week – Moist adiabatic processes of moist air: moistsaturated and pseudo-adiabatic process. Temperatures defined by the pseudo-adiabatic changes in moist air.


12th week – Basic models of the static atmosphere. Polytropic (isothermal, homogeneous, adiabatic) models. Standard atmospheres.


14th week – Overview of the semester's material, consultation.

Requirements:
- for a signature
  Attendance at lectures is recommended, but not compulsory.

  Participation at problems classes is compulsory. A student must attend the problems classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at problems classes will be recorded by the class leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed problems classes should be made up for at a later date, to be discussed with the tutor. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation

- for a grade
  The course ends in an oral examination. Two different topic from the semester’s material should be discussed. Based on the student’s presentation the following guidelines are applied:

  - knowledge of fundamental laws, theorems and definitions: sufficient (2)
  - in addition, ability to prove the fundamental theorems: average (3)
  - in addition, knowledge of the proofs and derivations presented during the lectures: good (4)
  - in addition, knowledge of applications discussed during problems classes: excellent (5)

Person responsible for course: Dr. Zsolt Schram, associate professor, PhD

Lecturer: Dr. Zsolt Schram, associate professor, CSc, PhD habil.
Title of course: Dynamics of the Atmosphere II  
Code: TTFBE2203  
ECTS Credit points: 4

Type of teaching, contact hours
- lecture: 3 hours/week  
- problems: 1 hours/week  
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 42 hours  
- problems: 14 hours  
- laboratory: -  
- home assignment: 34 hours  
- preparation for the exam: 30 hours  
Total: 120 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s): Dynamics of the Atmosphere I

Further courses built on it: -

Topics of course
The course gives a theoretical background for describing atmospheric dynamics. In particular, the interactions and forces in the atmosphere and the dynamics of atmospheric motion are discussed as listed in the following topics:

Literature
Compulsory:
- Holton, J.R.: An Introduction to Dynamic Meteorology, Elsevier 2004  

Recommended:

Schedule:
1st week – The basics of atmospheric kinematics, Eulerian and Lagrangian description of fluid mechanics. Connection between the two descriptions.
2nd week – The fundamentals of atmospheric dynamics. Systems with infinite degrees of freedom. Mechanical principles, axioms.
3rd week – Atmospheric forces. Internal friction, viscosity. Ideal and Newtonian fluids. The connection between the velocity field and the stress tensor.
<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th</td>
<td>The hydrodynamic equations of motion in an inertial reference system. (Euler equations, Navier-Stokes equations.)</td>
</tr>
<tr>
<td>5th</td>
<td>The Navier-Stokes equations in general coordinates (spherical coordinate system). Scale analysis of the equations of motion.</td>
</tr>
<tr>
<td>6th</td>
<td>The equations of motion in isobaric and isentropic vertical coordinates. Fundamental energy forms and their transformations in the atmosphere.</td>
</tr>
<tr>
<td>7th</td>
<td>Simplified solutions to the equations of motion. The hydrostatic approximation. The geostrophic wind and its properties.</td>
</tr>
<tr>
<td>8th</td>
<td>The ageostrophic component of the horizontal motion. Isallobaric wind.</td>
</tr>
<tr>
<td>9th</td>
<td>The gradient wind. Comparison of geostrophic and gradient wind. The thermal wind.</td>
</tr>
<tr>
<td>10th</td>
<td>Circulation and vorticity. Kelvin’s and Bjerkness’ circulation theorem.</td>
</tr>
<tr>
<td>12th</td>
<td>Wave motions and their typical forms in the atmosphere. Wave equations, simple solutions. Rossby waves.</td>
</tr>
<tr>
<td>13th</td>
<td>Discontinuity surfaces in the atmosphere. Inclination of frontal surfaces. The planetary boundary layer.</td>
</tr>
<tr>
<td>14th</td>
<td>Overview of the semester's material, guidance for further studies, consultation.</td>
</tr>
</tbody>
</table>

**Requirements:**
- **for a signature**
  Attendance at **lectures** is recommended, but not compulsory.

  Participation at **problems classes** is compulsory. A student must attend the problems classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at problems classes will be recorded by the class leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed problems classes should be made up for at a later date, to be discussed with the tutor. Active participation is evaluated by the teacher in every class. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation.

- **for a grade**
  The course ends in an **oral examination**. Two different topic from the semester’s material should be discussed. Based on the student’s presentation the following guidelines are applied:
  - knowledge of fundamental laws, theorems and definitions: **sufficient (2)**
  - in addition, ability to prove the fundamental theorems: **average (3)**
  - in addition, knowledge of the proofs and derivations presented during the lectures: **good (4)**
  - in addition, knowledge of applications discussed during problems classes: **excellent (5)**

**Person responsible for course:** Dr. Zsolt Schram, associate professor, PhD

**Lecturer:** Dr. Zsolt Schram, associate professor, PhD
**Title of course:** Synoptic meteorology 1  
**Code:** TTGBE5515_EN  
**ECTS Credit points:** 3

**Type of teaching, contact hours**
- lecture: 2 hours/week  
- practice: -  
- laboratory: -

**Evaluation:** practice grade

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: -  
- preparation for the exam: 62 hours  
Total: 90 hours

**Year, semester:** 3rd year, 1st semester

**Its prerequisite(s):**

**Further courses built on it:**

---

**Topics of course**

The aim of the course is to provide knowledge on the history of weather forecasting, the principles of modern weather forecasting; possibilities and limits of numeric forecasting of atmospheric processes and up-to-date forecasting models. Modern remote sensing instruments and techniques are presented such as weather radars lighting localization networks and satellite images. Atmospheric processes of different time and special scales with their forecasting methods are discussed as well. Methods of posterior evaluation, verification of weather forecasts based on international recommendations and characteristics of hazardous weather elements are presented as well.

**Literature**

**Compulsory literature:**
G. Lackman: Midlatitude Synoptic Meteorology: Dynamics, Analysis, and Forecasting.  

**Additional literature:**
T. Vasquez: Weather Analysis and Forecasting Handbook Weather Graphics Technologies  

**Schedule:**

1st week – Beginnings of the understanding of atmospheric processes, basic movements of the atmosphere. Scales of atmospheric movements and their processes. Dispersion of kinetic energy input in the atmosphere.


3rd week – Development of wind systems. Hill-valley winds, winds at the banks of waterbodies, air currents over and behind obstacles. Circulation systems of the Earth, the Headly cell, the effects of
Coriolis force. Jets.

4th week – Large scale horizontal eddies of the mid latitudes. The process of cyclone genesis, structures of cyclones and anticyclones, development and termination of cyclones. Air masses.

5th week – Seasonal differences in the weather generated by cyclones and anticyclones. Cyclone families. Cyclone paths. First and second type cold fronts, warm fronts, occluded front. Stationary winter anticyclones.

6th week – Beginnings of synoptic meteorology. Development of weather forecasts based on isobaric systems using extrapolation and analogies. Isobaric formations and their weather patterns.

7th week – Development of the weather observation system. Characteristics of the modern weather observation system. Weather observation telegrams: the SYNOP and the TEMP telegrams.

8th week – Beginnings of numeric prognostics. Elements and resolvability of the quasi deterministic hydro-thermodynamical equation system. Characteristics of the numeric models.

9th week – Interpretation and presentation of ensemble forecasts: the torch and the spaghetti diagram.


11th week – Weather information provided by weather radars and satellites.

12th week – Mathematical background of the quality of forecasts. ME, MAE, RMSE and other statistical parameters and contingency tables.

13th week – Short term forecasting methods. Storm forecasting at the Balaton and hail defense systems. Review of dangerous weather phenomena: characteristics of the tornadoes, tropical cyclones, single cell, multicell and supercell thunderstorms

14th week – Processes of fog development. Characteristics of cold air pools. Imperfections of the weather forecasting models.

Requirements:

- for a signature
  Attendance at lectures is recommended, but not compulsory.

- for a grade
  The course ends in an examination. The exam grade is the result of the examination
  The minimum requirement is 50%. The grade for the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
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<td>fail (1)</td>
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<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Person responsible for course: Dr. Ferenc Wantuch, assistant professor, PhD

Lecturer: Dr. Ferenc Wantuch, assistant professor, PhD
Title of course: Synoptic meteorology 2  
Code: TTGBG5516_EN  
ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -  
- practice: 2 hours/week  
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -  
- practice: 28 hours  
- laboratory: -  
- home assignment: 32 hours  
- preparation for the exam: -
Total: 60 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s): TTGBE5515_EN

Further courses built on it:

Topics of course
The aim of the course is to introduce students into the analyses of weather maps. They analyze surface and three height level weather maps independently during the practice. They interpret the weather situation and draw data, signs and codes into the map. Finally they carry out a front analysis. The final part is the weather lab practice, where students prepare their forecasts and verify them independently.

Literature
Compulsory literature:

Additional literature:

Schedule:
1st week – Identification and verbal analyses of weather patterns using weather maps.
2nd week – Drawing of upper level isohypse charts, height and humidity analyses for the 500 hpa level.
3rd week – Drawing of upper level isohypse charts, temperature analyses for the 500 hpa level.
4th week – Drawing of upper level isohypse charts, height and humidity analyses for the 850 hpa level.
5th week – Drawing of upper level isohypse charts, temperature analyses for the 850 hpa level.
6th week – Drawing of upper level isohypse charts, height and humidity analyses for the 700 hpa level.
7th week – Drawing of upper level isohypse charts, temperature analyses for the 700 hpa level.

8th week – Drawing of surface pressure charts, analyses of isobars and isallobars.

9th week – Identification of formations, areas of high temperature gradients, barotropic and baroclinic areas in surface pressure charts and upper level chart.

10th week – Frontal analyses, individual and teamwork.


12th week – Individual weather forecasting. Justification of the forecasts.

13th week – Verification of the forecasts. Preparation of ME, MAE RMSE and other statistical parameters and contingency tables in a frame of a forecasting competition.

14th week – Complementation of missing charts. Presentation of the completed chart series.

Requirements:
- for a signature

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- for a grade

The course ends in a practice grade.

The minimum requirement is 50%. The grade for the examination is given according to the following table:

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</table>

Person responsible for course: Dr. Ferenc Wantuch, assistant professor, PhD

Lecturer: Dr. Ferenc Wantuch, assistant professor, PhD
Title of course: Aviation meteorology
Code: TTGBG5513_EN
ECTS Credit points: 3

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours
Total: 90 hours

Year, semester: 3rd year, 1st semester

Its prerequisite(s): TTGBE5501_EN

Further courses built on it:

Topics of course
The aim of the course is to introduce students into aviation meteorology what is a special field of meteorology. The following topics are discussed in the frame of the course: weather phenomena what are hazardous for aviation; aviation meteorological telegrams, maps and weather forecasts; methods used in aviation meteorology; demands of aviation from meteorology and daily routine of weather services of aviation controlled by the International Civil Aviation Organization (ICAO).

Literature
Compulsory literature:
International Standards and Recommended Practices, Meteorological Service for International AirNavigation, Annex 3 ICAO

Additional literature:

Schedule:
1st week – Vertical division of the atmosphere, hypoxia. Effects of air temperatures on aviation. The thermic. Characteristics of the state curve.


6th week – Thermal convection, frontal lift, convergence, chimney effect. Types and classification of clouds. Effects of clouds on aviation. Determination of the amount of clouds and the height of cloud base. The highest level of the clouds the cloud top.


9th week – Definition, development conditions and types of icing. Factors what effect on icing of airplanes. Impacts of icing on airplanes and helicopters. Forecasting of icing.


12th week – METAR, TAF, SPECI, LANDING FORECAST coding rules

13th week – SIGMET, AIRMET, GAMET, SNOWTAM, VOLMET, ATIS telegrams.

14th week – Interpretation of meteorological information before flight. Review of the mid latitude significant maps. Review of the maps for different flight heights. High altitude temperature and wind forecast maps.

Requirements:
- for a signature
  Attendance at lectures is recommended, but not compulsory.
- for a grade
  The course ends in an examination. The exam grade is the result of the examination.

The minimum requirement is 50%. The grade for the examination is given according to the following table:

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Person responsible for course: Dr. Ferenc Wantuch, assistant professor, PhD

Lecturer: Dr. Ferenc Wantuch, assistant professor, PhD
Title of course: Basics of computer programming
Code: TTGBG5519_EN

ECTS Credit points: 2

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -
Total: 60 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s): TTGBE5501_EN

Further courses built on it:

Topics of course
The aim of the course is to introduce students into the basics of computer programming. Students get a programming task. They create a programming algorithm and write programs individually in C programming language in the frame the practice. By the end of the course students must be able to read in meteorological data from ASCII file format, to process them, to write results into file and screen; document and present them.

Literature

Compulsory:
- Kernighan, Brian W.; Ritchie Dennis, M.: C programozási nyelv Tankönyv ISBN: 9631605523-

Recommended:

Schedule:
1st week – History of C language. Language tag C, identifiers, constants, string literals, operators. Phases of translation of C programs. The first sample program.
2nd week – Structure of program C. Modules in C language. Types (character, integer, listed, floating point etc.), variables, constants. Sample program. Create and test own program.
3rd week – Operators and terms. Comparative and Logical Operators. Type conversion. Presentation of sample tasks and making own programs.
4th week – Values, Addresses, Indicators. Dynamic memory usage. Presentation of sample tasks and making own programs referring to this theme.
5th week – C language instructions "If" and cycle expressions. Presentation of sample tasks and making own programs by the help of these.
6th week – Return, Break and Continue Instructions.
Presentation of sample tasks and making own programs.
Use of interruption resume and return instructions.

7th week – Arrays, strings and their functions in C language.
Presentation of sample tasks and making own programs.

8th week – Pointers and their use in C language.
Presentation of sample tasks and making own programs.

9th week – Declaring, calling, and return type of C functions. Functions Parameters.
Presentation of sample tasks and making own programs.

10th week – C Librarian Functions and Their Use.
Presentation of sample tasks and making own programs.

11th week – The basics of standard file management in C.
Presentation of sample tasks and making own programs.

12th week – Mathematical functions in C. Error Test.
Examples and making own programs.

13th week – Programming task based on data of meteorological information.
File reading calculation and result file writing.

14th week – Consultation opportunity and submission of the required programming task.

Requirements:
- for a signature
Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- for a grade
The course ends in a practice grade.

The minimum requirement is 50%. the grade for the examination is given according to the following table:

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Person responsible for course: Dr. Ferenc Wantuch, assistant professor, PhD

Lecturer: Dr. Ferenc Wantuch, assistant professor, PhD
Title of course: Global climate change  
Code: TTGBE5511_EN  
ECTS Credit points: 2

Type of teaching, contact hours  
- lecture: 1 hours/week  
- practice: 1 hours/week  
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:  
- lecture: 14 hours  
- practice: 14 hours  
- laboratory: -  
- home assignment: 14 hours  
- preparation for the exam: 18 hours  
Total: 60 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s): TTGBE5501_EN

Further courses built on it:

Topics of course

The aim of the course is to provide up-to-date knowledge on the scientific background of climate change. The following topics are discussed in the frame of the course: research methods of climate change; estimations for the expected changes; reports of the Intergovernmental Panel on Climate Change (IPCC); possible regional impacts of climate change; remote signals of climate anomalies.

Literature

Compulsory literature:  
Additional literature:  

Schedule:  
1st week – The demand for examinations on the background of global changes. Aims, tasks and functioning of the Intergovernmental panel on Climate Change (IPCC).  
2nd week – Contents of IPCC reports. Review on the chapters of the volume on the physical science basis. Main processes of the climate system. Terminology: climate, natural variability of climate, climate change.  
3rd week – Observed climate change and variability 1: Observed changes in the surface temperatures during the last 200 years. Changes in higher atmospheric layers. Changes in parameters related to temperatures. Changes in the temperatures before the observations. Observed trends in the changes of the temperatures in Hungary.  
4th week – Observed climate change and variability 2: Observed changes in the precipitation during the last 200 years. Changes in higher atmospheric layers. Changes in parameters related to precipitation and air humidity. Changes in the precipitation before the observations. Observed
trends in the changes of the amount of precipitation in Hungary.


6th week – Atmospheric chemistry and greenhouse gases: methane, nitrous oxide, the CFCs and tropospheric ozone. Global emission scenarios (SRES scenarios) and their basic outcomes.

7th week – Atmospheric aerosols and their direct and indirect effects: feedback mechanisms. Radiation forcing on the climate change: radiation forcing of the greenhouse gases, decrease of stratospheric ozone, the stratospheric aerosol, changes in the surface albedo and changes in the intensity of solar radiation. Spatial pattern of radiation forcing on the earth’s surface. Radiation forcing in the past and present

8th week – Physical processes in the earth’s system and their feedbacks: atmospheric, marine, continental and cryospheric processes, their feedbacks and consequences.

9th week – Modell estimations: development and types of climate models. Problems and limits of climate models. Forecasting future climates: comprehension of the outcomes of different models for air temperatures and precipitation.


13th week – Possible impacts of climate change. Strategies for adaptation and mitigation measures. Hungarian examinations in the field of climate change.

14th week – End test.

Requirements:
Attendance at lectures is recommended, but not compulsory.
Attendance at practice is compulsory.

- for a grade
The course ends in an examination. The exam grade is the result of the examination.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

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</table>

Person responsible for course: Dr. István Lázár, assistant professor, PhD

Lecturer: Dr. István Lázár, assistant professor, PhD
Title of course: Meteorological field measurements
Code: TTGBE5518_EN
ECTS Credit points: 2

Type of teaching, contact hours
- lecture: 1 hours/week
- practice: 1 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: 14 hours
- practice: 14 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -
Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):
Further courses built on it: TTGBE5502_EN

Topics of course
The aim of the course is to introduce students into the methodology of meteorological field measurements. In the frame of the course students are introduced into the theoretic background, the methods and techniques of the preparation works and execution of meteorological field measurements. Field survey, measurement techniques, database building, data processing, evaluation and presentation methods are discussed as well. Students carry out their own meteorological field measurements in different topics (forest microclimate, urban climate, etc.) They take field trips to meteorological and climatological observatories.

Literature
Compulsory literature:
Additional literature:

Schedule:
1st week – Introduction: terminology used in local climatology.
2nd week – Characteristics of local climates.
3rd week – Development of the local climate conception.
4th week – Development of the methods used in local climatology.
5th week – Preparation activities before local climate measurements.
6th week – Methods and instruments of local climate measurements 1.
7th week – Methods and instruments of local climate measurements 2.
8th week – Additional examinations for description of local climate 1: micro precipitations.
9th week – Additional examinations for description of local climate 2: plant phenological observations.
10th week – Additional examinations for description of local climate 3: Frost mapping.
11th week – Additional examinations for description of local climate: cloud observations.
12th week – Interpretation of the results of local climate measurements 1.
13th week – Interpretation of the results of local climate measurements 2.
14th week – End test.

**Requirements:**
Attendance at **lectures** is recommended, but not compulsory.
Attendance at **practice** is compulsory.

- **for a grade**
The course ends in an **examination**. The exam grade is the result of the examination.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

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</tr>
</tbody>
</table>

**Person responsible for course:** Dr. Sándor Szegedi, associate professor, PhD

**Lecturer:** Dr. Sándor Szegedi, associate professor, PhD
Title of course: Meteorological instruments  
Code: TTGBL5508_EN  
ECTS Credit points: 2

Type of teaching, contact hours  
- lecture: -  
- practice: 2 hours/week  
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:  
- lecture: -  
- practice: 28 hours  
- laboratory: -  
- home assignment: 32 hours  
- preparation for the exam: -

Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): TTGBE5501_EN

Further courses built on it:

Topics of course
The aim of the course is to introduce the students of the course into the methods of climatological data collection, data base building and management; data processing, analyses and presentation. The course enables students to prepare and analyze climate diagrams, to recognize climate types and characterize the climate zones of the Earth. The following topics are discussed in the frame of the course: collection of climatological data; data base building and management; data processing, data screening methods, conversions between measures, presentation of datasets in diagrams; preparation and analyses climate diagrams; identification of climate types using Walter-Lieth diagrams; description of the climate zones of the Earth.

Literature
Compulsory literature:  

Additional literature:  
WMO GUIDE TO METEOROLOGICAL INSTRUMENTS AND METHODS OF OBSERVATION. WMO-No. 8 (Seventh edition) 6 August 2008  

Schedule:  
1st week – History of meteorological measurements.  
2nd week – The World Meteorological Organization (WMO).  
3rd week – The WMO classification of meteorological observatories.  
4th week – Weather station classification system of the Hungarian Weather Service (OMSZ).
Terminals of meteorological measurements. Types of meteorological instruments.
5th week – Instruments and methods of the measurement of temperature.
6th week – Instruments and methods of actionometry.
7th week – Instruments and methods of air pressure measurements.
8th week – Instruments and methods of the measurement of air humidity.
10th week – Instruments and methods of the measurement of precipitation. Observation methods of cloud cover.
11th week – Instruments and methods of the measurement of wind directions and wind speeds. Visibility measurements.
13th week – Meteorological satellites.
14th week – Use of remote sensed data and satellite images in weather forecasting. Evaluation of advantages disadvantages and hazards during the construction and working different technology, size and capacity hydropower plants.

Requirements:
- for a signature
  Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.
- for a grade
  The course ends in a practice grade.
  The minimum requirement is 50%. The grade for the tests and the examination is given according to the following table:

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</table>

Person responsible for course: Dr. István Lázár, assistant professor, PhD

Lecturer: Dr. István Lázár, assistant professor, PhD
Title of course: Agrometeorology
Code: TTGBE5517

ECTS Credit points: 3

Type of teaching, contact hours
- lecture: 1 hours/week
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: 14 hours
- practice: 28 hours
- laboratory: -
- home assignment: 48 hours
- preparation for the exam: -
Total: 90 hours

Year, semester: 2nd year, 2nd semester

Its prerequisite(s): TTGBE5501, TTGBE5502

Further courses built on it: -

Topics of course
The series of lectures are based on the topics of technical drawing and mechanics. It reviews the fundamental relations of the sizing procedure of machineries (stress analysis for static combined loads; dimensioning on strength at harmonically varying loads, fatigue and life of members) and the concept of manufacturing tolerance and fitting. After that it deals with connections between components (connection with force transmission by friction, positive connections, bolted joints, weldings), gaskets, elastic connections (metal springs, rubber springs) beds for machine eg. rolling bearings, plain journal bearings. In the laboratory, being connected with the lectures machine elements are studied and tests of them are carried out. In seminars there are two design tasks to elaborate: a welded machinery base, and a hydraulic cylinder.

Literature
Compulsory:
  ISBN-10: 1107145627

Recommended:

Schedule:
1st week – History of C programming language. Set of symbols, identifiers, constants, string literals operators of C language. Phases of the translations of C programs. The first sample program.

2nd week – Structure of the C program. Modules in the C language. Types (character, integrate, listed, floating point), variables, constants. Sample program. The students write their own program and test it.

3rd week – Operators and expressions. Comparative and logical operators. Type conversions. Presentation sample tasks and individual program writing.
4th week – Values, addresses, indexes, dynamic memory use.
Presentation sample tasks and individual program writing.

5th week – Statements of C language. The “if” statement and cycle statements.
Presentation sample tasks and individual program writing.

6th week – The “break”, “continue” and “return” statements.
Presentation sample tasks and individual program writing.

7th week – Blocks and strings and their functions.
Presentation sample tasks and individual program writing.

8th week – Indexes and their usage.
Presentation sample tasks and individual program writing.

9th week – Declaration, calling and return types of functions. Parameters of the functions.
Presentation sample tasks and individual program writing.

10th week – Library functions and their usage.
Presentation sample tasks and individual program writing.

11th week – Basics of standard file management.
Presentation sample tasks and individual program writing.

12th week – Mathematical functions, error handling.
Presentation sample tasks and individual program writing.

13th week – Achievement of the programming task on the base of meteorological measurements with opportunity for consultation.

14th week – Opportunity for consultation, and presentation of the programs written by the students.

Requirements:
Attendance at lectures is recommended, but not compulsory.
Attendance at practice is compulsory.

- for a grade
The course ends in an examination. The exam grade is the result of the examination.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

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Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD

Lecturer: Dr. Sándor Szegedi, associate professor, PhD
**Title of course:** Climate of the Earth  
**Code:** TTGBE5512_EN  
**ECTS Credit points:** 3

<table>
<thead>
<tr>
<th><strong>Type of teaching, contact hours</strong></th>
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<tbody>
<tr>
<td>- lecture: 2 hours/week</td>
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<tr>
<td>- practice: -</td>
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<tr>
<td>- laboratory: -</td>
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</table>

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours  
- practice: -  
- laboratory: -  
- home assignment: -  
- preparation for the exam: 62 hours  
Total: 90 hours

**Year, semester:** 2nd year, 1st semester

**Its prerequisite(s):** TTGBE5501_EN

**Further courses built on it:**

**Topics of course**
The aim of the course is to provide knowledge on the forming factors and features of the climate of the continents and their climate related environmental problems. The course deals with the following topics: overview of the factors that form the climate of the Earth: the role of solar radiation, surface material and energy transport processes in forming climate; the climate of Europe, Asia, Africa, North and South America, Australia and the Antarctica: the effects of climate forming factors, temporal and spatial patterns of climate elements in the continents; special features and environmental issues of the climate of the continents: impacts of relief, desertification in Africa, Asia and Australia; the monsoon; tropical cyclones in North America and over the Pacific; tropical deforestation; melting polar ice caps.

**Literature**

**Compulsory literature:**

**Additional literature:**

**Schedule:**

1st week – Introduction: definition of regional climatology. Its position within the system of sciences, its subject and methods.

2nd week – Review of the climate forming factors of the Earth: role of solar radiation, the surface and surface energy transport processes in the formation of climates.

3rd week – The climate of Europe 1: passive and active factors that form the climate of the continent.
4th week – The climate of Europe 2: spatial and temporal patterns of the climate parameters in Europe.

5th week – The climate of Europe 3: Climatic regions of Europe.

6th week – The climate of Asia 1: passive and active factors that form the climate of the continent.


8th week – The climate of Africa 1: passive and active factors that form the climate of the continent.


10th week – The climate of North America 1: passive and active factors that form the climate of the continent.


12th week – The climate of Central and South America: passive and active factors that form the climate of the continent, spatial and temporal patterns of the climate parameters in the continents. Special climate phenomenon: the ENSO.

13th week – The climate of Australia: passive and active factors that form the climate of the continent, spatial and temporal patterns of the climate parameters in the continent. Special climate phenomenon: droughts caused by ENSO.

14th week – Climate of the polar regions: passive and active factors that form the climate of the continent, spatial and temporal patterns of the climate parameters in the polar regions.

Requirements:
Attendance at lectures is recommended, but not compulsory.

- for a grade
The course ends in an examination. The exam grade is the result of the examination.

The minimum requirement is 50%. The grade for the tests and the examination is given according to the following table:

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<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-64</td>
<td>pass (2)</td>
</tr>
<tr>
<td>65-79</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>80-89</td>
<td>good (4)</td>
</tr>
<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD

Lecturer: Dr. Sándor Szegedi, associate professor, PhD
<table>
<thead>
<tr>
<th><strong>Title of course:</strong> Climate history</th>
<th><strong>ECTS Credit points:</strong> 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code:</strong> TTGBE5514_EN</td>
<td></td>
</tr>
</tbody>
</table>

**Type of teaching, contact hours**
- lecture: 2 hours/week
- practice: 1 hours/week
- laboratory: -

**Evaluation:** exam

**Workload (estimated), divided into contact hours:**
- lecture: 28 hours
- practice: 14 hours
- laboratory: -
- home assignment: 28 hours
- preparation for the exam: 50 hours

Total: 120 hours

**Year, semester:** 2nd year, 1st semester

**Its prerequisite(s):** TTGBE5501_EN

**Further courses built on it:**

**Topics of course**
The aim of the course is to provide knowledge on short term climate changes of the historic ages and their effects historic events. The aim of the course is to examine the connections between climate and history from climatological aspect as well. The course deals with the following topics: geologic, archeologic historical and meteorological methods and sources, data processing techniques of historical climate reconstruction; reasons and evidences of short time scale fluctuations of climate, characteristics of the climate of the geological ages; human adaptation to ice age environment; characteristics of the climate of historic ages from the ancient civilizations to present with special respects to those areas and periods where and when changes of the climate had a direct impact on historic events.

**Literature**

**Compulsory literature:**

**Additional literature:**

**Schedule:**

1st week – Subject, methods and position of climate history within the system of sciences.
2nd week – Scientific and archaeological methods used in climate historical research.
3rd week – Historical evidences of climate historical research.
4th week – Methods of the processing of historical sources of climate historical research.
5th week – Possible causes and evidences of short term fluctuations of climate
6th week – Brief review of the climate of the geological ages.
7th week – Adaptation of mankind to the ice age environment.
8th week – Fluctuations of climate during the times of the early civilizations.
9th week – Fluctuations of climate during the ancient Greek and Roman times.
10th week – Fluctuations of climate during the age of the great migrations in the early mediaeval period.
11th week – The medieval optimum climate period.
12th week – Characteristics of the climate of the 14th-15th centuries
13th week – The little ice age.
14th week – Fluctuations of climate during the 19th-20th centuries.

Requirements:
 Attendance at lectures is recommended, but not compulsory.

- for a grade
 The course ends in an examination. The exam grade is the result of the examination.
 The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
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<tr>
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<td>80-89</td>
<td>good (4)</td>
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<tr>
<td>90-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD
Lecturer: Dr. Sándor Szegedi, associate professor, PhD
Title of course: Environmental Climatology
Code: TTGBE5514_EN

ECTS Credit points: 3

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment:
- preparation for the exam: 62 hours
Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): TTGBE5501_EN

Further courses built on it:

Topics of course
The aim of the course is to provide knowledge on local and micro scale climate phenomena; the special climate of simple and complex surfaces (deserts, water bodies and ice surfaces); climate phenomena that occur at the border between surfaces of different physical types (water banks, sloping surfaces, etc.); climate of plant stands (low plant stands and forests); urban climate: its forming factors, main features and impacts on human comfort, mitigation of adverse effects of urban climate. The course deals with the meteorological aspects of air pollution as well.

Literature
Compulsory literature:

Additional literature:

Schedule:
1st week – Spatial and temporal characteristics of climatological scales.
4th week – Climate of unvegetated surfaces 1: Characteristics of the climate of sand deserts and water bodies.
5th week – Climate of unvegetated surfaces 2: Characteristics of the climate of snow and ice
surfaces.

6th week – Climate of plant stands: characteristics of the climates of vegetated surfaces (grasslands, low agricultural plant stands, orchards and forests).

7th week – Climate phenomena that occur at the border between surfaces of different physical types (water banks, sloping surfaces, etc.).


9th week – Urban climatology 2: the role of the alterations of urban surfaces in the development of local climate.


11th week – Urban climatology 4: urban water budget and its effects on energy budgets of urban surfaces.

12th week – Urban climatology 5: Changes of the climate elements in urban spaces: the air humidity, precipitation and air movements.


14th week – Diffusion climatology: meteorological issues of air pollution.

Fluctuations of climate during the 19th-20th centuries.

**Requirements:**
Attendance at lectures is recommended, but not compulsory.

*for a grade*

The course ends in an examination. The exam grade is the result of the examination.

The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
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<tbody>
<tr>
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</tr>
</tbody>
</table>

**Person responsible for course:** Dr. Sándor Szegedi, associate professor, PhD

**Lecturer:** Dr. Sándor Szegedi, associate professor, PhD
**Title of course:** Statistical Climatology  
**Code:** TTGBG5509_EN  
**ECTS Credit points:** 5

**Type of teaching, contact hours**  
- lecture: 2 hours/week  
- practice: 2 hours/week  
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**  
- lecture: 28 hours  
- practice: 28 hours  
- laboratory: -  
- home assignment: 54 hours  
- preparation for the exam: 40 hours  
Total: 150 hours

**Year, semester:** 2nd year, 1st semester

**Its prerequisite(s):** TTGBE5501_EN

**Further courses built on it:**

**Topics of course**  
The aim of the course is to introduce students into the most important methods of statistical climatology. The following topics are discussed in the frame of the course: description of climatological time series using different distributions: distribution and density functions of the length of solar irradiance, global irradiance, temperature, the amount of precipitation, wind speed, relative humidity; discrete climate probability variables: number of rainy days, diurnal changes of wind directions, number of threshold days etc.; correlation and regression analyses: definition, form and tightness of stochastic relationships; simple linear correlation and regression (SLCR); nonlinear regressions reducible to SLCR, the measures of their tightness; significance of the tightness of correlations; multiple linear correlation and regression; significance of the multiple linear correlation coefficient; statistical probes.

**Literature**  
Compulsory literature:  

Additional literature:  

**Schedule:**  
1st week – Objects, tasks and methods of statistical climatology.  
2nd week – The statistical sample. Main issues of statistical sampling.  
3rd week – Statistical functions: mean, standard deviation, corrected standard deviation, raw and central moments, median, lower and upper quantiles, mode, range, skewness, kurtosis.  
4th week – Characteristics of the statistical distribution and density functions.
5th week – Characteristics of discrete distributions. Most frequent distributions in meteorology and climatology: binomial, geometric, hypergeometric and Poisson distributions.


7th week – Characteristics of continuous distributions. Most frequent continuous distributions in meteorology and climatology 2: the gamma, the Weibull, the Rayleigh and the Gumbel distributions.

8th week – Statistical hypothesis testing 1: definition of a statistical hypothesis, tests for examinations of the parameters of the probability variables (U test, T tests, Welch test, F test).

9th week – Statistical hypothesis testing 2: tests for examinations of the distribution of the probability variables ($\chi^2$ test, Kolmogorov-Smirnov test).

10th week – Homogeneity and independence examinations using the $\chi^2$ test.

11th week – Definition of stochastic relationship. Measures of the correlation of stochastic relationships, regression equations that determine the shape of the relationship. The concept of simple linear correlation relationship (SLCR).

12th week – Nonlinear regressions reducible to SLCR, measure of their correlation and their significance.

13th week – The concept of multiple linear correlation and regression (MLCR). Significance of the multiple linear correlations.


Requirements:
- for a signature

Attendance at lectures is recommended, but not compulsory.

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- for a grade

The course ends in a practice grade.

The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
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<td>excellent (5)</td>
</tr>
<tr>
<td><strong>Person responsible for course:</strong></td>
<td>Dr. István Lázár, senior lecturer PhD</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td><strong>Lecturer:</strong></td>
<td>Dr. István Lázár, senior lecturer PhD</td>
</tr>
<tr>
<td><strong>Title of course:</strong> Geoecology</td>
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<tr>
<td><strong>Code:</strong> TTGBE6011_EN</td>
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<tr>
<td><strong>ECTS Credit points:</strong> 3</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Type of teaching, contact hours</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 1 hours/week</td>
</tr>
<tr>
<td>- practice: 2 hours/week</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
</tbody>
</table>

| **Evaluation:** mid-semester grade  |

<table>
<thead>
<tr>
<th><strong>Workload (estimated), divided into contact hours:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- lecture: 14 hours</td>
</tr>
<tr>
<td>- practice: 28 hours</td>
</tr>
<tr>
<td>- laboratory: -</td>
</tr>
<tr>
<td>- home assignment: 18 hours</td>
</tr>
<tr>
<td>- preparation for the exam: 30 hours</td>
</tr>
</tbody>
</table>

| **Total:** 90 hours                               |

| **Year, semester:** 2nd year, 1st semester     |

| **Its prerequisite(s):** Soil geography TTGBE6001_EN |

| **Further courses built on it:** Landscape ecology TTGBE6008_EN |

<table>
<thead>
<tr>
<th><strong>Topics of course</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The aim of the course is to introduce students into the theory and practice of analyzing spatial patterns and mosaics of natural ecosystems shaped by abiotic factors (heat, light, water, relief, soil, base rock, etc.). The characteristics of local biogeochemical cycles especially of water and coal, and the geoecological characterization of typical of habitats in Central Europe. Geoecological studies and their space-time scale. The practical part of the course is to know the most important geo-ecological factors in field data collection, sampling and measurement methods. It is an indispensable prerequisite for indicating the living phenomena required for field sampling methods, for the interpretation, representation and analysis of field data. Introduction into the methods of field data collection, sampling and measurements. The possibilities of data processing, depicting, interpretation and analysis. Mapping of ecosystems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compulsory:</strong></td>
</tr>
<tr>
<td><strong>Recommended:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Schedule:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>lectures</strong></td>
</tr>
<tr>
<td>1st week</td>
</tr>
<tr>
<td>Subject of geoecology. Approaches, research methods.</td>
</tr>
<tr>
<td>2nd week</td>
</tr>
<tr>
<td>Time-space scale of geoecological studies. Ecotops as units of geoecological studies.</td>
</tr>
<tr>
<td>3rd week</td>
</tr>
<tr>
<td>Role of topography and morphology of the surface in shaping of ecotops.</td>
</tr>
<tr>
<td>4th week</td>
</tr>
</tbody>
</table>
Local water cycles of ecotops.
5th week
Local carbon cycles of ecotops.
6th week
Local cycles of main plant nutrients and microelements in ecotops.
7th week
Functioning of ecotops. Types of Central European ecotops.
8th week
Peatlands and bogs and their typical processes.
9th week
Fluvial and riverine ecotopes.
10th week
Grassland ecotops on plain landscapes. Differences according the parent material of soils.
11th week
Forests and forest steppe ecotops in plain landscapes. Interactions with groundwater table.
12th week
Sloping forested ecotops and functioning. Effects of base rock quality.
13th week
Lacustrine ecotops.
14th week
Mapping of spatial pattern of ecotop-complexes.

practice
1st week
Sampling designe, orientation with sampling tools in the field.
2nd week
Evaluation of landforms, topography and morphology.
3rd week
Mapping of base rock and parent material diversity.
4th week
Soil sampling of surface samples, field evaluation. Soils field data collection.
5th week
Groundwater sampling. Tools, methods, field practice, database evaluation.
6th week
Sampling of vegetation I. Grasslands. Data collecting, evaluation.
7th week
Sampling of vegetation I. Forests. Data collecting, evaluation.
8th week
Sampling of animal communities. I. Insects.
9th week
Sampling of animal communities. II. Vertebrates.
10th week
Ecotop mapping. Delineation of habitats and ecotops.
11th week
Compilation of geoecological maps based on field data collection.

12th week
Application of databases from maps and remote sensed data in ecotope mapping.

13th week
Evaluation of geoecological surveys from conservational point of view and regarding the ecosystem services.

14th week
Mapping and evaluation of ecosystem interactions and networking.

Requirements:
- for a signature
  Attendance at lectures is recommended, but not compulsory.
- for a grade
  During the semester students have to write an essay dealing with a selected subject of course focussing attention on their home country.

The course ends in a written examination. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:
- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-74</td>
<td>satisfactory (3)</td>
</tr>
<tr>
<td>75-87</td>
<td>good (4)</td>
</tr>
<tr>
<td>88-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

Person responsible for course: Dr. Tibor Novák, associate professor, PhD

Lecturer: Dr. Tibor Novák, associate professor, PhD
Title of course: GIS fieldwork and mapping
Code: TTGBL7023_EN
ECTS Credit points: 4

Type of teaching, contact hours
- lecture: -
- practice: 4 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 56 hours
- laboratory: -
- home assignment: 64 hours
- preparation for the exam: -
Total: 120 hours

Year, semester: 3rd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course
The theory of the geoid and its important measurable parameters. Overview of national and international map projections. Horizontal measurements, the theory of triangulation, the structure of the horizontal baseline network. Types of altitude measurements. Structure of the elevation baseline network and persistence of the points. The main parts of geodetic field surveyor instruments for horizontal and altitude measurements, the principle of their operation, their practical use. Processing, mapping and analysis of field data in a software environment. Theory and practice of Global Positioning System.

Literature

Schedule:
1st week – Introduction
2nd week – Basics of field surveying
3rd week – Field survey methods – the classical methods
4th week – Field survey with classical surveying equipment – the levelling surveyor
5th week – Field survey with classical surveying equipment – the theodolite
6th week – Field survey methods –contemporary methods
7th week – Field survey with modern surveying equipment – the GPS
**8th week** – Mid-term test. Field survey with modern surveying equipment – the total station

**9th week** – Field survey with modern surveying equipment – the terrestrial laser scanner

**10th week** – Processing of collected data – I.

**11th week** – Processing of collected data – II.

**12th week** – Editing maps from collected data – I.

**13th week** – End-term test. Editing maps from collected data – II.

**14th week** – Questions

### Requirements:

- **for a signature**

  Attendance at classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks, drawing instruments and calculator of the course to each practice class.

- **for a grade**

  Students have to submit a homework, which contains a self-surveyed and mapped area or object with description, in a document. The grade based on the quality of this paper. During the semester there are two tests: the mid-term test in the 8th week and the end-term test in the 13th week. The final grade is calculated as an average of the grades of the tests. The minimum requirement for the mid-term and end-term respectively is 50%. Based on the score of the tests separately, the grade for the tests is given according to the following table:

<table>
<thead>
<tr>
<th>Score (%)</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>fail (1)</td>
</tr>
<tr>
<td>50-59</td>
<td>pass (2)</td>
</tr>
<tr>
<td>60-74</td>
<td>satisfactory (3)</td>
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<tr>
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<td>good (4)</td>
</tr>
<tr>
<td>87-100</td>
<td>excellent (5)</td>
</tr>
</tbody>
</table>

If the score of any test is below 50, students can take a retake test in the 14th week. If the score of test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

**Person responsible for course:** Dr. Gergely Szabó, assistant professor, PhD

**Lecturer:** Dr. Gergely Szabó, assistant professor, PhD
**Title of course:** Principles of database management in earth sciences  
**Code:** TTGBL7012_EN  
**ECTS Credit points:** 2

**Type of teaching, contact hours**
- lecture: -
- practice: 2 hours/week
- laboratory: -

**Evaluation:** mid-semester grade

**Workload (estimated), divided into contact hours:**
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 16 hours
- preparation for the exam: 16 hours
Total: 60 hours

**Year, semester:** 2nd year, 1st semester

**Its prerequisite(s):** -

**Further courses built on it:** -

**Topics of course**


**Literature**
- [http://web.mef.hr/web/images/pdf/ms_o_exc.pdf](http://web.mef.hr/web/images/pdf/ms_o_exc.pdf)
- [https://www.saylor.org/site/textbooks/How%20to%20Use%20Microsoft%20Excel.pdf](https://www.saylor.org/site/textbooks/How%20to%20Use%20Microsoft%20Excel.pdf)

**Schedule:**

1st week – Introduction to the course
2nd week – Introduction to the methods of hydrological and hydro-meteorological data collection.
3rd week – Data collection from yearbooks
4th week – Joint data
5th week – Grouping, debugging and fixing. Use of debugging statements I.
6th week – Grouping, debugging and fixing. Use of debugging statements II.
7th week – Application of enhanced conditional statements
8th week – Data analysis tools, validation menu, drop-down lists, error messages.
9th week – Practical test I.
10th week – Cross-reference between data sheets
11th week – Data tabulation, sub-total compositions
12th week – Complex and special filtering. Diagram templates.
13th week – Summary of the semester knowledge. Practice for the Practical test II.
14th week – Practical test II.

Requirements:
Participation at classes is compulsory. A student must attend the courses and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.
During the semester there is two practical test. First is at 9th week then second is at 14th week.
The minimum score is 50%. Based on the score of the test, the grade for the test is given according to the following table:

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</table>

Person responsible for course: Judit Kissné-Boda, assistant lecturer

Lecturer: Judit Kissné-Boda, assistant lecturer
          László Bertalan, assistant lecturer