UNIVERSITY OF ZAGREB – FACULTY OF GEODESY

GRADUATE PROGRAMME OF STUDIES OF GEODESY AND GEOINFORMATICS

Zagreb, March 15, 2005
At the 87th special meeting of the Teaching Staff at the Faculty of Geodesy University of Zagreb, held on 10th March 2005, the following proposal for graduate programme of studies of Geodesy and Geoinformatics was passed.

Dean of the Faculty of Geodesy

Prof. Dr. Zdravko Kapović
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1. INTRODUCTION

Croatia has a rather long tradition of higher education. The textbook written by Martin Sabolović *Exercitationes Gaeodeticae*, printed in 1775, brings evidence in this respect. The first diplomas that young graduates were presented certifying that they passed all necessary exams to acquire academic degree and authorizations to act as surveyors were handed in 1811. The students who have graduated from the today’s Faculty of Geodesy, University of Zagreb are highly acknowledged experts in Croatia and abroad.

Graduate engineers of geodesy have never had any difficulties in getting employed, and the present situation in the work market indicates that each of 40 annually graduating engineers finds adequate job immediately. Private firms and the public sector grant scholarships and stimulate students in other ways in order to provide high-quality experts for themselves. Scientific work and its connection with the teaching process have influenced the introduction of new cognitions into the teaching activity. In the periods shorter than 10 years, the Faculty of Geodesy has made more significant changes of this curriculum. In this context, this change makes a logical continuation being supplemented with the adaptation of the studies to the Bologna Declaration processes.

The previous curriculum changes at the Faculty of Geodesy have mostly been influenced by the university curricula from Central and Western Europe where the role of surveyors in the society is similar (Austria, Germany, Switzerland…). Thus, this curriculum can also be compared with the curricula at TU Graz, ETH Zurich and TU Delft.

The curriculum change that introduced significant alteration in teaching processes was carried out in 1978. The next new curriculum was adopted in 1985, and the last more important change of the curriculum happened in 1994 with smaller changes carried out in 2001.

Public institutions and the private sector are interested in the initiation of such a curriculum (State Geodetic Administration, Croatian Geodetic Institute, Hydrographic Institute of the Republic of Croatia, Croatian Chamber of Architects and Civil Engineers). The cooperation will be realized through the participation of skilled professionals in the teaching process, but also in the practical training of students in these institutions.
2. GENERAL PART

2.1 The name of the studies

We suggest that undergraduate, graduate and postgraduate studies get the name:

GEODESY AND GEOINFORMATICS

2.2 Holder and performer of the studies

Holder and performer of the studies is:

UNIVERSITY OF ZAGREB, FACULTY OF GEODESY

2.3 Duration of studies

The undergraduate studies last 3 years (6 semesters), the graduate studies 2 years (4 semesters) and postgraduate studies 3 years (6 semesters).

2.4 Admission terms

The terms of admission to the undergraduate studies are ruled by Laws, along with the credits gathered at the entrance exam.

To be admitted at the graduate studies of GEODESY AND GEOINFORMATICS it is necessary to have the diploma of undergraduate studies of GEODESY AND GEOINFORMATICS. There is a possibility to enrol at these studies with the diploma of some other adequate undergraduate studies, which is to be decided by the Faculty Council of the Faculty of Geodesy.

To enrol at the postgraduate studies of GEODESY AND GEOINFORMATICS, one needs a diploma of the graduate studies of GEODESY AND GEOINFORMATICS or any other studies from the same scientific area.

2.5 Undergraduate studies

After graduating from the undergraduate studies, one becomes competent in solving professional jobs in the following activities:

1. Determination of the Earth’s size and shape and measurement of all data necessary for defining the size, position, shape and contours of an part of the Earth, and their changes.
2. Placement and positioning of objects in space and time, and other engineering works on, above or under the Earth’s surface.
3. Production and updating of plans, maps and other documents.
4. Gathering and application of spatial data using close range methods, and aerial and satellite survey.
5. Determining the position of public and private land boundaries, including national and international borders, and recording the land in adequate registers.
6. Maintenance of geoinformation systems (GIS), and gathering and storing data in these systems.
7. Visualisation and communication by means of maps and mobile digital devices.
8. Assessment of values and real estate management, either urban or rural area, land or buildings.
9. Familiarity with geospatial services for various user groups. While performing the above-mentioned activities, surveyors/geoinformation collaborators take relevant legal, economic and social viewpoints into consideration that affect every single geodetic project.

Training programs for job performance:
- Geodetic surveyor
- GIS-collaborator
- Cadastral surveyor
- Collaborator in photogrammetry
- Collaborator in cartography
- Collaborator in hydrography

Students could attend the graduate curriculum of GEODESY AND GEOINFORMATICS at the Faculty of Geodesy and the following programmes at other faculties of the University of Zagreb, or in the Republic of Croatia or abroad:

- civil engineering, architecture, law, economy, agriculture, forestry.

2.6 Graduate studies

After graduating from the GEODESY AND GEOINFORMATICS graduate studies, the following competencies in solving professional and scientific problems are acquired:

1. Determination of the size and shape of the Earth and measuring all the data necessary to define the size, position, shape and contours of any part of the Earth and their more significant changes.
2. Placement and position determination of objects in space, monitoring the position of natural and man-made objects in space and time, and other engineering works on, above or under the Earth’s surface.
3. Development, testing and calibrating of geodetic instruments and sensors.
4. Designing, production and updating of plans, maps and other documents.
5. Gathering and application of spatial data using close-range, aerial and satellite survey methods, and automation of these processes.
6. Determination of public and private land boundaries, including national and international borders, and recording the land in adequate registers.
7. Designing, establishing and updating geoinformation systems (GIS), and gathering, storing, analysing, managing and distributing data.
8. Analysing, interpreting, and integrating spatial objects and phenomena, and their visualisation and communication by means of maps and mobile digital devices.
9. Studying natural and social environments, survey of land and sea resources, application of data in planning the development of urban, rural and regional areas.
10. Planning, development and renewal of real estates, and value assessment and real estate management, either urban or rural areas, land or buildings.
11. Planning, measurement and management of buildings, including cost assessment.
12. Development of geospatial services adapted to various user groups.

In performing the above-mentioned activities, geodesists/geoinformation engineers take relevant legal, economic, ecological and social viewpoints affecting each single geodetic project.
Training program for performing the jobs:

- Licensed engineer of geodesy
- Geoinformation operator
- GIS-analyst
- Head of geodetic/geoinformation project
- Supervisor of geodetic/geoinformation project
- Spatial information manager
- Cartographer
- Photogrammetrist
- Real estate assessor
- Cadastre planner
- Hydrographer
- Geodetic supervisor
- Court appointed expert for geodetic jobs
- Geodetic entrepreneur

A graduate engineer of geodesy and geoinformatics is an expert with university qualification and technical experience to:

- determine, present and measure the position of portions of land, three-dimensional objects, fields and trajectory on a scientific basis;
- gather and evaluate land information and geoinformation, and to apply this information for the purpose of planning and managing the land, sea and structures, as well as the objects on them;
- encourage the improvement and development of the above stated activities.

The undergraduate studies of GEODESY AND GEOINFORMATICS are sufficient in order to attend the programme.

2.7 Professional or academic title or degree acquired after graduating from the studies

After graduating from the studies one acquires the academic degree according to the Law with the supplement:

IN GEODESY AND GEOINFORMATICS
3. PROGRAMME DESCRIPTION

3.1 The list of obligatory and optional subjects with the number of active teaching hours needed for their execution, and with the number of ECTS credits

UNDERGRADUATE STUDIES OF GEODESY AND GEOINFORMATICS

Ist Semester

<table>
<thead>
<tr>
<th>Subject</th>
<th>Lectures</th>
<th>Exercises</th>
<th>Examination</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Beban-Brkić, J. Analytical Geometry and Linear Algebra</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2. Zadelj-Martić, V. Mathematical Analysis</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>3. Brkić, M. Physics</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>4. Barković, D., Vučetić, N. Basics of Geoinformatics</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>5. Lasić, Z. Geodetic Instruments</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Optional Špoljarić, D. Basics of Informatics</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Kapović, Z., Džapo, M. Introduction into Geodesy</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Mraović, B. Business Communication</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>From the other faculty</td>
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<tr>
<td>Total</td>
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<td>12(11)</td>
<td>5</td>
<td>30</td>
</tr>
</tbody>
</table>

L = Lectures, E = Exercises, Ex = Examination
Note: 2 ECTS credits are chosen in optional courses

Vranić, Z.: Sports 0+2

IInd Semester

<table>
<thead>
<tr>
<th>Subject</th>
<th>Lectures</th>
<th>Exercises</th>
<th>Examination</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Radović, N. Computer Geometry</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2. Vučetić, N. Programming</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>3. Džapo, M. Land Surveying</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>4. Barković, D. Field Measurements</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>5. Feil, L. Analysis and Processing of Geodetic Measurements</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Optional Fučkan-Držić, B. Basics of English for Special Purposes</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Fučkan-Držić, B. Basics of German for Special Purposes</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Radović, N. Spherical Trigonometry</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Josipović, T. Principles of Land Registry Law</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
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<tr>
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<td></td>
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<tr>
<td>Total</td>
<td>12(13)</td>
<td>14(13)</td>
<td>6</td>
<td>30</td>
</tr>
</tbody>
</table>

Note: Altogether 3 ECTS are chosen in optional courses

Vranić, Z.: Sports 0+2
### IIIrd Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>L</th>
<th>E</th>
<th>Ex</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Medak, D.</td>
<td>Databases</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Beban-Brkić, J.</td>
<td>Differential Geometry</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Roić, M.</td>
<td>Cadastre</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Ivković, M.</td>
<td>Geodetic Plans</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Mraović, B.</td>
<td>Introduction into Information Society</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

| Optional | Fučkan-Držić, B. | English in Geodesy | 1 | 1 | 1 | 3  |
| Optional | Fučkan-Držić, B. | German in geodesy | 1 | 1 | 1 | 3  |
| Optional | Cigrovski-Detelić, B. | Topography | 2 | 0 | 1 | 3  |

| From the other faculty | | | | | | 5 max |

**Total** | 13 | 11 | 7 | 30 |

Note: altogether 5 ECTS are chosen in optional courses

Vranić, Z.: Sports 0+2

### IVth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>L</th>
<th>E</th>
<th>Ex</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Frangeš, S.</td>
<td>Cartography</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Bašić, T.</td>
<td>Geodetic Reference Frames</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Fiedler, T.</td>
<td>Photogrammetry</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Rožić, N.</td>
<td>Geoinformation Quality</td>
<td>2</td>
<td>2</td>
<td>1</td>
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<tr>
<td>5.</td>
<td>Medak, D., Roić, M.</td>
<td>Geoinformation Modelling</td>
<td>2</td>
<td>2</td>
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<td>6.</td>
<td>Lapaine, M.</td>
<td>Geoinformation Manipulation</td>
<td>2</td>
<td>2</td>
<td>1</td>
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</tbody>
</table>

| | | | | | 24 |

Note: In this semester there are no optional sources

Vranić, Z.: Sports 0+2
### Vth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Lecturers</th>
<th>L</th>
<th>E</th>
<th>Ex</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellite Positioning</td>
<td>Bačić, Ž.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Engineering Geodetic Basis</td>
<td>Novaković, G.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Remote Sensing</td>
<td>Bajić, M.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Land Development</td>
<td>Mastelić-Ivić, S.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Professional Practice</td>
<td>Cigrovski-Detelić, B., Barković, D.</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
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</tbody>
</table>

**Optional Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lecturers</th>
<th>L</th>
<th>E</th>
<th>Ex</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Work with Geodetic Instruments</td>
<td>Lasić, Z.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Land Information Systems</td>
<td>Mastelić-Ivić, S.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Topographic Cartography</td>
<td>Frangeš, S.</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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</table>

From the other faculty

### VIth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Lecturers</th>
<th>L</th>
<th>E</th>
<th>Ex</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Geodesy</td>
<td>Kapović, Z.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>State Survey</td>
<td>Bašić, T.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Map Projections</td>
<td>Lapaine, M.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Hydrographic Survey</td>
<td>Pribičević, B.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

**Optional Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lecturers</th>
<th>L</th>
<th>E</th>
<th>Ex</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction into Management</td>
<td>Mraović, B.</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Geoinformation Infrastructure</td>
<td>Roić, M.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Web Cartography</td>
<td>Frangeš, S.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Basics of Geodetic Astronomy</td>
<td>Špoljarić, D.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
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<tr>
<td>Discrete Mathematics</td>
<td>Zadelj-Martić, V.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
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</table>

From the other faculty

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>L</th>
<th>E</th>
<th>Ex</th>
<th>ECTS</th>
</tr>
</thead>
</table>

24

Note: Altogether 7 ECTS credits are chosen in optional courses.

There are totally 180 ECTS at the undergraduate studies with at least 27 ECTS or 15% in optional courses.
## VIIth Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Exercises</th>
<th>Practical</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Džapo, M.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Feil, L.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Kapović, Z.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Optional 1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Optional 2</td>
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<td>6</td>
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<tr>
<td>From the other faculty</td>
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<tr>
<td><strong>Total</strong></td>
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<td>10</td>
<td>5</td>
<td>30</td>
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</table>

Note: Altogether 12 ECTS credits are selected among optional courses.

### Optional courses in the VIIth semester

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Exercises</th>
<th>Practical</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fučkan-Držić, B.</td>
<td>English for Academic Purposes</td>
<td>2</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Hećimović, Ž.</td>
<td>Global Geodesy</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Ivković, M.</td>
<td>Digital Plans</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Izetbegović, J.</td>
<td>Basics of Civil Engineering</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Kapović, Z.</td>
<td>Movements and Deformations</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
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<tr>
<td>Kapović, Z.</td>
<td>Geodesy in Environmental Protection</td>
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<td>3. Novaković, G.</td>
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Note: altogether 12 ECTS are selected among optional subjects

**Optional courses in the VIIIth semester**

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### IXth Semester

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Note: altogether 12 ECTS are selected among optional subjects

### Xth Semester

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There is a total of 120 ECTS credits at the graduate studies, with at least 24 ECTS credits or 20% among them in optional courses.
### VIIth Semester

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From the other faculty: 12 max

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Note: Altogether 12 ECTS credits are selected among optional courses.

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Note: Altogether 12 ECTS credits are selected among optional courses

### Optional courses in the IIIrd semester

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Note: Altogether 12 ECTS credits are selected among optional courses

**Xth Semester**

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There is a total of 120 ECTS credits at the graduate studies, with at least 24 ECTS credits or 20% among them in optional courses.
Optional project list in the IXth semester for both subject-oriented fields

A student selects 2 out of offered projects

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<td>20.</td>
<td>Pribičević, B. Geodynamics of the Adriatic Microplate</td>
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<td>Rožić, N. Optimizing of Geodetic Networks</td>
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<td>Spoljarić, D. Geodetic Astronomy</td>
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<td>24.</td>
<td>Vučetić, N. Generalization of Geoinformation</td>
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</table>
3.2 Description of each course

GRADUATE STUDIES OF GEODESY AND GEOINFORMATICS

CONTENTS OF COURSES
NAME OF THE COURSE: NAVIGATION

Teacher's name: Assoc. Prof. Željko Bačić, PhD
Assistant name: Danko Markovinović, MSc, Danijel Šugar

- (Subject oriented field): Geodesy
- Year/semester: 4/VIII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling: attended course “Satellite Positioning”
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Short overview of the principles of navigation. Navigation by means of applying the satellite positioning systems. Absolute methods of observation by means of GPS (absolute and DGPS). Guaranteed and achievable accuracy of positioning by means of absolute observation methods (absolute, DGPS). Accuracy levels of DGPS. Combination of code and phase for the purpose of increasing the accuracy of DGPS. Errors sources in absolute methods and their influence on measuring results. Properties, usage manner and possibilities of GPS devices for navigational purposes. Properties, usage manner and possibilities of GPS software in navigation application. Application of navigation devices in geodesy and geoinformatics. Application of navigation devices for non-geodetic usage (transport, environmental protection, agriculture and forestry, sport, recreation, etc.).
In the practical part (exercises) the students are acquainted with navigation GPS devices and software for data processing, they get practical field task and work on technical report.

Developed competence (knowledge and skills)
The students are expected to adopt knowledge about navigation and application of satellite positioning for that purpose. The advantages and disadvantages of GPS in navigation application. The are acquainted with GPS equipment (hardware and software) for navigational application and adopt skills in using this equipment. Application of satellite navigational technique for geodetic and non-geodetic purposes.

Ways of teaching

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<td>Tutorial ✓</td>
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<td>Workshops ✓</td>
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Student obligations

| Oral exam ✓ | Written exam ✓ ✓ | Seminar ✓ | Essay ❌ | Active participation in education process ✓ |

Supervision and grading students

| Written exam ✓ | Oral exam ✓ | Essay ❌ | Practical work ❌ |

| Oral exam ✓ | Written exam ✓ ✓ | Seminar ✓ | Essay ❌ | Active participation in education process ✓ |

| Written exam ✓ | Oral exam ✓ | Essay ❌ | Practical work ❌ |

| Oral exam ✓ | Written exam ✓ ✓ | Seminar ✓ | Essay ❌ | Active participation in education process ✓ |

| Written exam ✓ | Oral exam ✓ | Essay ❌ | Practical work ❌ |
References

a) Obligatory

b) Additional
Bačić, Ž. i Bašić, T: Satelitska geodezija (interna skripta), Geodetski fakultet, Zagreb, 1999.


NAME OF THE COURSE: INTEGRATED SYSTEMS IN GEOMATICS

Teacher's name: Assoc. Prof. Željko Bačić, PhD
Assistant name: Danko Markovinović, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 5/IX
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling: completion of “Satellite Positioning”
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

New cognitions about the advanced measuring methods with GPS, differential (DGPS) and kinematical in real time (RTK). The methods of determining and techniques of searching for ambiguities are dealt with more extensive (least squares method, variance-covariance, FASF, Lambda method and others) as phase as well as for combination of code and phase. Advanced application of GPS in geodesy and geodynamics and non-geodetic economy. Plans of GPS development and the advantages that new properties will contribute to the integration of sensors in geomatics. In the second part of the course the basic principals and prerequisites of sensor integration are dealt with, as well as the advantages that result from the integration. There are the characteristics of the sensors given that are applied in the integration for geodetic and geoinformation purposes (GPS, inertial systems, remote sensing sensors, odometers, gyroscopes). Algorithms of sensor integration. Integration of GPS and GIS as passive and active factors of integrated systems. Sensor integration for non-geodetic tasks. Geomatic approaches to sensor integration, defining the space of integrated sensors, problems of collecting and the quality of data.

Developed competence (knowledge and skills)

The students are expected to adopt extended knowledge about the systems of satellite positioning with an accent on GPS and other sensors convenient for integration. They will understand the concept of sensor integration, advantages and problems. They will develop the skills of solving the problems and applying the knowledge in advanced application of geodetic and geoinformation concepts.

Ways of teaching

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### Supervision and grading students

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<td>Research ✗</td>
<td>Seminar ✗</td>
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### References

a) obligatory


b) additional

NAME OF THE COURSE: SATELLITE POSITIONING – A PROJECT

Teacher's name: Assoc. Prof. Željko Bačić, PhD
Assistant name: Milan Rezo, MSc and Dinko Marković, MSc

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory(optional)): optional
- Conditions of course enrolling: attended course “Satellite positioning” and “Navigation” or “Integrated systems in Geomatics”
- Number of weeks in a semester/number of classes in a week: 15/0 + 4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

The Project “Satellite Positioning” encompasses the practical works in which the students will be given a task to prepare the observation, to observe, to process observation data and interpret the obtained results. The project tasks are practically oriented and connected with concrete works in geodetic practice and are partly connected with geodetic firms – contractors for the purpose of making the tasks maximally realistic.

Developed competence (knowledge and skills)

The project is aimed to develop organisational and executive abilities in individual task implementation applying previously adopted knowledge and skills. The independence in working on the project is also motivated by problem-oriented approach to the task and it is required from the student to make decision in the process of project realization.

Ways of teaching

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Supervision and grading students

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References

a) Obligatory
Bačić, Ž. i Bašić, T: Satelitska geodezija (interna skripta), Geodetski fakultet, Zagreb, 1999.
NAME OF THE COURSE: ADVANCED METHODS OF REMOTE SENSING

Teacher's name: Assoc. Prof. Milan Bajić, PhD
Assistant name: Andrija Krtalić

- (Subject oriented field): Geoinformatics
- Year/semester: 5/IX
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling: Remote Sensing
- Number of weeks in a semester/number of classes in a week: 15/2 + 2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

This course is planned as a continuation to the knowledge acquired in the course Remote sensing (RS). It contains advanced methods of RS that encompass complex methods of interpretation, including interactive and supervised classification, quality control, data fusion, quantitative evaluation of results by means of confusion matrix. The purpose of the subject is making students skilled for between usage of all available information and data, sensor and contextual, about the shot area or the objects on it. Apart from multispectral, radar data and images, there are also hyper spectral data and images considered.

- Spatial differentiation, modulation transfer function, minimal recognisable contract, minimal recognisable temperature difference.
- Improvement of the relationship – signal-noise and bleariness of images with deconvolution (inverse, Wienerov filter).
- Radar with synthetic antenna (SAR). Polarimetric and interfeormetric regimes.
- Specific characteristic and interpretation of radar images and data.
- Multispectral and hyperspectral line and image scanners.
- Specific details about shooting and interpretation of multispectral and hyper spectral images.
- Image processing on the level of pixel and group.
- Method of the main components.
- Fusion of the pixel level, features, decision. Basic methods of associating the data. Criteria for association quality control.
- Analysis of the interpolation results by means of matrix confusion.
- Use of programme tools for RS.

Developed competence (knowledge and skills)

Students are acquainted and skilled in the methods of shooting and complex methods of interpreting multisensor, multispectral and hyper spectral images. They learn about applicable characteristics of sensors and shooting systems. They are skilled in applying quantitative method of evaluation and supervision of RS process and result quality.

Ways of teaching

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**Supervision and grading students**

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<td>Continuous evaluation of knowledge or grading of activity</td>
<td>Research ✓</td>
<td>Seminar ✓</td>
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</table>

**References**

a) Obligatory
1. M. Bajić, Remote sensing, course material
2. J.A. Richards, Remote Sensing Digital Image Analysis
NAME OF THE COURSE: APPLICATION OF REMOTE SENSING

Teacher's name: Assoc. Prof. Milan Bajić, PhD
Assistant name: Andrija Krtalić

- (Subject oriented field): Geoinformatics
- Year/semester: 4/X
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

The course is intended for: a) the students at the Faculty of Geodesy who have not attended the course Remote Sensing (RS) at the undergraduate studies or the students of other faculties; b) the students of other faculties who want to apply the methods of RS in their profession. The course therefore contains the basic principles of RS, it deals with the methods of applied interpretation of aerial and satellite images. Students work on seminar papers in thematic interpretation in the selected specialized field.

- Basic terms, definitions of RS. Usable physical properties of electromagnetic waves that are used in RS.
- Usable properties of aerial and satellite images obtained by means of passive and active sensors.
- The most important methods of thematic interpretation in RS.
- Geocoding and correction of images. Emphasizing, ranking and reduction of properties.
- Automatic and controlled classification.
- Specific characteristics of thematic interpretation for selected specialized areas.
- Preparation of seminars with thematic interpretation in the selected area chosen by students.
- Using of program tools for remote sensing.

Developed competence (knowledge and skills)

This course makes the students acquire skills for using the results of RS methods and the implementation in practical problems of the profession.

Ways of teaching

| Lectures ✓ | Exercises ✓ | Seminar ✓ | Practicum ✗ |
| Individual research ✓ | Field classes | Tutorial ✓ | Consultations ✓ |
| Workshops | Discussion | Internet ✓ |

Student obligations

| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay | Active participation in education process ✓ |

Supervision and grading students

| Written exam | Oral exam ✓ | Essay ✗ | Practical work ✗ |
| Project ✗ | Continuous evaluation of knowledge or grading of activity | Research ✓ | Seminar ✓ |

References

a) Obligatory
1. M. Bajić, Daljinska istraživanja (Remote sensing), course manuscript
3. J. A. Richards, Remote Sensing Digital Image Analysis
NAME OF THE COURSE: REMOTE SENSING – A PROJECT

Teacher's name: Assoc. Prof. Milan Bajić, PhD
Assistant name: Andrija Krtalić

- (Subject oriented field):
- Year/semester: 5/I (IX)
- Course status (obligatory/optional): optional
- Conditions of course enrolling: Advanced Methods of Remote Sensing
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes): 5
- ECTS points: 6

Description/contents of the course

Creation and derivation of the proposal of a remote sensing project in one or in several combined topics: Thematic interpretation for the needs of the geosciences. Airborne acquisition, airborne surveillance and airborne reconnaissance. Interpretation and evaluation of the satellite scenes. Identification of the system for the airborne multisensor or multispectral acquisition. Evaluation of the results of the remote sensing. Deployment of new sensor in operations. Research and development of the interpretation’s methods; of data fusion; of decision support system based on results of the remote sensing, knowledge management and contextual information. Application of the methods for complex projects management PERT, GANNT, SWOT and demanding methodologies for submission of the scientific and technology projects (e.g. of European Commission etc.).

Developed competence (knowledge and skills)

Students will be trained to create and derive proposal of a hypothetic (or real) project in selected thematic topics of the remote sensing by use of the methodologies for preparation and management of projects.

Ways of teaching

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<td>Research ✓</td>
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References

a) Obligatory

b) Additional

c) Internet sources
In accordance to the contents of a project.
NAME OF THE COURSE: PRECISE GEODETIC MEASUREMENTS

Teacher's name: Assist. Prof. Duro Barković, PhD
Assistant name:

- (Subject oriented field):
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes): 5
- ECTS points: 6

Description/contents of the course

Lectures:
Introduction into precise measurements. Global limits of measuring uncertainty of linear and angle quantities. Methods of precise geodetic measurements. Methods of precise measurements of linear quantities (distances and elevation differences). Methods of precise measurement of angle quantities. Discrepancy sources with the methods of precise geodetic linear and angle quantities with the estimation of measuring uncertainty, repeatability, and reliability. Description and theoretical basis of instruments and accessories for precise geodetic measurements of linear and angle quantities. Testing, rectification and comparison of instruments and accessories for precise geodetic measurements of linear and angle quantities according to international ISO standards. Analysis of measured data obtained by means of comparison. Establishment of the Laboratory for measurements and measuring techniques of the Geodetic Institute at the Faculty of Geodesy according to the International standard ISO 17025, and the initiation of the procedure for enlisting the Laboratory into the national (European) network of authorized measurement laboratories.

Exercises
Precise measurement of distances between two given points with the measuring uncertainty of 0,3 mm + 1 ppm. The given distance is to be set on the straightline between two points with measuring uncertainty of 0,3 mm + 1 ppm. Three parallel straight lines are to be set up, and the parallel characteristic is to be with measuring uncertainty 0,5". Precise measurement of elevation difference with measuring uncertainty of 0,7 mm/km. Invar measuring rod is to be compared on the comparator of the Faculty of Geodesy, and the measured data are to be analysed. The measuring tape to be compared on the comparator, and analysed the measured data obtained by comparison. Testing and comparison of theodolite and electronic distance meter according to ISO standards. Testing of distance meter frequency in the Laboratory and on the base of the Geodetic Faculty.

Developed competence (knowledge and skills)

Knowledge:
Students acquire the knowledge of the methods of precise geodetic measurements and the instruments and accessories used in these measurements. They have knowledge about field and laboratory procedures for testing and calibration of geodetic instruments and accessories according to ISO standards. They know how to process and analyse the data and give reports about testing and calibrating geodetic instruments and accessories.

Skills:
The make precise measurements of distances and angles and of elevation differences using thereby precise geodetic instruments and accessories. They perform field and laboratory testing and calibrating of geodetic instruments and accessories according to ISO standards. They process and analyse, and make reports on testing and calibrating geodetic instruments and accessories.

**Ways of teaching**

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**References**

a) Obligatory
Interarna skripta za studente, u pripremi.

b) Additional
NAME OF THE COURSE: TESTING AND CALIBRATION OF GEODETIC INSTRUMENTS AND ACCESSORIES ACCORDING TO ISO STANDARDS – A PROJECT

Teacher's name: Assist. Prof. Duro Barković, PhD
Assistant name: –

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes): 5
- ECTS points: 6

Description/contents of the course
Testing, rectification and comparison of instruments and accessories for precise geodetic measurements and of linear and angle quantities according to the international ISO standards. Testing and comparison of theodolite and electronic distance meter according to ISO standards, field and laboratory procedures. Testing and calibration of invar levelling tapes and steel measuring tapes on the comparator at the Faculty of Geodesy. Testing of distance meter frequency in the Laboratory and on the base of the Faculty of Geodesy. Processing and analysis of measured data obtained by means of calibration. Making a report on testing and calibration.

Developed competence (knowledge and skills)
Knowledge:
Students acquire the knowledge on theoretical and laboratory procedures for testing and calibrating geodetic instruments and accessories according to ISO standards. They know how to process and analyse the data, and how to make a report on testing and calibration of geodetic instruments and accessories.

Skills:
The students make field and laboratory testing and calibration of geodetic instruments and accessories according to ISO standards. They process and analyse, and make report on testing and calibration of geodetic instruments and accessories.

Ways of teaching
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Student obligations
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</table>
or grading of activity

References

a) Obligatory
Course material for student being prepared.

b) Additional
NAME OF THE COURSE: PHYSICAL GEODESY

Teacher's name: Prof. Tomislav Bašić, PhD
Assistant name: Danko Markovinović, MSc

- (Subject oriented field): Geodesy
- Year/semester: 4/VIII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Introduction into the physical geodesy. The principle of determining the shape and the external gravity filed of the Earth. Physical parameters as a connection between the physical surface and the rotational ellipsoid. Coordinate systems in physical geodesy. The elements of the Earth's body physics, basic geological composition of the Earth, geotectonic forces and isostatic compensation. The Earth's tide waves, geomagnetism, seismics (the basic terms). Gravitational acceleration and gravitational potential, centrifugal acceleration and centrifugal potential, gravity and gravity potential. The first, the second and the third differential quotient of gravity potential and their physical significance. Normal gravity field and normal gravity. Gravity anomalies. Absolute and relative determination of the gravity acceleration with the pendulum and gravimeter. The sources of errors in precise gravimetry, calibration function. Gravimetric reference systems and gravimetry networks. Gravity measurement on movable platforms (ship, plane) and necessary corrections. The development of the potential of attraction into the degree according to spherical functions. Introduction of disturbance potential, its properties and significance. Gravimetric method of physical geodesy: the third “geodetic” boundary task of the potential theory and fundamental equation of physical geodesy. Solution for a geoid, Stokes and Bruns theorem. Presentation of Molodenski solution. Astrogeodetic determination of geoid surface, i.e. quasi-geoid. Combined astrogravimetric levelling. Application of the collocation method by means of the least squares and “remove-restore” technique for precise determination of geoid surface using heterogeneous data of the Earth’s gravity field, global geopotential models and digital terrain models.

Program of exercises:

Developed competence (knowledge and skills)
Knowledge about determination of the external gravity filed of the Earth as one of the main tasks in geodesy, based on the measured physical parameters on and above the Earth's surface, knowledge and skill during the practical measurement of those parameters, especially of gravimetric measurement and practical calculation of geoid surface, the basic surface in
geodesy from which the heights have been counted, especially for the necessity of the completion of the new 3D positional datum of the Republic of Croatia.

Ways of teaching

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Student obligations

| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay ✗ | Active participation in education process ✓ |

Supervision and grading students

| Written exam ✓ | Oral exam ✓ | Essay ✗ | Practical work ✗ |
|                |             |       |                |
| Project ✗      | Continuous evaluation of knowledge or grading of activity ✓ | Research ✗ | Seminar ✓ |

References

a) Obligatory

b) Additional

c) Internet sources
   URL1: ftp://www.iag-aig.org/
NAME OF THE COURSE: GEOPHYSICAL GEODESY

Teacher's name: Prof. Tomislav Bašić, PhD
Assistant name: Danko Markovinović, MSc

- (Subject oriented field): Geodesy
- Year/semester: 5/IX
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Definition and significance of a new geodetic discipline for better understanding of slow deformation of the Earth’s crust. It includes the research of slow movements of the Earth’s crust, time and space variations of the Earth’s gravity field, as well as the rotation and deformations caused by tide waves of the Earth. The geodetic concept encompasses special processing of the gravity, precession and nutations, and the rotational movement of the deformable body, and the geophysical concept includes the radial structure of the Earth, lateral variations and hypotheses on the plate tectonics, hydrosphere and atmosphere in the sense of the sea level, sea tide waves, atmosphere in motion and underground water. Short overview of terrestrial and satellite measuring methods, and the measurements to the Moon, and radio interferometric-measuring techniques. The movements of the Earth’s crust, tide waves and the rotation of the Earth. Basic presentation of the theory of relativity and its geodetic application.
Description of exercises:
Detailed seminar work in one part of the subject material using available literature and especially internet, with the obligatory final presentation having the benefit of modern presentation technique and defending of the theme.

Developed competence (knowledge and skills)
Knowledge about geodetic and geophysical aspects in the slow deformation of the Earth’s crust with the respect to the space-time and frequency-time dimension of those phenomenons, and skill of autonomous research in solving of concrete task using most recent geodetic terrestrial and space techniques and internet.

Ways of teaching
Lectures ✓ | Exercises ✓ | Seminar ✓ | Practicum ✗
Individual research ✓ | Field classes ✓ | Tutorial ✓ | Consultations ✓
Workshops ✗ | Discussion ✓ | Internet ✓ |

Student obligations
Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay ✗ | Active participation in education process ✓
Supervision and grading students

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<td>Continuous evaluation of knowledge or grading of activity ✓</td>
<td>Research ✓</td>
<td>Seminar ✓</td>
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</table>

References

a) Obligatory

b) Additional

c) Internet sources
   URL1: ftp://www.iugg.org/
   URL2: ftp://www.geology.yale.edu/RETREAT/
NAME OF THE COURSE: EARTH SHAPE DETERMINATION – A PROJECT

Teacher's name: Prof. Tomislav Bašić, PhD
Assistant name: Danko Markovinović, MSc, Milan Rezo, MSc

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): Optional
- Conditions of course enrolling: State survey, Physical Geodesy
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes): No
- ECTS points: 6

Description/contents of the course

Project of the practical Earth shape determination in local area using all available positional and physical parameters, global geopotential models, digital terrain models, ev. digital density models, etc. For the purpose of either classical or concept of integral geodesy (if possible from the hardware point of view), the proper computer software should be developed for the calculation of necessary geometry or/and physical parameters in the investigated area.

Developed competence (knowledge and skills)

Knowledge and skills of autonomous project design towards practical realization of complex tasks of Earth shape determination in the area of interest using all necessary theoretical knowledge and computer programming.

Ways of teaching

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Student obligations

| Oral exam ✓ | Written exam × | Seminar ✓ | Essay × | Active participation in education process ✓ |

Supervision and grading students

| Written exam × | Oral exam ✓ | Essay × | Practical work × |
|                |             | Project ✓ | Continuous evaluation of knowledge or grading of activity × |
|                |             |          | Research ✓ | Seminar ✓ |

References

a) Obligatory
b) Additional

c) Internet sources
   URL1: ftp://www.iag-aig.org/
   URL2: ftp://www.euref-iag.net/
NAME OF THE COURSE: METHODS OF LINEAR ALGEBRA

Teacher's name: Jelka Beban-Brkić, PhD
Assistant name:

- (Subject oriented field): Geodesy, Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
  - Number of weeks in a semester/number of classes in a week: 15/ 2 + 2
  - (Total number of field classes): 0
  - ECTS points: 6

Description/contents of the course

Real vector space: Subspaces. Linear independence. Basis and dimension. Rank and nullity.
Basic ideas of linear algebra (basic algorithms on matrices, vector and matrix norms). Inner
Eigenvalues and eigenvectors: Diagonalization and orthogonal diagonalization.
Linear transformations: General linear transformations. Inverse linear transformations.
Matrices of general linear transformations.
Additional topics: Quadratic forms. Diagonalizing quadratic forms. Comparison of procedures
for solving linear systems. LU-decompositions. The Cholesky algorithm. Some applications

Developed competence (knowledge and skills)

The students are acquainted with the theory and use of linear algebra methods in solving
problems emphasizing its application in geodesy. The problems will be solved by use of the
program - Mathematica and WebMathematica

Ways of teaching

| Lectures ✓ | Exercises ✓ | Seminar × | Practicum × |
| Individual research × | Field classes × | Tutorial × | Consultations ✓ |
| Workshops × | Discussion × | Internet ✓ |

Student obligations

| Oral exam × | Written exam ✓ | Seminar × | Essay × | Active participation in education process ✓ |

Supervision and grading students

| Written exam ✓ | Oral exam × | Essay × | Practical work × |
| Project × | Continuous evaluation of knowledge or grading of activity ✓ | Research × | Seminar × |
References

a) Obligatory

b) Additional

c) Internet sources
http://archives.math.utk.edu/topics/linearAlgebra.html
http://lavica.fesb.hr/~slap/la.html
NAME OF THE COURSE: GEOMAGNETIC SURVEY

Teacher's name: Assist. Prof. Mario Brkić, PhD  
Assistant name: Danijel Šugar

- (Subject oriented field): Geodesy  
- Year/semester: 4/VIII  
- Course status (obligatory/optional): optional  
- Conditions of course enrolling: -  
- Number of weeks in a semester/number of classes in a week: 15 /2+2  
- (Total number of field classes): 3  
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Fundamentals of the geomagnetism; application of contemporary measurement methods of the geomagnetic declination, inclination, total intensity and total intensity gradients.

Ways of teaching

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Supervision and grading students

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References

a) Obligatory

b) Additional
Newitt, L. R., Barton, C. E., i J. Bitterly (1996): Guide For Magnetic Repeat Station Surveys, IAGA, Boulder, USA.
NAME OF THE COURSE: GEOMAGNETIC NETWORKS – A PROJECT

Teacher's name: Assist. Prof. Mario Brkić, PhD
Assistant name: Danijel Šugar

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling: Geomagnetic Survey
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes): 7
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Independence in assessment of the geomagnetic point status; proficiency in surveying of the geomagnetic declination, inclination, total intensity and total intensity gradients; and related reporting and organizational skills.

Ways of teaching

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Student obligations

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Supervision and grading students

| Written exam | Oral exam | Essay | Practical work ✓ |
| Project ✓ | Continuous evaluation of knowledge or grading of activity | Research | Seminar ✓ |

References

a) Obligatory
Newitt, L. R., Barton, C. E., J. Bitterly (1996): Guide For Magnetic Repeat Station Surveys, IAGA, Boulder, USA.
NAME OF THE COURSE: GEODESY IN GEOSCIENCES

Teacher's name: Assist. Prof. Brankica Cigrovski-Detelić, PhD
Assistant name:

- (Subject oriented field):
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Geodetic works in interdisciplinarz geodynamic projects. Geodynamic networks base on GPS measurements. Designing, reconaissance and stabilization of points in geodynamic networks. Absolute and relative adjustment models and the application in geosciences. Geodetic measurements as the basis for establishing geodynamic models. Geodetic models of tectonic movements. Models of seismic activities based upon geodetic measurements. Determination of movements and deformation of external Earth surface by means of geodetic methods. Application of surface deformation analysis in modelling the external Earth surface. Practical application of the correlation of geodetic models of external Earth surface deformation with the models obtained by applying the methods from other areas of geosciences (geophysics, geology, seismisc, tectonics...) for detecting the positions of mineral resources, oil resources, water, movement of geological structures, faults, earthquake epicentres etc.

Developed competence (knowledge and skills)
Application of the methods of classical and satellite geodesy in interdisciplinary (geodynamic) projects.

Ways of teaching

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Supervision and grading students

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References

a) Obligatory
Cigrovski-Detelić, B. (1998): Primjena GPS-mjerenja i getektonskih informacija u obradi geodinamičke mreže CRODYN (Application of GPS measurements and geotectonic information in the processing of geodynamic network CRODYN)

b) Additional
Altiner, Y.: (1996): Geometrische Modellierung innerer und äusserer Deformationen der Erboderfläche

c) Internet sources
key words: GPS-measurements, geodynamic models, tectonics
NAME OF THE COURSE: FOUR-DIMENSIONAL GEODESY – A PROJECT

Teacher's name: Assist. Prof. Brankica Cigrovski-Detelić, PhD
Assistant name:

- (Subject oriented field): Geodesy, Geoinformatics
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
  - Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Application of GPS measurements in determining the internal and external deformations of the external Earth's surface. Computing and graphic presentation of movement vector speed and surface deformation measures.

Ways of teaching
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Student obligations
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Supervision and grading students
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a) Obligatory:
Cigrovski-Detelić, B. (1998): Primjena GPS-mjerenja i geotektonskih informacija u obradi geodinamičke mreže CRODYN (Application of GPS measurements and geotectonic information in the processing of geodynamic network CRODYN)


b) Additional:

Skoko, D (1998): Andrija Mohorovičić


c) Internet sources:
Key words: GPS-mjerenja, tenzori, deformacijska analiza
NAME OF THE COURSE: CADASTRAL SURVEY

Teacher's name: Assoc. Prof. Marko Džapo, PhD
Assistant name: Marko Šljivarić, MSc, Loris Redovniković

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes): 8
- ECTS points: 6

Description/contents of the course


Exercises: Coded tacheometry. Survey of inner premises – working on floor division.

Developed competence (knowledge and skills)

Students are skilled in independent conducting new cadastral survey, and in making floor division project.

Ways of teaching

| Lectures ✓ | Exercises ✓ | Seminar ✓ | Practicum ✗ |
| Individual research ✓ | Field classes ✓ | Tutorial ✓ | Consultations ✓ |
| Workshops ✓ | Discussion ✓ | Internet ✓ |

Student obligations

| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay ✗ | Active participation in education process ✓ |

Supervision and grading students

| Written exam ✓ | Oral exam ✓ | Essay ✗ | Practical work ✗ |
| Project ✗ | Continuous evaluation of knowledge | Research ✓ | Seminar ✓ |
References

a) Obligatory
3. Official Gazette: Laws and ordinances
NAME OF THE COURSE: INDUSTRIAL SURVEY

Teacher's name: Assoc. Prof. Marko Đžapo, PhD
Assistant name: Vlado Cetl, MSc

- (Subject oriented field): Geodesy
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
  - Number of weeks in a semester/number of classes in a week: 15/2+2
  - (Total number of field classes): 6
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Students adopt the knowledge in theory and practice of survey and control of industrial objects.

Ways of teaching

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Student obligations

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Supervision and grading students

| Written exam ✓ | Oral exam ✓ | Essay | Practical work ✓ |
| Project | Continuous evaluation of knowledge or grading of activity | Research | Seminar |
References

a) Obligatory
Roić, M.: Industrijska izmjera, interna skripta (Industrial survey), course material, Faculty of Geodesy, Zagreb 2000
NAME OF THE COURSE: LAND SURVEYING – A PROJECT

Teacher's name: Assoc. Prof. Marko Džapo, PhD
Assistant name:

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes): 5
- ECTS points: 6

Description/Contents of the course

Detailed survey as the basis for designing. Measuring data processing and presentation of the free mode. Processing and adjustment of geodetic networks needed in tunnel cutting. Layout and survey of transverse and longitudinal tunnel profiles, volume calculation of excavations and over profiles and under profile. Positional and vertical underground control for monitoring the tunnel cutting and its specific features.

Developed competence (knowledge and skills)

Students are skilled in independent conducting geodetic works.

Ways of teaching

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Supervision and grading students

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References

a) Obligatory
b) Additional
NAME OF THE COURSE: SPECIAL ALGORITHMS FOR GEODETIC MEASUREMENT PROCESSING

Teacher's name: Prof. Ladislav Feil, PhD
Assistant name: Martina Gucek

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Analysis and special processing of geodetic measurements. Measurement processing according to $L_1, L_2$ and $L_{\infty}$ standards. Adjustment of measurement in time sets and deformation analysis. Regression and collocation. Congruency test.
Exercises: Practical and computer aided special processing of geodetic measurements. Measurement processing according to $L_1$ and $L_{\infty}$ standards. Adjustment of measurement in time sets and deformation analysis. Regression. Congruency test.

Developed competence (knowledge and skills)
Analysis and special processing of geodetic measurements.

Ways of teaching

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References

Feil, L. Teorija pogrešaka i račun izjednačenja I, Textbook of the Faculty of Geodesy, University of Zagreb, Zagreb 1990.
Feil, L. Teorija pogrešaka i račun izjednačenja II, Textbook of the Faculty of Goedesy, University of Zagreb, Zagreb 1990.
b) Additional

Klak, S. Teorija pogrešaka i račun izjednačenja, Textbook of the Faculty of Geodesy, University of Zagreb, Zagreb 1982.
NAME OF THE COURSE: DETERMINATION OF WATER POWER PLANT OBJECTS MOVEMENT – A PROJECT

Teacher's name: Prof. Ladislav Feil, PhD
Assistant name: Martina Gucek

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Preparing the study on determination of water power plant objects movement and deformation analysis.

Developed competence (knowledge and skills)
Developing the knowledge and skills for determining the movements of water power plant object and the analysis of movements.

Ways of teaching

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References

a) Obligatory
Feil, L.: Elaborati određivanja pomaka objekata hidrocentrala (30 elaborata u posljednjih 25 godina)
NAME OF THE COURSE: IMAGE SURVEY

Teacher's name: Prof. Teodor Fiedler, PhD
Assistant name: Dubravko Gajski, PhD

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
  - Number of weeks in a semester/number of classes in a week: 15/2+2
  - (Total number of field classes):
  - ECTS points: 6

Description/contents of the course

Mathematical and physical models of space mapping, and the methods of georeferencing, specific for individual types of sensors. It is vital for understanding and correct application of modern technologies in digital photogrammetry and remote sensing. The following units are encompassed:

- Central projection
- Coordinate systems in photogrammetry, Homogeneous coordinates
- Calibration of classical and digital cameras, distortion
- Numerical procedures of inner, relative and absolute orientation
- Georeferencing of data with active and passive sensors
- Integrated systems (sensors+GPS+IMU)
- Aerial triangulation in sets and blocks
- Adjustment of triangulation with the methods of independent models and air parcel
- Quality estimation of photogrammetric works

Developed competence (knowledge and skills)

The students are motivated and skilled to solve standard tasks in photogrammetry independently and correctly focusing on georeferencing the data collected with classical and digital photogrammetric cameras, and other sensors common in photogrammetry and remote sensing.

Ways of teaching

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Student obligations

| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay | Active participation in education process ✓ |

Supervision and grading students

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</table>
References
a) Obligatory
Kraus, K., Photogrammetrie Band 3, Topographische Informationsysteme, Dümmler 2001.
NAME OF THE COURSE: TOPOGRAPHIC INFORMATION SYSTEMS

Teacher's name: Prof. Teodor Fiedler, PhD
Assistant name: Dubravko Gajski, PhD

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling: no
- Number of weeks in a semester/number of classes in a week: 15/2 +2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

The course brings necessary knowledge, important for projecting, building and maintaining of TIS, and it contains the following topics:

- Visualisation of astronomic data for Internet (production of digital map of the star sky intended for Internet).
- Collecting topographic data
- Structures for TIS
- TIS design
- Modelling in TIS
- Interpolations and approximations in TIS
- Digital terrain models
- Quality assessment
- Use of TIS
- Spatial analysis, visualisation and animation of TIS

Developed competences (knowledge and skills)

The students are skilled in competent participation in all phases of designing, building and maintaining of TIS, and in efficient data usage contained in TIS.

Ways of teaching

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or grading of activity

References

a) Obligatory
Kraus, K., Photogrammetrie Band 3, Topographische Informationsysteme, Dümmler 2001.
NAME OF THE COURSE: GEOINFORMATION SYSTEMS

Teacher's name: Prof. Teodor Fiedler, PhD
Assistant name: Tomislav Ciceli, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
  - Number of weeks in a semester/number of classes in a week: 15/2+2
  - (Total number of field classes):
  - ECTS points: 6

**Description/contents of the course**


Exercises: Usage of CAD tools and their modules for preparation of vector and raster data for the project. Topological data processing according to the data model CROTIS. Getting acquainted with program package GEOMedia PRO.

**Developed competence (knowledge and skills)**

Deeper understanding of GIS and acquiring the knowledge for independent work in the area of collecting processing and analysing the spatial information as infrastructure base of geographic information systems.

**Ways of teaching**

| Lectures ✓ | Exercises ✓ | Seminar | Practicum |
| Individual research ✓ | Field classes | Tutorial | Consultations ✓ |
| Workshops ✓ | Discussion ✓ | Internet ✓ |

**Student obligations**

| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay | Active participation in education process ✓ |

**Supervision and grading students**

| Written exam ✓ | Oral exam ✓ | Essay | Practical work ✓ |
| Project | Continuous evaluation of knowledge or grading of activity | Research | Seminar |

**References**

a) Obligatory
Langley, P. A. dr.: GIS, Volume 1 i Volume 2, NV 1999
Aronof, S. Geographic Information System, A Management Perspective

b) Additional:
NAME OF THE COURSE: PHOTOGRAMMETRY OUTSIDE GEODESY

Teacher's name: Prof. Teodor Fiedler, PhD
Assistant name: Tomislav Ciceli, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Practice-oriented tasks in terrestrial photogrammetry. Overview of methods and possibilities. Instruments for shooting, measuring and amateur images. Special problems of calibration and rectifying the used photogrammetric systems for shooting and surveying in terrestrial photogrammetry. Geodetic measurements in field works. Application of terrestrial photogrammetry and solving the tasks in:
Archaeology
Ship building
Construction heritage
Medicine
Underwater photogrammetry
Traffic accidents
Stomatology
Machine engineering

Developed competence (knowledge and skills)
Ability of solving photogrammetric tasks in the scientific areas outside of geodesy

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References

a) Obligatory


Kraus, K (1997): PHOTOGRAMMETRY, VOLUME 2, ADVANCED METHODS AND APPLICATIONS, Dümmlers Verlage, Bonn, Germany

b) Additional
Kraus, K (1993): PHOTOGRAMMETRY, VOLUME 1, FUNDAMENTALS AND STANDARD PROCESSES, Dümmlers Verlage, Bonn, Germany
NAME OF THE COURSE: GIS IN APPLICATIONS

Teacher's name: Prof. Teodor Fiedler, PhD
Assistant name: Tomislav Ciceli, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Presenting various examples of GIS project applications. Application areas:
GIS applied in infrastructure (gas, water, drainage, power supply…)
Spatial development and GIS,
GIS in telecommunications,
GIS in transport systems
GIS in environmental protection, Local, national and global application of GIS in agriculture

Developed competence (knowledge and skills)
Ability of deciding where and when to apply Geoinformation systems, to understand and apply GIS in given circumstances.

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References

a) Obligatory

b) Additional:
NAME OF THE COURSE: SELECTED CHAPTERS OF PHOTOGRAMMETRY
AND GIS – A PROJECT

Teacher's name: Prof. Teodor Fiedler, PhD
Assistant name: Tomislav Ciceli, MSc, Andrija Krtalić, Sanja Šamanović

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling: GIS
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes): up to 7
- ECTS points: 6

Description/contents of the course

Practical implementation of a project which will be a mutual project of Photogrammetry and Geoinformatics. Project starts with planning (time, resources, finances), and ends up with finalization. Special issues of interdisciplinary and implemented procedures and methods. It will serve as the introduction in master thesis.

Developed competence (knowledge and skills)

Skills and competences in planning, execution and quality control of the practical tasks in particular project.

Ways of teaching

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References

a) Obligatory
   Depending on the chosen subject
b) Additional
   Depending on the chosen subject
c) Internet sources
   Depending on the chosen subject
NAME OF THE COURSE: THEMATIC CARTOGRAPHY

Teacher's name: Assoc. Prof. Stanislav Frangeš, PhD
Assistant name: Vesna Poslončec-Petrić, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Description of lectures: Historical outline. Goals and tasks of thematic cartography. Thematic maps; experts information systems. Thematic mapping; characteristics of base map for thematic mapping. Differences and similarities of thematic and topographic maps. Classification of thematic maps according to object properties, on the basis of presentation forms and applied map graphics, and according to thematic fields. Design of thematic maps. Basic characteristics of natural territory thematic maps. Basic characteristics of maps belonging to the field of human activity. Nacional atlases. Possibilities of computer programs in the production of thematic maps. Structures of experts information systems. Experts information systems of Croatia.
Description of exercises: Production of various thematic maps using various program packages.
Seminar: Research of production, updating and use of experts informations systems and thematic maps.

Developed competence (knowledge and skills)

The students learn about thematic cartography, classifications and creation of experts information systems and thematic maps and the possibilities of program packages in their production.

Ways of teaching

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</table>
References

a) Obligatory


b) Additional


c) Internet sources

http://129.187.175.5/materials/Them_Karto_I/t4_5.pdf

NAME OF THE COURSE: GEOVISUALISATION

Teacher's name: Assoc. Prof. Stanislav Frangeš, PhD  
Assistant name: Robert Župan, MSc

- (Subject oriented field): Geoinformatics  
- Year/semester: 5/IX  
- Course status (obligatory/optional): obligatory  
- Conditions of course enrolling: completed a course Geoinformation Systems and Digital Cartography  
- Number of weeks in a semester/number of classes in a week: 15/2+2  
- (Total number of field classes):  
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Interpretation of geoinformation and their visualisation and communication by means of various cartographic presentations.

Ways of teaching

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References

a) Obligatory


b) Additional


c) Internet sources

http://129.187.175.5/materials/Master_Course/Meng_Liqui/designissue_script.pdf

http://129.187.175.5/materials/Visualization_I/mdmv.pdf
NAME OF THE COURSE: PRACTICAL CARTOGRAPHY – A PROJECT

Teacher's name: Assoc. Prof. Stanislav Frangeš, PhD  
Assistant name: Robert Župan, MSc, Vesna Poslončec-Petrić, MSc

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

| Project of various cartographic presentations. Preparation for a cartographic project. Making an offer in the process of map production project. Course of map production – project realisation. Sequence of producing single cartographic plots. Basic technologies of map production. |
| Project, production and updating of various cartographic presentations that are made or have been made by the Institute for Cartography at the Faculty of Geodesy, University of Zagreb. Research of map graphics and map visualisation. Research of various cartographic software types. |

Developed competence (knowledge and skills)

| Project, production and updating of various cartographic presentations. Interpretation of geoinformation and their visualisation and communication by means of cartographic presentations. |

Ways of teaching

| Lectures ✗ | Exercises ✗ | Seminar ✓ | Practicum ✗ |
| Individual research ✓ | Field classes ✗ | Tutorial ✓ | Consultations ✓ |
| Workshops ✗ | Discussion ✓ | Internet ✓ |

Student obligations

| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay ✗ | Active participation in education process ✓ |

Supervision and grading students

| Written exam ✓ | Oral exam ✓ | Essay ✗ | Practical work ✗ |
| Project ✓ | Continuous evaluation of knowledge or grading of activity ✗ | Research ✓ | Seminar ✓ |

References

a) Obligatory
Diploma theses made in the Institute for Cartography, at the Faculty of Geodesy, University of Zagreb.

Manuals of various program packages.

b) Additional


c) Internet sources

http://www.lrz-muenchen.de/~t583101/WWW/index.html
NAME OF THE COURSE: ENGLISH FOR ACADEMIC PURPOSES

Teacher's name: Biserka Fućkan Držić, Prof.
Assistant name: 

- (Subject oriented field): Geodesy, Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling: a pass mark in “English in Geodesy”
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course:
Developing language skills in the context of geodesy. Attending lectures in English for geodetic purposes. Studying the skills in making notes in English for special purposes. Case studies for various topics, e.g. Informatics and geodesy, importance of geoinformation systems, new challenges in geodesy, shape and size of the Earth as functions of time, map as a work of art, etc. Practising various types of presenting specialised topics. Techniques of efficient presentation, usage of visual tools. Team and individual presentation of material. Teaching the skill in reading specialized literature in English for special purposes. Improving the language for special purposes by means of Internet. Writing professional, i.e. scientific paper in English (organisation of the written material, sentence types characteristic for single parts of written material). Transfer of written material into oral presentation. Production of personal specialized glossaries on the basis of language corpus by means of computers. Business ethics and decision making (developing speech skills in foreign language).

Developed competence (knowledge and skills)
The students are expected to adopt communicative skills in English, as well as other skills necessary for independent participation in the studies and in working environment of the English speaking area. They are prepared to use the foreign language in situations they may come across during their studies or later on in their professional careers.

Ways of teaching
| Lectures ✓ | Exercises ✓ | Seminar ✓ | Practicum |
| Individual research ✓ | Field classes | Tutorial | Consultations ✓ |
| Workshops ✓ | Discussion ✓ | Internet ✓ |

Student obligations
| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay | Active participation in education process ✓ |

Supervision and grading students
| Written exam ✓ | Oral exam ✓ | Essay | Practical work |
| Project | Continuous evaluation of knowledge or grading of activity ✓ | Research | Seminar ✓ |
NAME OF THE COURSE: GERMAN FOR ACADEMIC PURPOSES

Teacher's name: Biserka Fučkan Držić, Prof.
Assistant name:

- (Subject oriented field): Geodesy, Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling: a pass mark in “German in Geodesy”
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course:
Developing language skills in the context of geodesy. Attending lectures in German for geodetic purposes. Studying the skills in making notes in German for special purposes. Case studies for various topics, e.g. Informatics and geodesy, importance of geoinformation systems, new challenges in geodesy, shape and size of the Earth as functions of time, map as a work of art, etc. Practising various types of presenting specialised topics. Techniques of efficient presentation, usage of visual tools. Team and individual presentation of material. Teaching the skill in reading specialized literature in German for special purposes. Improving the language for special purposes by means of Internet. Writing professional, i.e. scientific paper in German (organisation of the written material, sentence types characteristic for single parts of written material). Transfer of written material into oral presentation. Production of personal specialized glossaries on the basis of language corpus by means of computers. Business ethics and decision making (developing speech skills in foreign language).

Developed competence (knowledge and skills)
The students are expected to adopt communicative skills in German, as well as other skills necessary for independent participation in the studies and in working environment of the German speaking area. They are prepared to use the foreign language in situations they may come across during their studies or later on in their professional careers.

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NAME OF THE COURSE: GLOBAL GEODESY

Teacher's name: Assist. Prof. Željko Hečimović, PhD
Assistant name: Assist. Prof. Željko Hečimović, PhD

- (Subject oriented field): Geodesy
- Year/semester: 4/ VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling: no
- Number of weeks in a semester/number of classes in a week: 15 / 2 + 2
- (Total number of field classes): 0
- ECTS points: 6

Description/contents of the course

Lecturing Program:

Exercises Contents:
Reduction of geodetic measurements considering geosystem models, using of data and services of international geodetic services.

Developed competence (knowledge and skills)

Mastering of knowledge and skills about geosystem models, satellite measuring techniques, satellite missions and sensors, reductions of geodetic measurements considering geosystem models, using of international geodetic services and data.

Ways of teaching

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Student obligations

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References

a) Obligatory

b) Additional

c) Internet sources
   1. Global geodesy Internet pages - http://www.geof.hr/~zhecimovic
   8. Permanent Service for Mean Sea Level - http://www.pol.ac.uk
NAME OF THE COURSE: GLOBAL GEODESY – A PROJECT

Teacher's name: Assist. Prof. Željko Hečimović, PhD
Assistant name: Assist. Prof. Željko Hečimović, PhD

- (Subject oriented field):
- Year/semester: 5/ IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling: no
- Number of weeks in a semester/number of classes in a week: 15 / 0 + 4
- (Total number of field classes): 0
- ECTS points: 6

Description/contents of the course

Modeling of gravity field of idealized bodies (sphere, level ellipsoid) and modeling of gravity field of real Earth gravity field, e.g. geoid as fundamental Earth surface. Introduction in gravity fields data bases. Using official computer programs of International Association of Geodesy. Interpretation of modeled local geoid in Croatia.

Developed competence (knowledge and skills)

Mastering of knowledge and skills of gravity field modeling. Introduction in characteristic of gravity field data and associated databases. Using of official computer programs of International Association of Geodesy for modeling gravity field. Modeling of geoid as fundamental Earth surface. Interpretation of the model.

Ways of teaching

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References

a) Obligatory
b) Additional

c) Internet sources
1. Global geodesy Internet pages - http://www.geof.hr/~zhecimovic
NAME OF THE COURSE: DIGITAL PLANS

Teacher's name: Assoc. Prof. Mira Ivković, PhD
Assistant name:

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

The students acquire the skills in the theory of producing topographic plans and in practical application of some graphic programs and using digital data for various geodetic calculations.

Ways of teaching

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References

a) Obligatory
Ivković, M.: Digitalni planovi (digital plans), Course material, Faculty of Geodesy
Internet pages dealing with these issues
NAME OF THE COURSE: DIGITAL PLANS – A PROJECT

Teacher's name: Assoc. Prof. Mira Ivković, PhD
Assistant name:

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Production the seminar of project- Digital plans.

Developed competence (knowledge and skills)
Individual research.

Ways of teaching

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References

a) Obligatory
Ivković, M.: Digitalni planovi (digital plans), Course material, Faculty of Geodesy
Internet pages dealing with these issues
NAME OF THE COURSE: ENGINEERING GEODESY IN CIVIL ENGINEERING

Teacher's name: Prof. Zdravko Kapović, PhD
Assistant name: Rinaldo Paar, Ante Marendić

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes): 3-4
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Students are skilled in performing geodetic works in civil engineering.

Ways of teaching

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References

a) Obligatory
3. Hennecke, Muller, Werner (1994): Handbuch Ingenieurvermessung, Band 1, Grundlagen, 2. völlig überarbeitete und erweiterte Auflage,

b) Additional
NAME OF THE COURSE: MOVEMENTS AND DEFORMATIONS

Teacher's name: Prof. Zdravko Kapović, PhD
Assistant name: Rinaldo Paar, Ante Marendić

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling: pass mark in all courses from previous year
- Number of weeks in a semester/number of classes in a week: 15/2 +2
- (Total number of field classes): 2-3
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Students are skilled for measuring the movements of objects.

Ways of teaching

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References

a) Obligatory
2. Caspar, W. F. (1996): Concept of network and deformation analysis, The University of New South Wales, Kensington, NSW, Australia, Monograph 11

b) Additional
NAME OF THE COURSE: GEODESY IN ENVIRONMENTAL PROTECTION

Teacher's name: Prof. Zdravko Kapović, PhD
Assistant name: Rinaldo Paar, Ante Marendić

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Students are acquainted with the significance of geodesy in environmental protection.

Ways of teaching

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References

a) Obligatory
3. Zakon o građenju, Zakon o prostornom planiranju, Zakon o komori arhitekata i inženjera u graditeljstvu, Zakon o državnoj izmjeri i katastru nekretnina
NAME OF THE COURSE: ORGANISATION OF GEODE蒂C WORKS

Teacher's name: Prof. Zdravko Kapović, PhD
Assistant name:

- (Subject oriented field): Geodesy
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Students are acquainted with the basic elements of financing and market competition.

Ways of teaching
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References
a) Obligatory

b) Additional
1. Priručnik za konzultantske usluge u investicijskoj izgradnji, Poslovna zajednica "Koprojekt-Zagreb, Gundulićeva 23/II
2. Zakon o građenju, Zakon o prostornom planiranju, Zakon o komori arhitekata i inženjera u graditeljstvu, Zakon o državnoj izmjeri i katastru nekretnina
NAME OF THE COURSE: ENGINEERING GEODESY IN CIVIL ENGINEERING – A PROJECT

Teacher's name: Prof. Zdravko Kapović, PhD
Assistant name:

- Subject oriented field:
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes): 4-5
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Independent work on a concrete geodetic task.

Ways of teaching

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References

- **Obligatory**
8. Hennecke, Muller, Werner (1994): Handbuch Ingenieurvermessung, Band 1, Grundlagen, 2. völlig überarbeitete und erweiterte Auflage,

b) Additional
2. Znanstveno-stručni projekti o mostovima i tunelima
NAME OF THE COURSE: MULTIMEDIA CARTOGRAPHY

Teacher's name: Prof. Miljenko Lapaine, PhD
Assistant name: Dražen Tutić, MSc, Ivka Kljajić, MSc, Rober Župan, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory optional): optional
- Conditions of course enrolling: no
- Number of weeks in a semester/number of classes in a week: 15/2 +2
- (Total number of field classes): 1
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Basic knowledge and skills in collecting data and their processing for the purpose of making interactive and dynamic web-maps connected with multimedia contents.

Ways of teaching

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References

a) Obligatory
Lapaine, M., Tutić, D.: Multimiđijska kartografija, rukopis u pripremi

b) Additional

c) Internet sources
Hrvatsko kartografsko društvo
http://www.kartografija.hr
NAME OF THE COURSE: GEODETIC HERITAGE

Teacher's name: Prof. Miljenko Lapaine, PhD
Assistant name: Ivka Kljajić, MSc

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes): 3
- ECTS points: 6

Description/contents of the course


Exercises: Visit to adequate collections in the Technical museum, National and University Library, State Archives and organising adequate exhibitions.

Developed competence (knowledge and skills)

Basic knowledge about Croatian and world history of geodetic theory and practice. Basic knowledge about organisation of exhibitions, museum and archive collections.

Ways of teaching

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References

a) Obligatory
Lapaine, M.: Povijest geodezije, rukopis u pripremi

b) Additonal
Geodetski list i njegovi prethodnici.
Bialas, V.: Erdgestalt, Kosmologie und Weltanschauung, K. Wittwer, Stuttgart 1982

c) Internet sources
Hrvatsko kartografsko društvo
http://www.kartografija.hr
Hrvatsko geodetsko društvo
http://www.geof.hr/hgd
Geodetski fakultet Sveučilišta u Zagrebu
http://www.geof.hr
NAME OF THE COURSE: SYSTEM OF SCIENTIFIC INFORMATION

Teacher's name: Prof. Miljenko Lapaine, PhD
Assistant name: Ivka Klajić, MSc

- (Subject oriented field): Geodesy/Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
  - Number of weeks in a semester/number of classes in a week: 15/2+2
  - (Total number of field classes):
  - ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Developing competences (knowledge and skills) in scientific activities, methodology and technology of scientific research. Knowledge about the existence and skills in using scientific information by means of libraries, journal, and available bibliographic databases.

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References

a) Obligatory
b) Additional

c) Internet sources
Sustav znanstvenih informacija RH
http://www.szi.hr/
Nacionalna i sveučilišna knjižnica
http://www.nsk.hr/
NAME OF THE COURSE: CARTOGRAPHY AND NEW TECHNOLOGIES – A PROJECT

Teacher's name: Prof. Miljenko Lapaine, PhD
Assistant name: Ivka Klajić, MSc

- (Subject oriented field):
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Within the project the students have the task to prepare, collect and process the data and interpret the obtained results. The topics of the project are practice-oriented and connected with the application of the most recent technologies in cartography (digital cartography, Internet, multimedia)

Developed competence (knowledge and skills)

The project is intended to develop organisational and performable abilities in an independent task work applying previously adopted knowledge. The independence in executing the project also encourages the problem-oriented approach to the tasks and makes the student decide in the process of project realization.

Ways of teaching

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Student obligations

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Supervision and grading students

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References

Depending on the project topic.
NAME OF THE COURSE: APPLICATION OF LASER DEVICES

Teacher's name: Assoc. Prof. Zlatko Lasić, PhD
Assistant name: Loris Redovniković

- (Subject oriented field): Geodesy
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes): field work six times
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Basic knowledge in the field of laser technology. Using laser devices in geodetic practice as well as the application in other professions.

Ways of teaching

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Student obligations

| Oral exam ✅ | Written exam ✅ | Seminar | Essay | Active participation in education process |

Supervision and grading students

| Written exam ✅ | Oral exam ✅ | Essay | Practical work |
| Project | Continuous evaluation of knowledge or grading of activity ✅ | Research | Seminar |

References

a) Obligatory
Lasić, Z.: Predavanja – rukops (Course material – manuscript)

b) Additional

c) Internet sources
Internet pages of the world geodetic instruments producers
NAME OF THE COURSE: INFLUENCE OF ATMOSPHERIC MEASURING CONDITIONS ON OPTICAL FUNCTION OF THEODOLITE TELESCOPE – A PROJECT

Teacher's name: Assoc. Prof. Zlatko Lasić, PhD
Assistant name: Loris Redovniković

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

In geodetic measurements one has to consider the fact that the atmosphere is an optical medium having the optical characteristics changing in space and time. On the basis of known meteorological parameters one can judge the limits of optical system resolution.

Ways of teaching

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Supervision and grading students

References

a) Obligatory

b) dopunska
NAME OF THE COURSE: LAND CONSOLIDATIONS

Teacher's name: Assist. Prof. Siniša Mastelić Ivić, PhD
Assistant name: Hrvoje Tomić

- (Subject oriented field): Geodesy
- Year/semester: 4/IX
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Historical overview of land consolidation with special emphasize on the role and the development of land consolidation works. The law of land consolidation and urban subdivision. Phases of land consolidation works. The initiation of the procedure. Preparation works, harmonizing land registry and land registry book situation and definition of the existing situation (technical revision). Land consolidation estimation of land, definition of relative property value. Preactivities for the land consolidation project, geodetic and technical activities, conceptual design of new road and canal network, and the conceptual project of new tables, project documentation. Detailed survey needed for the land consolidation project. Land consolidation project, feasibility projects. Regulation of land consolidation area boundaries and boundary regulation of settlements. Transfer and layout of land consolidation project to the field. Division of land consolidation tables of various sizes, distribution discussion. Final works, layout of new properties, land consolidation decisions. Solving the complaints to: project, land evidence, land estimation, distribution of new properties.

Developed competence (knowledge and skills)

Skills in organising and performing the procedure of land consolidation and urban subdivision.

Ways of teaching

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a) Obligatory
b) Additional
NAME OF THE COURSE: GEODETIC WORKS IN HYDROTECHNIQUES

Teacher's name: Assoc. Prof. Siniša Mastelić Ivić, PhD
Assistant name: Hrvoje Tomić

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
  - Number of weeks in a semester/number of classes in a week: 15/2+2
  - (Total number of field classes):
  - ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Skills in organising and performing the procedure in hydro techniques.

Ways of teaching

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References
a) Obligatory
Ingham, A. E.: Sea Surveying, John wiley and Sons, London
NAME OF THE COURSE: REAL ESTATE ESTIMATION

Teacher's name: Assist. Prof. Siniša Mastelić Ivić, PhD
Assistant name: Hrvoje Tomić

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Knowledge in estimating real estate value.

Ways of teaching

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References

a) Obligatory
Ross, F.W., Brachmann, R., Holzner, P.: Ermittlung des Bauwertes von Gebäuden und Grundstücken

b) Additional
NAME OF THE COURSE: RISK MANAGEMENT

Teacher's name: Assist. Prof. Siniša Mastelić Ivić, PhD
Assistant name: Vlado Ćetl, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Using spatial data for preventing damage in risk circumstances.

Ways of teaching

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References

a) Obligatory
Casale, R., Claudio, M. (2004): Natural Disasters and Sustainable Development
b) Additional

c) Internet sources
Global Disaster Information Network. www.gdin.org
NAME OF THE COURSE: SPACE DEVELOPMENT – A PROJECT

Teacher's name: Assist. Prof. Siniša Mastelić Ivić, PhD
Assistant name: Hrvoje Tomić

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Development of knowledge about geodetic support in the realisation of spatial plans.

Ways of teaching

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References

a) Obligatory
Zakon o prostornom uredenju
Pravilnik o izradi prostornih planova
Zakon o poljoprivrednom zemljištu
Zakon o izvlaštenju
Zakon o komasacijama
b) Additional
NAME OF THE COURSE: SPATIAL DATABASES

Teacher's name: Assoc. Prof. Damir Medak, PhD
Assistant name: Ivan Medved, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Theoretical background and practical application of advanced commercial and free spatial database management systems in networked computer environment. Distinction between monolithic geoinformation software packages and spatial database management systems.

Ways of teaching

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References

a) Obligatory
Rigaux, Scholl, Voisard (2002): Spatial Databases with application to GIS. Morgan Kaufmann.

b) Additional
NAME OF THE COURSE: SOFTWARE ENGINEERING IN GEOMATICS

Teacher's name: Assoc. Prof. Damir Medak, PhD
Assistant name: Ivan Medved, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
  - Number of weeks in a semester/number of classes in a week: 15/2+2
  - (Total number of field classes):
  - ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Notion of software specification as a link between the expert knowledge (geodesy and geoinformation) and computer scientists or programmer. Introduction to modern standardization technologies for building of general specifications (UML), geoinformation specifications (OGC) and its implementation in object-oriented programming language Java.

Ways of teaching

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References

a) Obligatory

b) Additional
NAME OF THE COURSE: SPATIAL DATA ANALYSIS

Teacher's name: Assoc. Prof. Damir Medak, PhD
Assistant name: Ivan Medved, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Understanding of operations for analytic functionality of geoinformation systems and its application in computer environment.

Ways of teaching

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References

a) Obligatory

b) Additional
NAME OF THE COURSE: COMPUTER PROGRAMMING FOR GIS – A PROJECT

Teacher's name: Assoc. Prof. Damir Medak, PhD
Assistant name: Ivan Medved, MSc

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
  - Number of weeks in a semester/number of classes in a week: 15/0+4
  - (Total number of field classes):
- ECTS points: 6

Description/contents of the course

The objective of this subject is to provide students with competence in scripting for and customisation of Geographic Information System (GIS) and database technology. The subject will include: structure and syntax of a visual programming language; development of GIS functionality in general programming environments using GIS function libraries; customisation of GIS using a scripting language; introduction to databases and SQL; and programming with databases.

Developed competence (knowledge and skills)

The ability to write computer programs that enhance the function of GIS and database software, and write computer programs that provide GIS and database functionality independently of more general programs.

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References

a) Obligatory
NAME OF THE COURSE: ORGANISATIONAL THEORY

Teacher's name: Assoc. Prof. Branka Mraović, PhD
Assistant name:

- (Subject oriented field): Geodesy, Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Within this subject, the attention of students is focused on the modes of retreat of the organisation paradigm against the paradigm of global network organising. When employing a person, employers increasingly give preference to experts who, in addition to specialist knowledge, also have basic knowledge in the areas of organisational theory and human resources management. This subject is accordingly articulated in such a way as to focus on complex problems of business organisations in the context of an extremely fast development of information and communication technologies. This issue is approached in a comparative way during the teaching process by providing students with information about recent research in the area of business organisations, behaviour of managers and characteristics of entrepreneurs and entrepreneurial firms, as well as international corporations from a variety of cultures – Europe, USA, Japan and the new industrial countries in the Pacific. Also, during lectures and seminars, the specific features of organisations and managers in Croatia are addressed, especially those falling within the scope of activities of engineers in geodesy, and their experiences are compared with those from Europe and the world.


Developed competence (knowledge and skills)

- The foundations of organisational theory;
- Human resource management in the technical environment;
- Organisational behaviour;
- Teamwork.
- Organisational design;
- Understanding financial reports;
- Knowledge management;
• The new forms of organising;
• Modernist and postmodernist organisation;
• Virtual organisation;
• The learning organisation.

Ways of teaching

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Student obligations

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Supervision and grading students

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<td>Research ✓</td>
<td>Seminar ✓</td>
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</tbody>
</table>

References

a) Obligatory

b) Additional

c) Internet sources
3. Professor David Crowther, London Metropolitan University: http://www.davideacrowther.com
   http://www.davideacrowther.org
   http://socialresponsibility.biz
NAME OF THE COURSE: HOW MARKETING OPERATES – ITS TOOLS AND TECHNIQUES – A PROJECT

Teacher’s name: Assoc. Prof. Branka Mraović, PhD
Assistant name:

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the project

Students are given an opportunity to do their own research in the field of marketing and public relations in companies which might be their potential employers. All excellent companies are close to their clients and customers. Today’s sophisticated marketing tools and techniques have well-thought-out and precisely scheduled marketing plans for products. These plans outline two key points: 1. The overall objectives for the marketing plan – what is to be achieved?; 2. The strategies to be employed – how is the objective to be reached? The marketing mix represents the resources one has as a marketer to encourage exchanges with customers and clients. There are four components of the marketing mix: product, pricing, distribution and promotion. Products involve more than just the obvious features of goods and services; they can also include customer service, warranties, repair, prestige, and other components of value. The pricing element serves the obvious function of generating revenue and profit, but it is also used to stimulate purchases at certain times, create images for products, and build competitive advantage. Distribution focuses on getting products from producers to final customers. Finally, promotion is the process of communicating with customers and other members of the public, using variety of techniques and media. Themes: 1. How public relations is managed – planning, administering, budgeting, evaluating; 2. Strategic marketing planning and forecasting; 3. Analysis of marketing environment; 4. Marketing research and marketing information systems; 5. Ethics and social responsibility in the marketing environment.

Developed competence (knowledge and skills)

After undertaking a piece of field research, students will be able to:
- List the most common objectives of marketing in geodesy and geoinformatics;
- Define the utilities that marketers can offer customers and clients;
- Discuss the categories of services and products;
- Outline the process of developing a marketing strategy;
- Describe the marketing mix and its major components.

Ways of teaching

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Student obligations

| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay ✗ | Active participation in education process ✓ |

Supervision and grading students

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References

a) Obligatory


b) Additional

NAME OF THE COURSE: GEODETIC NETWORKS FOR SPECIAL PURPOSES

Teacher's name: Assoc. Prof. Gorana Novaković, PhD
Assistant name: Rinaldo Paar, Ante Marendić

- (Subject oriented field): Geodesy
- Year/semester: 4/VIII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course:

Developed competence (knowledge and skills):
Capability of designing and establishing the independent geodetic network used as geodetic reference for high precise engineering works as well as deformation monitoring of man-made and natural features of the Earth's surface.

Ways of teaching

| Lectures ✓ | Exercises ✓ | Seminar ✓ | Practicum ✗ |
| Individual research ✓ | Field classes ✓ | Tutorial ✓ | Consultations ✓ |
| Workshops ✓ | Discussion ✓ | Internet ✓ | |

Student obligations

| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay ✗ | Active participation in education process ✓ |
| Project ✗ | Continuous evaluation of knowledge or grading of activity ✓ | | | |

Supervision and grading students

| Written exam ✓ | Oral exam ✓ | Essay ✗ | Practical work ✗ |
| Project ✗ | Continuous evaluation of knowledge or grading of activity ✓ | Research ✓ | Seminar ✓ |
References

a) Obligatory

b) Additional

c) Internet sources:
actual sources
NAME OF THE COURSE: GEODETIC NETWORKS FOR SPECIAL PURPOSES – A PROJECT

Teacher's name: Assoc. Prof. Gorana Novaković, PhD
Assistant name: 

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course:
The project deals with a theme or tasks related to the concept of the optimum design, adjustment methods and quality analysis of independent geodetic networks. The task can be connected with the theme of diploma thesis.

Developed competence (knowledge and skills):
Adoption of theoretical and practical skills through independent work on a concrete task in the field of geodetic networks for special purposes.

Ways of teaching

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Student obligations

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Supervision and grading students

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References:
Actual literature (books, scripts, papers, Web) connected with the project theme.
NAME OF THE COURSE: MARINE GEODESY

Teacher's name: Assist. Prof. Boško Pribičević, PhD
Assistant name: Almin Đapo, MSc

- (Subject oriented field): Geodesy
- Year/semester: 5/IX
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Understanding the link between tide-gauge measurements and height system. Theoretic background of underwater acoustic and its application for underwater positioning. Introduction into modern systems for electronic marine navigation, underwater research, and oceanographic satellite missions.

Ways of teaching
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Student obligations
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Supervision and grading students
| Written exam ✓ | Oral exam ✓ | Essay | Practical work |
| Project | Continuous evaluation of knowledge or grading of activity ✓ | Research ✓ | Seminar |
References

a) Obligatory

b) Additional
NAME OF THE COURSE: PRESENTATION TECHNIQUES

Teacher's name: Assist. Prof. Boško Pribičević, PhD
Assistant name: Ivan Medved

- (Subject oriented field): Geodesy, Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Self-confidence in preparation and performing scientific and professional presentations of projects and papers. Recognition of personal presentation weaknesses and avoiding them.

Ways of teaching

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Supervision and grading students

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References

a) Obligatory
NAME OF THE COURSE: GEODETIC BUSINESS ACTIVITY

Teacher's name: Assoc. Prof. Boško Pribičević, PhD
Assistant name: Alkmin Dapo

- (Subject oriented field): Geodesy
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
The students are acquainted with all legal, economic and aethical bases of geodetic firm business activity at national and global level. The graduates are skilled to get integrated into the business world of geodesy and geoinformatics.

Ways of teaching

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Student obligations

| Oral exam ✓ | Written exam ✓ | Seminar | Essay | Active participation in education process ✓ |

Supervision and grading students

| Written exam ✓ | Oral exam ✓ | Essay | Practical work |
| Project | Continuous evaluation of knowledge or grading of activity ✓ | Research ✓ | Seminar |
References

a) Obligatory

b) Additional

c) Internet sources
Global Disaster Information Network. www.gdin.org
NAME OF THE COURSE: GEODYNAMICS OF ADRIATIC MICROPLATE – A PROJECT

Teacher's name: Assist. Prof. Boško Pribićević, PhD
Assistant name: Almin Dapo, MSc

• (Subject oriented field):
• Year/semester: 5/IX
• Course status (obligatory/optional): optional
• Conditions of course enrolling:
• Number of weeks in a semester/number of classes in a week: 15/0+4
• (Total number of field classes):
• ECTS points: 6

Description/contents of the course
Precise satellite GPS-observations within the EUREF-Permanent project. Permanent GPS-stations in Croatia and movements of Adriatic Microplate. Permanent stations on tide-gauges. Geodynamic network of the City of Zagreb. Processing and interpretation of the results.

Developed competence (knowledge and skills)
Contribution of geodesy to geodynamic research of the territory of Croatia, especially on the coast and in Zagreb area.

Ways of teaching
Lectures Exercises ✓ Seminar ✓ Practicum ✓
Individual research ✓ Field classes Tutorial ✓ Consultations ✓
Workshops ✓ Discussion ✓ Internet ✓

Student obligations
Oral exam × Written exam × Seminar ✓ Essay × Active participation in education process ✓

Supervision and grading students
Written exam × Oral exam × Essay × Practical work ✓
Project ✓ Continuous evaluation of knowledge or grading of activity ✓ Research ✓ Seminar ✓

References
a) Obligatory
b) Additional
NAME OF THE COURSE: GEOMATHEMATICS

Teacher's name: Nikol Radović, MSc
Assistant name:

- (Subject oriented field): Geodesy, Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2 + 2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Training how to combine mathematical theory, geodesy and GPS.

Ways of teaching

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References

a) Obligatory
b) Additional
NAME OF THE COURSE: SPATIAL MANAGEMENT SUPPORT

Teacher's name: Prof. Miodrag Roić, PhD
Assistant name: Hrvoje Matijević, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Survey and modelling of 3D objects and subdivision of real estate for the purpose of their being entered in official registers. Realisation of space development support system. 3D surveys and measurements processing. Official registering of objects and parts. Subdivision and preparation of studies. Strategy of introducing information system for the purpose of managing larger objects (airports, river ports, business objects, stations). Special characteristics of such objects. Spatial survey and geometry modelling. 3D modelling (CSG, b-rep). 3D topological models. 3D GIS. 3D Databases. 3D data formats (VRML, X3D, GML). Modular creation of information system. Using of different data types. The connection with the data from digital land registry and communal information systems. Maintenance and supplementation of information system. Using the system. Visualisation and presentation.

Developed competence (knowledge and skills)
The students acquire the knowledge in theory and practice of residential and industrial management.

Ways of teaching
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Student obligations
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Supervision and grading students
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References
a) Obligatory
Narodne novine: Propisi
b) Additional
NAME OF THE COURSE: LAND INFORMATION MANAGEMENT – A PROJECT

Teacher's name: Prof. Miodrag Roić, PhD
Assistant name:

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Adopting the knowledge through independent production, study and technical report creation, and public presentation of the produced project.

Developed competence (knowledge and skills)

Ways of teaching

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Supervision and grading students

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References

a) Obligatory
Recent professional journals and books in the field of land information management

b) Additional

c) Internet sources
Land information portals
NAME OF THE COURSE: GEOKINEMATICS

Teacher's name: Prof. Nevio Rožič, PhD
Assistant name: Marija Repanić

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling: Physical geodesy, State survey
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes): 0
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Knowledge about geodynamics and geokinematics global, continental, regional and local processes. Knowledge about geodetic positioning methods and techniques appliance regarding quantification of geodynamics and geokinematics influences on topographic surface and builded objects. Knowledge about ways of geodynamics and geokinematics influence on stability of the geodetic reference frames. Appliance skills of geodetic positioning regarding quantification of geodynamics and geokinematics movements and deformations of Earth surface at regional and local level.

Ways of teaching
Lectures ✓ Exercises ✓ Seminar ✓ Practicum ✗
Individual research ✓ Field classes ✗ Tutorial ✓ Consultations ✓
Workshops ✗ Discussion ✗ Internet ✓

Student obligations
Oral exam ✓ Written exam ✓ Seminar ✓ Essay ✗ Active participation in education process ✓

Supervision and grading students
Written exam ✓ Oral exam ✓ Essay ✗ Practical work ✗
Project ✗ Continuous evaluation of knowledge Research ✓ Seminar ✓
References

a) Obligatory
b) Additional
c) Internet sources
http://www.geo.ucalgary.ca/~wu/Geodyn.html
http://vmsg.geo.uu.nl/Info/researchplan.shtml
NAME OF THE COURSE: OPTIMIZATION OF GEODE蒂C NETWORKS

Teacher's name: Prof. Nevio Rožič, PhD
Assistant name: Marija Repanić

- (Subject oriented field): Geodesy
- Year/semester: 4/VIII
- Course status (obligatory/optional): Optional
- Conditions of course enrolling: State survey
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes): No
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Knowledge and skills of design and optimization of geodetic networks.

Ways of teaching

| Lectures ✓ | Exercises ✓ | Seminar ✓ | Practicum ✗ |
| Individual research ✗ | Field classes ✗ | Tutorial ✓ | Consultations ✓ |
| Workshops ✗ | Discussion ✗ | Internet ✗ |

Student obligations

| Oral exam ✓ | Written exam ✓ | Seminar ✓ | Essay ✗ | Active participation in education process ✓ |

Supervision and grading students

| Written exam ✓ | Oral exam ✓ | Essay ✗ | Practical work ✗ |
| Project ✗ | Continuous evaluation of knowledge or grading of activity ✓ | Research ✓ | Seminar ✓ |

References

a) Obligatory
b) Additional
NAME OF THE COURSE: OPTIMIZATION OF GEODETIC NETWORKS – A PROJECT

Teacher's name: Prof. Nevio Rožić, PhD
Assistant name: Marija Repanić

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): Optional
- Conditions of course enrolling: State survey
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes): No
- ECTS points: 6

Description/contents of the course
Concrete design and optimization project of special purpose geodetic network, including all significant fazes of: network design specification, network purpose and user requirements, network configuration, measurement requirements, observation plan, optimization criteria, optimization method, analysis of optimization results and reporting with special attention on developing of systematic and creative engineers designing knowledge, documenting of solved works and active initiative for investigating and gathering information necessary for project execution.

Developed competence (knowledge and skills)
Knowledge and skills of design and optimization of geodetic networks.

Ways of teaching

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<th>Exercises</th>
<th>Seminar</th>
<th>Practicum</th>
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Student obligations

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Supervision and grading students

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<td>Research ✓</td>
<td>Seminar ✓</td>
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</tbody>
</table>

References
a) Obligatory

b) Additional
NAME OF THE COURSE: SPACE GEODESY

Teacher's name: Assist. Prof. Drago Špoljarić, PhD
Assistant name: –

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling: no
- Number of weeks in a semester/number of classes in a week: 15/2 + 2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Lectures:

Developed competence (knowledge and skills)
Mastering basic knowledge and skills about space geodesy and observational and computational techniques, and using of international astrogeodetic services and data.

Ways of teaching

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Supervision and grading students

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</table>
References

a) Obligatory
Špoljarić, D. Svemirska geodezija, Lecturing notes.

b) Additional

c) Internet sources
Špoljarić, D. Svemirska geodezija, presentation, http://www.geof.hr/~dspoljar
International Astronomical Union (IAU), http://www.iau.org/
NAME OF THE COURSE: GEODETIC ASTRONOMY – A PROJECT

Teacher’s name: Assist. Prof. Drago Špoljarić, PhD
Assistant name: –

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling: no
- Number of weeks in a semester/number of classes in a week: 15/0 + 4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Visualization of astronomic data for Internet (production of the star sky map intended for Internet).
Production of program package for the recalculation of time scales, calendars and Julian Datum (JD) and its adjustment for Internet.
Testing the precision of simultaneous determination of astronomic coordinates with astrolabe along with the synchronized receipt and correction of time by means of GPS signal receipt.
Development of the program for automated azimuth (bearing angle) determination of some side with Leica electronic tachometer and field computers.
Production of specialized web pages with the list of astrogeodetic services, institutions and organizations.

Developed competence (knowledge and skills)

Broadening of knowledge in modern geodetic astronomy and astrometry. Practice in precise astrogeodetic measurement. Programming and adjustment (development of applications for Internet).

Ways of teaching

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Student obligations

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Supervision and grading students

| Written exam ✗ | Oral exam ✓ | Essay ✗ | Practical work ✗ |
| Project ✓ | Continuous evaluation of knowledge or grading of activity ✗ | Research ✓ | Seminar ✓ |
References

a) Obligatory
Špoljarić D.: Geodetska astronomija, Svemirska geodezija, Lecturing notes.

b) Additional

c) Internet sources
numerous Internet pages (geodetic, astronomic, time-related and others)
NAME OF THE COURSE: COMPUTER CARTOGRAPHY

Teacher's name: Assist. Prof. Nada Vučetić, PhD
Assistant name: Ivka Kljajić, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): obligatory
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Developed competence (knowledge and skills)
Application of digital methods for cartography

Ways of teaching
<table>
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Student obligations
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Supervision and grading students
| Written exam ✓ | Oral exam ✓ | Essay x | Practical work x |
| Project x | Continuous evaluation of knowledge or grading of activity x | Research x | Seminar x |

References
a) Obligatory
b) Additional
Stoll, H.: Computergestützte Kartographie, Kartografische Publikationsreihe Nr. 15,

c) Internet sources
http://www.ika.ethz.ch/cgi-bin/pub_public.pl
NAME OF THE COURSE: CARTOGRAPHY AND GIS

Teacher's name: Assist. Prof. Nada Vučetić, PhD
Assistant name: Dražen Tutić, MSc

- (Subject oriented field): Geodesy
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

Raster-data scanning and processing. Geocoding, georeferencing. Data accuracy. Basics of creating, editing, managing, querying, analysing, presenting and plotting maps in GIS. Choosing a map projection and choosing and assigning a global coordinate system. Editing the maps in digital cartography using various tools for cleaning, transforming and generalizing a map objects. Ability of GIS for executing a various analysis of data stored in a map or with it. Defining, editing and executing various queries. Data stored in map, i.e. object data, and data stored in external databases. Thematic map and GIS. Example: population map. Topology relationships: connectivity, adjacency and relative position. Relationships between nodes, links and polygons. Types of topology: node, network and polygon topology. Defining and editing a topology, and executing a various queries and analysis using topology. Mobile cartography and GIS.

Developed competence (knowledge and skills)

Theoretical and practical knowledge of relationship between cartography and GIS

Ways of teaching

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Supervision and grading students

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| Project ✗ | Continuous evaluation of knowledge or grading of activity ✗ | Research ✗ | Seminar ✗ |
References

a) Obligatory

b) Additional

c) Internet sources
NAME OF THE COURSE: CARTOGRAPHIC GENERALIZATION

Teacher's name: Assist. Prof. Nada Vučetić, PhD
Assistant name: Ivka Kljajić, MSc

- (Subject oriented field): Geoinformatics
- Year/semester: 4/VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

Theoretical and practical knowledge in cartographic generalization

Ways of teaching

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References

a) Obligatory

b) Additional

c) Internet sources
NAME OF THE COURSE: GENERALIZATION OF GEOINFORMATION – A PROJECT

Teacher's name: Assist. Prof. Nada Vučetić, PhD
Assistant name: Ivka Kljajić, MSc

- (Subject oriented field):
- Year/semester: 5/IX
- Course status (obligatory/optional): optional
- Conditions of course enrolling:
- Number of weeks in a semester/number of classes in a week: 15/0+4
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course
Generalization of geoinformation for certain purposes. Project includes collecting of geoinformation, analyzing its quality, finding out of generalization rules and methods.

Developed competence (knowledge and skills)
Solving assignment in area of geoinformation generalization

Ways of teaching

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References

a) Obligatory
Theacher recommends in keeping with project problem.

b) Additional

c) Internet sources
NAME OF THE COURSE: COMPLEX ANALYSIS

Proposer's name: Vida Zadelj-Martić, MSc
Assistant name:

- (Subject oriented field):
- Year/semester: 4/ VII
- Course status (obligatory/optional): optional
- Conditions of course enrolling: Mathematical analysis
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course

- Complex Functions
- The Elementary Functions
- Analytic Functions
- Cauchy – Riemann Equations
- Conformal Mapping
- Integration in the Complex Plane
- Cauchy's Integral Formula
- Applications in Geodesy
- Applications in Cartography

Developed competence (knowledge and skills)

Understanding of the key topics and problems of Complex Analysis and developing the necessary techniques and skills for solving exercises and problems that are met in Geodesy.

Ways of teaching

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Student obligations

| Oral exam ✓ | Written exam ✓ | Active participation in education process ✓ |

Supervision and grading students

| Written exam ✓ | Oral exam ✓ | Two non-obligatory colloquia with exercises and theoretical questions. |
| To pass the exam, the student must collect at least 50% of all possible | | |
points that can be collected by solving exercises and at least 50% of all possible points that can be collected by answering the theoretical questions, both linked with colloquia. Otherwise, or if not content with the proposed mark, the student can take the written part and afterwards the oral part of the exam.

References

a) Obligatory:
M. R. Spiegel; Complex Variables, Schaum's Outline series, McGraw-Hill, New York

H. A. Priestley; Introduction to Complex Analysis, Oxford, University Press

b) Additional:
E. Kreyszig; Advanced Engineering Mathematics, J. Wiley&Sons Inc., Ohio
NAME OF THE COURSE: NUMERICAL ANALYSIS

Teacher's name: Vida Zadelj-Martić, MSc
Assistant name:

- (Subject oriented field): Geodesy, Geoinformatics
- Year/semester: 4/VIII
- Course status (obligatory/optional): optional
- Conditions of course enrolling: Mathematical analysis
- Number of weeks in a semester/number of classes in a week: 15/2+2
- (Total number of field classes):
- ECTS points: 6

Description/contents of the course


Developed competence (knowledge and skills)

| Understanding of the key topics and problems of Numerical Analysis and developing the necessary techniques and skills for solving exercises and problems that are met in Geodesy. |

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Supervision and grading students

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part and afterwards the oral part of the exam.

References

a) Obligatory:
W. A. Smith; Elementary Numerical Analysis, Harper & Row, New York

b) Additional:
E. Kreyszig; Advanced Engineering Mathematics, J. Wiley&Sons Inc., Ohio