I. DESCRIPTION OF STUDY PROGRAMME FORM

<table>
<thead>
<tr>
<th>BASIC INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title of study programme</strong></td>
</tr>
<tr>
<td><strong>study programme coordinator</strong></td>
</tr>
<tr>
<td><strong>Study programme implementor</strong></td>
</tr>
<tr>
<td><strong>Type of study programme</strong></td>
</tr>
<tr>
<td><strong>Level of study programme</strong></td>
</tr>
<tr>
<td><strong>Academic/professional degree awarded upon completion of study</strong></td>
</tr>
</tbody>
</table>

1. INTRODUCTION

1.1. Reasons for initiating the study

The four year studies of mathematics, as a single major or in a combination with physics and computer science have been carried out at the Faculty of Humanities and Social Sciences in Rijeka (i.e. its predecessors) since 1964. In October 2004 the Ministry of Science, Education and Sports issued the accreditation which verified that the studies carried out at the Department of Mathematics of the Faculty of Humanities and Social Sciences in Rijeka were at the desired level. After that, in accordance with the Bologna process, in June 2005 the accreditations for carrying out the Undergraduate course in Mathematics, the Graduate course in Mathematics (teacher training) and the Graduate course in Mathematics and Computer Science (teacher training) at the Department of Mathematics of the Faculty of Humanities and Social Sciences in Rijeka were issued. Upon the foundation of the Department of Mathematics at the University of Rijeka, the Ministry of Science, Education and Sports in its declaration from 16th January 2009 (class: 602-04/08-13/00041, reg. no.: 533-07-09-0002) stated that the change of the legal successor has not influenced the content and legal validity of the previously issued accreditations and that the Department of Mathematics will keep the accreditations for carrying out the given study programmes, about which a certain recordation in the Register of Higher Education Institutions is going to be made.

1.2. Estimation of purpose with respect to labour market needs in public and private sector

The results of the analysis of labour market carried out previously by the Croatian Employment Service indicate that in the area under the Area office Rijeka of the Croatian Employment Service there are no unemployed bachelors of science in mathematics. As the evidence of the deficit of mathematicians there are numerous scholarships for deficit occupations that are offered to the students of mathematics both on local and national levels. Although the Undergraduate course in Mathematics has been developed as a part of the integrated study of teacher training profiles, the course is organized to offer basic knowledge in the field of mathematics so afterwards it is possible to continue to study mathematics even on the profile that is not in the teacher training field.

1.2.1. Relationship with the Local Community (economy, business, civil society)

Although the profession of mathematician is currently not recognized as the profession that significantly influences the improvement of work process due to current economic situation, this profession has been classified as one of the best professions that guarantee employment, which can be seen in the annual reports issued by CareerCast.com (http://www.careercast.com/jobs-rated/best-jobs-2014).

1.2.2. Compatibility with the requirements of professional associations (recommendation)

When the study programme concept was made, special attention was given to the source: Tuning Educational Structures in Europe (http://www.unideusto.org/tuningeu/), especially the part that refers to the following competences: basic competences (http://www.unideusto.org/tuningeu/competences/generic.html) and specific competences in the field of mathematics (http://www.unideusto.org/tuningeu/competences/specific/mathematics.html). Besides, the recommendations for...
designing the study programmes in mathematics were taken into account (http://www.unideusto.org/tuningeu/subject-areas/mathematics.html). Apart from the recommendations from national professional associations, the Department of Mathematics follows modern trends and recommendations for higher education of the professional associations such as:

- Société Mathématique de France (SMF) (http://smf.emath.fr/content/enseignement) and

1.2.3. List of the possible partners outside the higher education system who expressed interest for study program

The partners outside the higher education system that have expressed interest for the given study programme are elementary schools and high schools.

1.3. Comparability of study program with similar programs of accredited institutions of higher education in Croatia and the EU (specify and explain the comparability of the two programs, of which at least one of the EU, with a program that is proposed, and state network sites)

The proposed syllabuses of the majority of courses coincides with the syllabuses of the undergraduate course in mathematics at other Croatian universities, which enables transfer of the students of mathematics between the University of Rijeka and other Croatian universities. As an example the comparison of the Undergraduate course in Mathematics at the University of Rijeka and the University of Osijek (http://www.mathos.unios.hr/index.php/en/study-programmes/undergraduate-university-study-programme-in-mathematics/study-programme-undergraduate) can be taken. Basic mathematical courses of the same or similar name and of the similar content constitute the study programmes of mathematics at the majority of European universities, such as:

- Queen Mary University of London (http://qplus.qmul.ac.uk/course/view.php?id=1530),
- Ruprecht-Karls-Universität Heidelberg (http://www.mathematik.uni-heidelberg.de/).

1.4. Openness to the horizontal and vertical student mobility in national and international higher education

The Undergraduate course in Mathematics is open to the horizontal and vertical student mobility in national and international higher education system. The horizontal linkage with all undergraduate courses in mathematics in the Republic of Croatia that are constituted under the principles of the Bologna process has been assured. The syllabuses of the majority of courses coincides with the syllabuses of the undergraduate courses in mathematics at other Croatian universities, which allows the student mobility between the Department of Mathematics, University of Rijeka, the Faculty of Science, University of Zagreb, the of Mathematics, University of Josip Juraj Strossmayer in Osijek and the Faculty of Science, University of Split. The vertical mobility manifests through the possibility of enrolment of the bachelors of science in mathematics who finished the Undergraduate course in Mathematics at the Department of Mathematics, University of Rijeka, on some of the graduate courses at the Department of Mathematics or on another graduate courses in mathematics. The bachelors of science in mathematics can enrol the graduate courses in related fields by eventually passing the necessary examinations. The course is also open to the horizontal and vertical student mobility in international higher education system (Erasmus, CEEPUS). The basic courses in mathematics and computer science of this programme with the same or similar names and with the similar content are a part of the study programmes in mathematics at the majority of European universities and if necessary they can be carried out in English.

Considering the currently signed agreements as a part of the Erasmus programme with Karl-Franzens-Universitaet Graz, University of Ghent, St. Cyril and St. Methodius University of Veliko Turnovo and University of Ljubljana, the students of the Department of Mathematics have a possibility of international mobility. Furthermore, if necessary, the teaching in course can be carried out in English, which opens a possibility of arrival of foreign students.

1.5. Compatibility with mission and strategy of the University of Rijeka

The study programme is thoroughly in accordance with the University of Rijeka Strategy 2007-2013, since according to the Strategy special attention is going to be given to the development of natural sciences. This study programme contributes to the following goals of the Strategy:

- All study programmes at the University are structured in a way that at least 20% of learning outcomes in each programme develop generic competencies

Apart from professional competencies, this study programme develops generic competencies such as IT and information literacy, presentation skills through presentation of seminars and final works in front of groups, communication skills through teaching practice in elementary and high schools, teamwork and collaborative work
through common works. Through professional courses logical thinking as well as reasoned presentation and work are developed. Furthermore, the students often use sources in English.

- E-learning tools are used in at least 50% courses of each study programme (hybrid teaching or completely on-line teaching).

The majority of course programmes list e-learning and/or multimedia and on-line learning as a way of teaching.

- To increase the number of institutional popularization activities as well as the number of teaching staff and students who participate in them.

The significant projects carried out in collaboration with community and directed towards community are participation in and organization of the Science Festival in Rijeka, organization of several workshops and lectures for pupils in elementary and high schools in Rijeka and wider area, organization of the Open Days of the University departments of the University of Rijeka and the Evening of Mathematics.

In 2004 the Dublin Descriptors (http://archive.ehea.info/getDocument?id=2117) set learning outcomes for all three levels of university education. The Descriptors are given in general, for a single educational level and not for a single discipline or the field of study. They are given in five dimensions: knowledge and understanding which students should posses in order to gain a certain qualification, application of knowledge and understanding, inference and reasoning, communication and teaching skills. In accordance with the University of Rijeka Strategy 2007-2013 the University started the reform of the curriculum based on learning outcomes on the 31st session of the Senate at the end of 2007. The Draft of the Croatian Qualifications Framework was relevant during the curriculum reform (the Croatian Qualifications Framework was adopted in February 2013). The Dublin Descriptors were used as foundation for determining learning outcomes. From these outcomes the learning outcomes of each course were determined (by using Bloom’s Taxonomy of Educational Objectives, which is the world’s most widespread taxonomy). The learning outcomes of each course are in line with the content of courses, the methods of teaching and the methods of grading achievements on courses. The described methodology was used to derive learning outcomes for all study programmes (undergraduate, graduate, postgraduate specialist and postgraduate doctoral studies) and for all lifelong learning programmes.

1.6. Institutional development strategy of study programs (compatibility with the mission and strategic aims of the institution)

The Department of Mathematics, University of Rijeka, is a member institution of the University of Rijeka which does both research and professional work in the field of mathematics and assures the development of the personnel in mathematics at the University of Rijeka. The Department of Mathematics organizes and carries out courses from its field and also participates in the organization and performance of study programmes at other institutions of the University of Rijeka. Striving towards excellence in science and teaching both on national and international levels, the Department of Mathematics contributes to the development of the University of Rijeka and to the development of the whole society.

1.7. Other important information - in the opinion of the proposer
2. GENERAL PART

2.1. Title of study programme

Undergraduate course in Mathematics

2.1.1. Type of study programme

University

2.1.2. Level of study programme

Undergraduate

2.1.3. Area of study programme (scientific/artistic) – indicate the title

Mathematics

2.2. Study programme coordinator

University of Rijeka

2.3. Implementor/s of study programme

Department of Mathematics – University of Rijeka

2.4. Duration of study programme (indicate possibilities of part-time study, long distance study)

Study lasts 6 semesters, there is no possibility of attending classes in working time, neither through distance learning.

2.4.1. ECTS credits – minimal number of credits required for completion of study programme

180 ECTS

2.5. Enrolment requirements and selection procedure

The undergraduate course can be enrolled by a person who has finished a four year high school and who has satisfied classification procedure conditions for enrolment of new students.

2.6. Study programme learning outcomes

2.6.1. Competences which student gains upon completion of study (according to CROQF (HKO): knowledge, skills and competences in a restricted sense – independence and responsibility)

After finishing this study, the students will:

- be able to define and differentiate basic mathematical and ICT concepts,
- have knowledge about basic theories in the field of mathematics,
- be able to practically use and apply ICT,
- be able to apply theoretical knowledge with arguments in order to set and creatively solve mathematical problems,
- be able to continually educate themselves in the field of mathematics and computer science.

Through this study, the students develop independence and responsibility, especially through seminar works and projects and by solving tasks independently.

2.6.2. Employment possibility (list of possible employers and compliance with professional association's requirements)

The profession of mathematician has been classified as one of the best professions that guarantee employment, which can be seen in the annual reports issued by CareerCast.com.

2.6.3. Possibility of continuation of study on higher level

The bachelors of science in mathematics who finished the Undergraduate course in Mathematics at the Department of Mathematics, University of Rijeka, can enrol some of the graduate courses at the Department of Mathematics or other graduate courses in mathematics. The bachelors of science in mathematics can enrol the graduate courses in related fields by eventually
passing the necessary examinations.

<table>
<thead>
<tr>
<th>2.7. Upon applying for graduate studies list proposer’s or other Croatian institution’s undergraduate study programmes which enable enrolment to the proposed study programme</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2.8. Upon application of integrated studies - name reasons for integration of undergraduate and graduate level of study programme</th>
</tr>
</thead>
</table>
3. **PROGRAMME DESCRIPTION**

3.1. List of compulsory and elective subjects and/or modules (if existing) with the number of active teaching hours required for their implementation and number of ECTS-credits

**Table 1**

3.2. Description of each subject

**Table 2**

3.3. Structure of study programme, dynamic of study and students’ obligations

The study programme consists of the larger number of compulsory subjects (163 ECTS) and the smaller number of elective subjects (17 ECTS, i.e. 9.44% of the total number of ECTS on the study). The rhythm of the study is defined by the Study regulations at the University of Rijeka as well as general obligations, while specific obligations of the students are given in description of each subject and its syllabus that is given out annually at the beginning of a semester.

3.3.1. Enrolment requirements for the next semester or trimester (course title)

Admission requirements are determined by the Study regulations at the University of Rijeka.

3.4. List of courses and/or modules student can choose from other study programmes

<table>
<thead>
<tr>
<th>Course title (course status within the proposed program)</th>
<th>The existing program in which the course is taught (course status within the other program)</th>
<th>Note</th>
</tr>
</thead>
</table>
| Information systems (elective) | Undergraduate single major program of Informatics (compulsory)  
Undergraduate double major program of Informatics (compulsory) | DI |
| Operating systems (elective) | Undergraduate double major program of Informatics (compulsory)  
Undergraduate double major program of Informatics (compulsory) | DI |
| Programming (compulsory) | Undergraduate course in Physics (compulsory) | DI |
| Algorithms and Data Structures (compulsory) | Undergraduate course in Physics (compulsory) | DI |

DI – Department of Informatics

3.5. List of courses and/or modules that can be implemented in a foreign language (specify the language)

All compulsory courses of this study can be performed in English.

3.6. Allocated ECTS credits that enable national and international mobility

The proposed study is open to the student mobility on all related studies of national and international universities.

3.7. Multidisciplinarity/interdisciplinarity of study programme

The study programme covers courses in mathematics and computer science.

3.8. Mode of study programme completion

A student completes the study programme by taking the final exam in front of a three member committee. A part of the final exam is presentation and defence of the work that the student does during the last semester of the study. The student gains a right to access the final exam after he has taken all exams and has done all obligations.
proscribed by the study programme.

<table>
<thead>
<tr>
<th>3.8.1. Conditions of approval of final work /thesis and/or final/thesis exam application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditions for approval of application for the final exam are assigned by the Regulation of thesis and final exam at the university undergraduate courses of Department of Mathematics, University of Rijeka (<a href="http://www.math.uniri.hr/hr/propisi/propisi-i-dokumenti.html">http://www.math.uniri.hr/hr/propisi/propisi-i-dokumenti.html</a>).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.8.2. Composing and furnishing of final work/thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forming thesis is defined by the Regulation of thesis and final exam at the university undergraduate courses of Department of Mathematics, University of Rijeka (<a href="http://www.math.uniri.hr/hr/propisi/propisi-i-dokumenti.html">http://www.math.uniri.hr/hr/propisi/propisi-i-dokumenti.html</a>).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.8.3. Final work/thesis assessment procedure and evaluation and defence of final work/thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation process of thesis and final exam is defined by the Regulation of thesis and final exam at the university undergraduate courses of Department of Mathematics, University of Rijeka (<a href="http://www.math.uniri.hr/hr/propisi/propisi-i-dokumenti.html">http://www.math.uniri.hr/hr/propisi/propisi-i-dokumenti.html</a>).</td>
</tr>
</tbody>
</table>
### List of Compulsory and Elective Courses and/or Modules with Teaching Hours Required and ECTS Credits Allocated

<table>
<thead>
<tr>
<th>Semester</th>
<th>Module</th>
<th>Course</th>
<th>Organiser</th>
<th>L</th>
<th>E</th>
<th>S</th>
<th>ECTS</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analysis I</td>
<td>45</td>
<td>45</td>
<td>0</td>
<td>8</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Linear Algebra I</td>
<td>45</td>
<td>45</td>
<td>0</td>
<td>8</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elementary Mathematics I</td>
<td>45</td>
<td>30</td>
<td>0</td>
<td>7</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Computer Laboratory I</td>
<td>0</td>
<td>30</td>
<td>0</td>
<td>5</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Foreign language I</td>
<td>0</td>
<td>30</td>
<td>0</td>
<td>2</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Analysis II</td>
<td>45</td>
<td>45</td>
<td>0</td>
<td>8</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Linear Algebra II</td>
<td>45</td>
<td>45</td>
<td>0</td>
<td>8</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elementary Mathematics II</td>
<td>45</td>
<td>30</td>
<td>0</td>
<td>7</td>
<td>C</td>
<td></td>
<td></td>
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<td></td>
<td>Computer Laboratory II</td>
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<td>0</td>
<td>5</td>
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<tr>
<td></td>
<td>Foreign language II</td>
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<td>30</td>
<td>0</td>
<td>2</td>
<td>C</td>
<td></td>
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<tr>
<td>3</td>
<td>Analysis III</td>
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<td>7</td>
<td>C</td>
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<td></td>
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<tr>
<td></td>
<td>Combinatorics</td>
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<td>30</td>
<td>0</td>
<td>5</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Differential Equations</td>
<td>30</td>
<td>30</td>
<td>0</td>
<td>5</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Euclidean Spaces</td>
<td>30</td>
<td>30</td>
<td>0</td>
<td>5</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seminar I</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>3</td>
<td>C</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Internal elective B1&gt; number of elective courses to be selected: at least 5 ECTS</td>
<td>30</td>
<td>15</td>
<td>0</td>
<td>5</td>
<td>E</td>
<td></td>
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<tr>
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<td>Information Systems</td>
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<td>5</td>
<td>E</td>
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<td></td>
<td>Operating Systems</td>
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<td>30</td>
<td>0</td>
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<td>E</td>
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<td>4</td>
<td>Complex Analysis</td>
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<td>0</td>
<td>5</td>
<td>C</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Discrete Mathematics</td>
<td>30</td>
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<td>0</td>
<td>5</td>
<td>C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **IMPORTANT**: Put C for compulsory course or E for elective course.
2. **IMPORTANT**: Put C for compulsory course or E for elective course.
3. **IMPORTANT**: Put C for compulsory course or E for elective course.
4. **IMPORTANT**: Put C for compulsory course or E for elective course.
<table>
<thead>
<tr>
<th>Module</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester: 5</td>
<td>Programming 30 30 0 5 C, Set Theory 30 30 0 5 C, Geometry 30 30 0 5 C, Using Computers in Mathematics 15 30 15 5 C</td>
</tr>
<tr>
<td>Module</td>
<td>Courses</td>
</tr>
<tr>
<td>Metric Spaces</td>
<td>30 30 0 5 C</td>
</tr>
<tr>
<td>Introduction to Probability and Mathematical Statistics</td>
<td>30 45 0 6 C</td>
</tr>
<tr>
<td>Mathematical logic</td>
<td>30 30 0 6 C</td>
</tr>
<tr>
<td>Introduction to Numerical Mathematics</td>
<td>30 30 0 5 C</td>
</tr>
<tr>
<td>Seminar II</td>
<td>0 0 30 3 C</td>
</tr>
<tr>
<td>Internal elective A1</td>
<td>number of elective courses to be selected: at least 5 ECTS</td>
</tr>
<tr>
<td>Projective Geometry</td>
<td>30 30 0 5 E</td>
</tr>
<tr>
<td>Introduction to Number theory</td>
<td>30 30 0 5 E</td>
</tr>
<tr>
<td>Semester: 6</td>
<td>Courses</td>
</tr>
<tr>
<td>Module</td>
<td>Courses</td>
</tr>
<tr>
<td>Algebraic Structures</td>
<td>30 30 0 7 C</td>
</tr>
<tr>
<td>Introduction to Differential Geometry</td>
<td>45 30 0 7 C</td>
</tr>
<tr>
<td>Algorithms and Data Structures</td>
<td>30 30 0 5 C</td>
</tr>
<tr>
<td>Seminar / B. Sc. thesis</td>
<td>0 0 30 3 C</td>
</tr>
<tr>
<td>Final exam</td>
<td>1 1 C</td>
</tr>
<tr>
<td>Internal elective A2</td>
<td>number of elective courses to be selected: at least 7 ECTS</td>
</tr>
<tr>
<td>Introduction to Topology</td>
<td>45 30 0 7 E</td>
</tr>
<tr>
<td>Hyperbolic balance laws and applications</td>
<td>45 30 0 7 E</td>
</tr>
<tr>
<td>Numerical Linear Algebra</td>
<td>45 30 0 7 E</td>
</tr>
<tr>
<td>Theoretical Computer Science</td>
<td>45 30 0 7 E</td>
</tr>
</tbody>
</table>

Table 2

**IMPORTANT:** Put C for compulsory course or E for elective course.

**IMPORTANT:** Put C for compulsory course or E for elective course.
1. COURSE DESCRIPTION

1.1. Course objectives

This course aims to give students the basic knowledge about:
- field of real numbers and field of complex numbers,
- numerical sequences and convergence criteria,
- functions of a real variable and their properties (function limit, continuity, etc.),
- differential calculus and its applications

1.2. Correspondence and correlation with the program

Course program is correspondent to the program of similar courses in mathematics' studies. There exists a correlation with the following courses: Analysis II and III, Complex Analysis, Differential Geometry, Differential Equations and Numerical Mathematics.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this class, students are expected to know the basis of real numbers, field of complex numbers, limit of function in a point, derivative rules and applications. Students have to be able to use learned material for doing exercises.

1.4. Course content


1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

1.6. Comments

Attendance at all classes and active participation is expected. Student gets a grade after the final exam.
### 1.8. Evaluation and Assessment

| Class attendance and class participation | 1.6 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 4 | Oral exam | 1.7 | Essay | Research work |
| Project work | Continuous assessment | 0.7 | Presentation | Practical work |
| Portfolio | |

### 1.9. Assessment and grade of student’s work during the class and after the final exam

Attendance at all classes and active participation is expected. The total number of points a student can achieve during the class is 70 (assessed activities are indicated in the table above). Student gets a grade after the exam. The exam is scored with a maximum of 30 points.

### 1.10. Required literature

1. S. Kurepa: Matematička analiza I, II, Tehnička knjiga, Zagreb (više izdanja)
2. B. P. Demidović: Zadaci i riješeni primjeri iz više matematike, Tehnička knjiga, Zagreb (više izdanja)

### 1.11. Recommended literature


### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

### 1.13. Quality assurance of course and/or module

- questionnaire at the end of the course aimed to assess students’ understanding,
- questionnaire designed to evaluate course program, lectures and lecture materials, teaching methods and interaction with students

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7 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
# General Information

<table>
<thead>
<tr>
<th>Course title</th>
<th>Linear Algebra I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>I</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

## 1. COURSE DESCRIPTION

### 1.1. Course objectives

This course aims to give students the basic knowledge about:
- basic algebraic structures,
- dot and cross product,
- vector spaces,
- characteristics of matrices and determinants (rank of matrix, inverse matrix, similar matrices, etc.)
- characteristics of linear operators

### 1.2. Correspondence and correlation with the program

Course program is correspondent to the program of other mathematics' courses, especially Linear Algebra II, Euclidean Spaces and Analysis I.

### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this class, students are expected to know the basic properties of basic algebraic structures, to calculate dot and cross product, to operate with matrices, to know the basis of vector spaces and linear operators, to be able to mathematically prove procedures and formulas defined within this course. Students have to be able to use learned material for doing exercises.

### 1.4. Course content

Groups, homomorphisms of groups, fields, vectors, vector spaces, matrices, basic operations with matrices, determinants, inverse matrix, rank of matrix, linear operator, vector space base transformation, similar matrices.

### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Laboratory work
- Field work
- Multimedia and the Internet
- Tutorials
- Other
- Consultations

### 1.6. Comments

### 1.7. Student requirements

Every student have to satisfy student's obligations: attendance at all classes and active participation.
### 1.8. Evaluation and Assessment

| Class attendance and class participation | 1.7 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 3 | Oral exam | 2 | Essay | Experiment |
| Project work | Continuous assessment | 1.3 | Presentation | Research work |
| Portfolio | | | | Practical work |

### 1.9. Assessment and grade of student’s work during the class and after the final exam

Students’ work is monitored continuously. The main part of the evaluation and assessment of students is the quality of active participation in lectures and exercises. The total number of points a student can achieve during the class is 70 (assessed activities are indicated in the table above). The complete knowledge of students is evaluated in the exam scored with maximum of 30 points.

### 1.10. Required literature


### 1.11. Recommended literature


### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

### 1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

---

8 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
### General information

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Elementary Mathematics I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>I</td>
</tr>
<tr>
<td>Credit values and modes of instruction</td>
<td>ECTS credits / student workload: 7</td>
</tr>
<tr>
<td>Hours (L+E+S)</td>
<td>45+30+0</td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

#### 1.1. Course objectives

This course aims to acquaint students with basis of Elementary Mathematics, i.e.:
- define basic elements of mathematical logic and analyse basic mathematical proofs
- define sets, relations and functions; analyse their properties,
- learn basic properties of polynomials, rational, exponential and logarithmic functions and solving equations and inequalities,
- define basic concepts about arithmetic and geometric sequences,
- Analyse basic properties of trigonometric functions; solving trigonometric equations and inequalities.

#### 1.2. Correspondence and correlation with the program

Course program is in correlation with other mathematical courses, especially with Elementary Mathematics II, Analysis I and Set theory.

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will learn basic concepts of mathematical logic and properties of sets, relations and functions and also arithmetic and geometric sequences. Students will learn basic properties of polynomials, rational, exponential, logarithmic and trigonometric functions and be able to solve equations and inequalities in which these functions appear. Students will know how to do partial fractions decomposition of a rational functions. Students will know and understand theorems and their proofs.

#### 1.4. Course content


#### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work

- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

#### 1.6. Comments

#### 1.7. Student requirements
Every student is obliged to satisfy conditions for obtaining the signature for the course Elementary Mathematics I and pass the exam. Conditions for obtaining the signature:
Attendance at all forms of classes and active participation in all forms of work required for this course is expected.

<table>
<thead>
<tr>
<th>1.8. Evaluation and Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class attendance and class participation</td>
</tr>
<tr>
<td>Written exam (preliminary exam)</td>
</tr>
<tr>
<td>Project work</td>
</tr>
<tr>
<td>Portfolio</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.9. Assessment and grade of student’s work during the class and after the final exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student's activities in the subject will be evaluated and assessed during the semester and final exam. Total number of points a student can achieve during the semester is 70 (evaluating the activities identified in table above), while in the final examination can achieve 30 points.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.10. Required literature</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>1.11. Recommended literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. D. Palman: Geometrijske konstrukcije, Element, Zagreb</td>
</tr>
<tr>
<td>5. Corresponding textbooks and collections of problems for high school mathematics are recommended</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.12. Number of copies of recommended literature in regard to the number of students who attend the class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
</tr>
<tr>
<td>-------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.13. Quality assurance of course and/or module</th>
</tr>
</thead>
<tbody>
<tr>
<td>After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.</td>
</tr>
</tbody>
</table>

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Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
## General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Computer Laboratory I</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>I</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

#### 1.1. Course objectives

This course aims to develop the skills for practical usage of theoretical knowledge of computer science and abilities of problem solving with the aid of a computer.

#### 1.2. Correspondence and correlation with the program

This course is in the correlation with most of the other courses, in sense that most of the other courses will use a computer for problem solving.

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course, it is expected from students to have a basic theoretical knowledge of computer science and skills for solving basic problems with the aid of a computer (they will be able to use and understand e-mail services, Internet and its architecture, an operating system, a word processor made for text formatting, a spreadsheet application used for dealing with calculations, data processing, organizing data in chart forms, etc. They will be able to use an application for creating presentations and to make a static (personal) webpage in HTML with CSS).

#### 1.4. Course content

**Computer architecture:** processor, memory, motherboard, input-output units, how parts of computer work and communicate; operating systems and applications, graphic user interface.

**Getting started:** operating systems, text editing, files, folders, saving the data on various media, graphical interface.

**Use of computers:** formatting and editing text in a document, spreadsheets used for calculations and for organizing data in chart forms, presentations, basic Internet services, electronical mail, Internet connection, searching Internet, making websites and dealing with basic concepts of web design. Media for storing image and sound.

#### 1.5. Modes of instruction (mark in bold)

- [ ] Lectures
- [x] Seminars and workshops
- [x] Exercises
- [ ] Distance learning
- [ ] Field work
- [ ] Independent work
- [x] Multimedia and the Internet
- [ ] Laboratory work
- [ ] Tutorials
- [ ] Other
- [x] Consultations

#### 1.6. Comments

#### 1.7. Student requirements

Students are obligated to attend classes, actively participate in any form of work that is required and pass the exam.
1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>0.75</th>
<th>Seminar paper</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
<td>3</td>
<td>Oral exam</td>
<td>Essay</td>
</tr>
<tr>
<td>Project work</td>
<td>Continuous assessment</td>
<td>1.25</td>
<td>Presentation</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.9. Assessment and grade of student's work during the class and after the final exam

Student's activities will be evaluated and graded during the semester. Total number of points a student can achieve during the semester is 100 (evaluating the activities identified in table above).

1.10. Required literature


1.11. Recommended literature

- HTML I CSS tutorial, http://www.w3.org/Style/Examples/011/firstcss.en.html
- Journals (Bug, Enter,...)
- Original product handbooks and tutorials for operating systems and programs that are used in class.

1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grundler, Grozdanović, Ikica, Kos, Miljaš, Srnec, Širanović, Zvonarek: Europska računalna diploma; ECDL European Driving Licence, PRO-MIL d.o.o., Varaždin, lipanj 2010.</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Vučina: Pretraživanje i vrednovanje informacija na Internetu, Edupoint, Zagreb 2006.</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>D. Sušanj: PC računala izvana i iznutra, BUG i SysPrint, Zagreb, 2002.</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>D. Petric: Internet uzduž i poprijeko, BUG i SysPrint, Zagreb, 2002.</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>V. Galešev, L. Kralj, G. Sokol, Z. Soldo, D. Kovač: Informatika i računalstvo, SysPrint, 2006.</td>
<td>0</td>
<td>45</td>
</tr>
</tbody>
</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analized.

---

10 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
**General Information**

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
</table>
| Course title       | Foreign language I  
                    | English for specific purposes (Information technology) |
| Program            | Undergraduate course in Mathematics |
| Course status      | Compulsory |
| Year               | I |
| Credits and Teaching | ETCS credits / student workload | 2 |
|                    | Hours (L+E+S) | 0+30+0 |

**1. COURSE DESCRIPTION**

**1.1. Course objectives**

This is an upper-intermediate English course covering a wide range of current Information Technology topics. Its aims are: to develop the skill of reading for information from a wide variety of authentic IT texts; to develop the ability to understand native speakers talking about IT; to develop the ability to participate in exchanges of information and opinions in the context of IT; to write instructions, descriptions and explanations about topics in computing and IT.

**1.2. Correspondence and correlation with the program**

The program of this course corresponds with similar course programs at: University of Zagreb, Faculty of Philosophy; University of Zadar, Faculty of Philosophy; University of Split, Humanities; University of Osijek, Faculty of Pedagogy. The program correlates with some programs of Informatics.

Prerequisites: knowledge of English at intermediate level.

**1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)**

Students are expected to:
- know most vocabulary and grammar structures relating to Information Technology;
- be able to read and understand authentic texts from newspapers, popular computing magazines, Internet, web pages;
- be able to give information and express opinions about IT;
- write instructions, descriptions and explanations concerning IT and computing.

**1.4. Course content**

Computer Users; Computer Architecture; Computer Applications; Peripherals; Operating Systems; Graphical User Interfaces; Applications Programs; Multimedia; Networks; The Internet; The World Wide Web; Websites; Webpage Creator; Communications Systems; Computing Support; Data Security; Software Engineering; People in Computing; Recent Developments in IT; Electronic Publishing.

**1.5. Modes of instruction (mark in bold)**

- Lectures
- Exercises
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

**1.6. Comments**

The number of students should be limited to 20 per group. The classes should be held in a computer-equipped classroom.

**1.7. Student requirements**

Students should attend all classes. Students are expected to participate in class activities and to carry out all required tasks.
Students should hand in papers by the due date.
At the end of the course students should take a written exam.

### 1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>0.5</th>
<th>Seminar paper</th>
<th>0.3</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
<td>0.6</td>
<td>Oral exam</td>
<td></td>
<td>Essay</td>
</tr>
<tr>
<td>Project work</td>
<td></td>
<td>Continuous assessment</td>
<td>0.5</td>
<td>Presentation</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 1.9. Assessment and grade of student's work during the class and after the final exam

Student's activities in the subject will be evaluated and assessed during the semester and final exam. Total number of points a student can achieve during the semester is 70 (evaluating the activities identified in table above), while the final examination can achieve 30 points.

### 1.10. Required literature

6. [www.dictionary.cambridge.org](http://www.dictionary.cambridge.org)

### 1.11. Recommended literature

6. [http://www.webopedia.com](http://www.webopedia.com)
7. [www.m-w.com](http://www.m-w.com)

### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

### 1.13. Quality assurance of course and/or module

Students' work and development will be monitored by means of:
- Group and individual discussions after each lesson (when necessary);
- Questionnaires after each unit and at the end of the course;
- Portfolios

---

11 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
1. COURSE DESCRIPTION

1.1. Course objectives

This course aims to give students the basic knowledge on real analysis, ie:
- indefinite integrals and integration methods,
- definite integral and applications,
- numeric series and convergence criteria,
- sequences and series of functions, convergence and uniform convergence,
- power series and Fourier series.

1.2. Correspondence and correlation with the program

Program of Analysis II is correlated with other mathematical courses, especially Analysis I and III, Complex Analysis, Differential Geometry, Differential Equations and Numerical Mathematics. Prerequisite courses: Analysis I.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to:
- apply methods of integration in calculation of integrals,
- know and understand notions of numeric series and convergence of series,
- apply integral calculus in calculating area between curves, volume of solids,
- analyze sequence convergence and function series,
- express functions as a power series
- form Fourier series expansion of a function
- know and understand theorems and its proofs

1.4. Course content


1.5. Modes of instruction (mark in bold)

- Lectures
- Exercises
- Distance learning

1.6. Comments
### 1.7. Student requirements

Every student is obliged to fulfill conditions for signature in Analysis II and to pass the exam. Conditions for signature: Students are expected to attend and actively participate at all classes.

### 1.8. Evaluation and Assessment

| Class attendance and class participation | 1.6 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 4 | Oral exam | 1.7 | Essay | Research work |
| Project work | | Continuous assessment | 0.7 | Presentation | Practical work |
| Portfolio | | | |

#### 1.9. Assessment and grade of student's work during the class and after the final exam

Students’ work is continually observed. Integral part of observing and evaluating of students is the quality of active contribution in work on the lectures and exercises. The total number of points a student can achieve during the class is 70 (assessed activities are indicated in the table above). Student’s knowledge is evaluated in the exam scored with maximum of 30 points.

#### 1.10. Required literature

1. S. Kurepa: Matematička analiza I, II, Tehnička knjiga, Zagreb (više izdanja)
2. B: P. Demidović: Zadaci i riješeni primjeri iz više matematike, Tehnička knjiga, Zagreb (više izdanja)

#### 1.11. Recommended literature


#### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

#### 1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

---

12 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
### General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Linear Algebra II</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>I</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload 8</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S) 45+45+0</td>
</tr>
</tbody>
</table>

### 2. COURSE DESCRIPTION

#### 1.1. Course objectives

This course aims to give students the basic knowledge on linear algebra, ie:
- analyze the solvability of systems of linear equations and the structure of the solution set;
- define a linear manifold;
- identify and apply different ways of solving systems of linear equations;
- define the characteristic and minimal polynomial and analyze their properties;
- define the eigenvalues of the linear operator, analyze their properties and describe methods for determining the eigenvalues;
- with arguments apply the diagonalisation criteria of a linear operator;
- define the Jordan form of a matrix;
- define a unitary spaces and norm; analyze Cauchy-Schwartz inequality;
- define the orthonormal base and orthogonal complement; describe Gram – Schmidt orthogonalisation process;
- the introduction of the concepts of linear mappings on unitary spaces;
- define the main features of the unitary, orthogonal, hermitian, symmetric and antihermitian matrices;
- analyze quadratic forms.

#### 1.2. Course prerequisite

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students should be able to:
- be able to analyze and successfully solve systems of linear equations;
- be able to identify and apply different ways of solving linear systems;
- be able to determine the characteristic and minimal polynomial;
- be able to explain the procedure diagonalization;
- be able to apply the diagonalisation criteria of a linear operator
- be able to state the definition and examples of inner product;
- be able to the use the Gram - Schmidt orthogonalization procedure;
- recognize some special types of vector space (unitary, standardized and metric);
- recognize some special types of linear mappings on unitary spaces;
- recognize the properties of the unitary, orthogonal, symmetric, hermitian and antihermitian matrices;
- recognize the properties of quadratic forms;
- to define mathematical terms presented in this course,
- to state and understand theorems and its proofs which are used in this course.

#### 1.4. Course content


<table>
<thead>
<tr>
<th>1.5. Modes of instruction (mark in bold)</th>
<th>Lectures</th>
<th>Independent work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seminars and workshops</td>
<td>Multimedia and the Internet</td>
</tr>
<tr>
<td></td>
<td>Exercises</td>
<td>Laboratory work</td>
</tr>
<tr>
<td></td>
<td>Distance learning</td>
<td>Tutorials</td>
</tr>
<tr>
<td></td>
<td>Field work</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consultations</td>
</tr>
</tbody>
</table>

| 1.6. Comments |

| 1.7. Student requirements |

Students must satisfy requirements for obtaining the Signature (listed in the executive program) and to pass the final exam.

| 1.8. Evaluation and Assessment |

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>1.7</th>
<th>Seminar paper</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
<td>3</td>
<td>Oral exam</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Essay</td>
<td>Research work</td>
</tr>
<tr>
<td>Project work</td>
<td></td>
<td>Continuous assessment</td>
<td>1.3</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 1.9. Assessment and grade of student's work during the class and after the final exam |

Students' work will be evaluated and assessed during the semester and in the final exam. Total number of points student can achieve during the semester is 70 (to assess the activities listed in the table), while in the final exam student can achieve 30 points. The detailed work out of monitoring and evaluation of students' work will appear in the executive program.

1.10. Required literature (when proposing the program)


1.11. Recommended literature (when proposing the program)


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

In the last week of the semester students will evaluate the quality of the lectures. At the end of each semester (March 1 and September 30 of the current academic year) results of the exams will be analyzed.

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13 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
General Information

Course organiser
Course title
Program
Course status
Year
Credits and Teaching

1. COURSE DESCRIPTION

1.1. Course objectives
- defining the sets of natural numbers, integers, rational, real and complex numbers,
- learning basic concepts and knowledge about triangle
- learning concepts about mappings in plane
- getting acquainted with basic properties of conics
- learning concepts about mappings in space
- learning basic knowledge about polyhedrons

1.2. Correspondence and correlation with the program
Course program is in correlation with other mathematical courses, especially with Elementary Mathematics I, Analysis I, Linear algebra I and Linear algebra II.
Predecessor course: Elementary Mathematics I.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)
After completing this course students will learn to define the sets of natural numbers, integers, rational, real and complex numbers. Students will learn basic concepts and properties of triangle, conics, polyhedrons and mappings in plane and in space. Students will know and understand theorems and its proofs.

1.4. Course content

1.5. Modes of instruction (mark in bold)
- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

1.6. Comments

1.7. Student requirements
Every student is obliged to satisfy conditions for obtaining the signature for the course Elementary Mathematics II and pass the exam.
Conditions for obtaining the signature: Attendance at all forms of classes and active participation in all forms of work required for this course is expected.

### 1.8. Evaluation\(^\dagger\) and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>1.4</th>
<th>Seminar paper</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
<td>2.5</td>
<td>Oral exam</td>
<td>2.5</td>
</tr>
<tr>
<td>Project work</td>
<td></td>
<td>Continuous assessment</td>
<td>0.6</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td>Practical work</td>
</tr>
</tbody>
</table>

### 1.9. Assessment and grade of student’s work during the class and after the final exam

Student’s activities in the subject will be evaluated and assessed during the semester and in the final exam. Total number of points a student can achieve during the semester is 70 (evaluating the activities identified in table above), while in the final examination can achieve 30 points.

### 1.10. Required literature


### 1.11. Recommended literature

3. Corresponding textbooks and collections of problems for high school mathematics are recommended

### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

### 1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

\(^\dagger\) Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
1. COURSE DESCRIPTION

1.1. Course objectives

This course aims to develop the skills for practical use of a general purpose programming language. The course introduces basics concepts of the programming language to the students. Furthermore, students are given basic information about scientific modules that are useful for problem solving and daily use of a computer during the entire study program.

1.2. Correspondence and correlation with the program

This course is in correlation with most of other courses, in sense that most of other courses will use a computer. There are no prerequisites for this course.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to:

- execute basic commands in the programming environment
- use operators, basic data types and write logical statements
- test a simple code and to correct basic syntactic and logical errors
- read and write data to a file
- write a computer code with proper documentation that follows a given standard
- independently write a simple code that demonstrates knowledge of basic programming techniques
- manipulate with dynamically allocated arrays
- use additional external modules, functions and sub routines

1.4. Course content
Basic history of a programming language and working environment.
Syntax and semantics of the programming language.
Loops and basic flow of a program
Use of functions, modules and external packages.
Data structuring, filtering and visualization
### General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Foreign language II Internet-based language learning</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>I</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

#### 1.1. Course objectives

This course helps students take full advantage of the Internet as a classroom resource. Its objectives are: to introduce computer terminology, Web-surfing and e-mail and to enable students to extend all their language skills through Internet-based activities. By searching the Web students will be able to read a variety of texts on various topics; they will be given an opportlessony to listen native speakers. Pair work and group work activities will give them the chance to share information and opinions and practice their speaking skills. Following useful instructions on the Web, students will also complete various writing assignments.

#### 1.2. Correspondence and correlation with the program

The program of this course corresponds with similar course programs at: University of Zagreb, Faculty of Philosophy; University of Zadar, Faculty of Philosophy; University of Split, Humanities; University of Osijek, Faculty of Pedagogy. The program correlates with some programs of Informatics.

Prerequisites: knowledge of English at intermediate level.

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

Students are expected to:
- know most words and expressions they may encounter on the Internet;
- be able to surf the Web independently;
- receive and send e-mail and take part in chat programs;
- use the Internet as a materials resource;
- read and understand authentic texts in various genres;
- engage in conversation relating to different topics;
- write information, concepts and opinion about a variety of situations and topics;
- use the Internet in order to manage their own learning.

#### 1.4. Course content

Computers today; Surfing the Web; Electronic Mail; Famous People; Web Cards; Study Abroad; Eating Out; Shopping Spree; Watching Movies; Vacation Abroad; Cyber C@fes; Working Abroad; News Online.

#### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

#### 1.6. Comments

The number of students should be limited to 16 per group.
The classes should be held in a computer-equipped classroom.

1.7. Student requirements

Students should attend all classes.
Students are expected to participate in class activities and to carry out all required tasks.
Students should hand in papers by the due date.
At the end of the course students should take a written exam.

1.8. Evaluation and Assessment

| Class attendance and class participation | 0.5 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 0.6 | Oral exam | Essay | 0.2 | Research work |
| Project work | Continuous assessment | 0.5 | Presentation | 0.1 | Practical work |
| Portfolio | Prezentacija | 0.1 |

1.9. Assessment and grade of student's work during the class and after the final exam

Student's activities in the subject will be evaluated and assessed during the semester and final exam. Total number of points a student can achieve during the semester is 70 (evaluating the activities identified in table above), while the final examination can achieve 30 points.

1.10. Required literature

4. www.englishpage.com
5. www.englishclub.com
7. www.cnn.com
9. www.dictionary.cambridge.org

1.11. Recommended literature

4. www.eudict.com
5. www.rd.com

1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of copies</td>
</tr>
<tr>
<td>Number of students</td>
</tr>
</tbody>
</table>

1.13. Quality assurance of course and/or module

Students’ work and development will be monitored by means of:
- Group and individual discussions after each lesson (when necessary);
- Questionnaires after each unit and at the end of the course;
- Portfolios

Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
### General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
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<tbody>
<tr>
<td>Course title</td>
<td>Analysis III</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
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<tr>
<td>Year</td>
<td>II</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

#### 1.1. Course objectives

This course aims to give students the basic knowledge about:
- Euclidean spaces,
- sequence convergence in \( \mathbb{R}^n \),
- real functions of several variables; continuity and limit of function,
- differential calculus and its application,
- implicit function theorem,
- multiple Riemann integral and application,
- vector functions,
- curves,
- line integral,
- surface integral,
- functions of bounded variation,
- Green’s theorem

#### 1.2. Correspondence and correlation with the program

Course program is correspondent to the program of similar courses in the mathematics studies. There exists a correlation with the following courses: Analysis I and Analysis II, Complex Analysis.

Predecessor courses: Analysis I and Analysis II.

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to define Euclidean space and calculate with vectors, analyze convergence of sequences in \( \mathbb{R}^n \), analyze the function properties, use differential and integral calculus, calculate line and surface integrals, know and understand theorems and their proofs.

#### 1.4. Course content


#### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
### Comments

#### Student requirements

Attendance at all classes and active participation is expected. Student gets a grade after finale exam.

#### Evaluation and Assessment

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class attendance and participation</td>
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</tr>
<tr>
<td>Oral exam</td>
<td>1.5</td>
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<tr>
<td>Seminar paper</td>
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<tr>
<td>Experiment</td>
<td></td>
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<tr>
<td>Project work</td>
<td>0.5</td>
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<tr>
<td>Continuous assessment</td>
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<tr>
<td>Essay</td>
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<tr>
<td>Research work</td>
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<tr>
<td>Presentation</td>
<td></td>
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<tr>
<td>Practical work</td>
<td></td>
</tr>
</tbody>
</table>

#### Assessment and grade of student's work during the class and after the final exam

Student's active participation at a class influences the final grade. The total number of points a student can achieve during the class is 70 (assessed activities are indicated in the table above). Final examination is scored with a maximum of 30 points.

#### Required literature

1. S. Kurepa: Matematička analiza III, Tehnička knjiga, Zagreb (više izdanja)

#### Recommended literature


#### Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

#### Quality assurance of course and/or module

- questionnaire at the end of the course aimed to assess students' understanding,
- questionnaire designed to evaluate course program, lectures and lecture materials, teaching methods and interaction with students.

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16 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
## General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
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<tbody>
<tr>
<td></td>
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<tr>
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<tr>
<td>Program</td>
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<td>Year</td>
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<tr>
<td>Credits and Teaching</td>
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<td></td>
</tr>
<tr>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

#### 1.1. Course objectives

In this course students will study and apply combinatorial techniques in a variety of settings (Pigeonhole principle, counting problems, recursive relations, generating functions, binomial and multinomial coefficients, Möbius inversion formula, combinatorial structures).

#### 1.2. Correspondence and correlation with the program

The program is correspondent to the program of other mathematical courses, especially to Discrete mathematics.

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this class, students should be able to:
- describe and compare various forms of the Pigeonhole principle,
- discuss and solve different counting problems,
- apply recursive relations and generating functions in solving mathematical problems,
- analyse problems; formulate them into mathematical terms and use the appropriate strategies to solve them; verify and interpret the solutions; present their mathematical arguments and solutions in a logical and clear fashion.

#### 1.4. Course content


#### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

#### 1.6. Comments

#### 1.7. Student requirements

Attendance at all classes and active participation is expected.
### 1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>1.1</th>
<th>Seminar paper</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
<td>2</td>
<td>Oral exam</td>
<td>1.3</td>
</tr>
<tr>
<td>Project work</td>
<td></td>
<td>Continuous assessment</td>
<td>0.6</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 1.9. Assessment and grade of student’s work during the class and after the final exam

Student’s activities are evaluated during the semester. Final exams are written and oral. The total number of points a student can achieve during the class is 70 (assessed activities are indicated in the table above). Maximum number of points at final exam is 30.

### 1.10. Required literature


### 1.11. Recommended literature


### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

### 1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.
# General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Differential Equations</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
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</tr>
<tr>
<td>Year</td>
<td>II</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
<tr>
<td></td>
<td>30+30+0</td>
</tr>
</tbody>
</table>

## 1. COURSE DESCRIPTION

### 1.1. Course objectives

This course aims to give students the basic knowledge about:
- existence and uniqueness of a solution of ordinary differential equations,
- ordinary differential equations of the first order (separation of variables, homogenous and exact equations, linear equations, Bernoulli, Ricatti and Lagrange equations),
- ordinary differential equations of higher orders,
- systems of differential equations,
- applications in the physical sciences

### 1.2. Correspondence and correlation with the program

Course program is correspondent to the program of similar courses in mathematical courses, particularly with Differential Geometry.

The mathematical tools that we use for this course include elements of Analysis I, Analysis II and Analysis III.

### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to:
- use differential equations in the physical and other sciences,
- to analyze solvability of differential equations and the uniqueness of solution
- to know different types of differential equations and methods for finding their solutions

### 1.4. Course content

Basic concepts and definitions. Solution of a differential equation of the first order:
- Equations in the mathematical physics.

### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

### 1.6. Comments

### 1.7. Student requirements
Attendance at all classes and active participation is expected. Student gets a grade after finale exam.

1.8. Evaluation and Assessment

| Class attendance and class participation | 1 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 2.1 | Oral exam | 1.3 | Essay | Research work |
| Project work | Continuous assessment | 0.6 | Presentation | Practical work |
| Portfolio |

1.9. Assessment and grade of student’s work during the class and after the final exam

Students active participation at a class influences the grade.
The total number of points a student can achieve during the class is 70 (assessed activities are indicated in the table above).
Student’s knowledge is evaluated in the exam scored with maximum of 30 points.

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

- questionnaire at the end of the course after aimed to assess students’ understanding,
- questionnaire designed to evaluate course program, lectures and lecture materials, teaching methods and interaction with students .

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18 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
General Information

Course organiser
Course title Euclidean Spaces
Program Undergraduate course in Mathematics
Course status Compulsory
Year II
Credits and Teaching ETCS credits / student workload 5
Hours (L+E+S) 30 +30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives
Objective of this course is to introduce basic properties of affine spaces and Euclidean spaces, ie. to:
- define and distinguish notions of affine and Euclidean spaces,
- define various forms of plane equation,
- analyze analytic geometry of affine space,
- define convex sets,
- define parallelotopes and simplexes,
- analyze affine transformation,
- calculate the volume of parallelotopes and simplexes,
- define isometries

1.2. Correspondence and correlation with the program
The program is correspondent to the program of other mathematical courses, especially to Geometry and Vector spaces.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)
After completing this course students will be able to understand basic properties of affine and Euclidean spaces, to define basic notions of these spaces and to apply adopted procedures in exercises.

1.4. Course content

1.5. Modes of instruction (mark in bold)
- Lectures
- Seminars and workshops
- Exercises
- Distance Learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

1.6. Comments

1.7. Student requirements
Students must attend the lectures and participate in all activities required for the course.
### 1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class attendance and class participation</td>
<td>1.1</td>
<td>Seminar paper</td>
</tr>
<tr>
<td>Written exam (preliminary exam)</td>
<td>2.0</td>
<td>Oral exam</td>
</tr>
<tr>
<td>Project work</td>
<td>0.6</td>
<td>Continuous assessment</td>
</tr>
<tr>
<td>Portfolio</td>
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<tr>
<td>Written exam (final exam)</td>
<td>2.0</td>
<td>Oral exam</td>
</tr>
<tr>
<td>Essay</td>
<td>1.3</td>
<td>Essay</td>
</tr>
<tr>
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<td>Continuous assessment</td>
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<td>Practical work</td>
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<td>Presentation</td>
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<td>0.6</td>
<td>Practical work</td>
</tr>
<tr>
<td>Portfolio</td>
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</tr>
</tbody>
</table>

### 1.9. Assessment and grade of student's work during the class and after the final exam

Student's activities are evaluated during the semester. The total number of points student may collect during the class is 70 and the total number of points student may achieve on the final exam is 30.

### 1.10. Required literature


### 1.11. Recommended literature


### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.
## General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Seminar I - Geometrical constructions</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
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<tr>
<td>Year</td>
<td>II</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

#### 1.1. Course objectives

This course aims:
- to extend students' vocabulary of mathematical expressions
- to teach how to use geometrical tools

#### 1.2. Correspondence and correlation with the program

Course program is correspondent to the program of other mathematics' courses, especially to Euclidean Spaces and Geometry.

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

Students are expected to have the basic knowledge of geometry, to extend their vocabulary of mathematical expressions and to learn how to use geometrical tools. After this course students will be able to define and describe methods of locuses, reflections, central symmetries, rotations, translations, inverses and algebraic method. They will be able to describe the constructions of regular polygons, conics, and constructions based on Hilbert's, Mohr-Mascheroni and Poncelet-Steiner theorem.

#### 1.4. Course content

Elementary constructions with ruler and compass, Method of locus, Method of reflection, Method of central symmetry, Method of rotation, Method of translation, Method of inverse, Algebraic method, Constructions of regular polygons, Conics, Geometrical constructions in bounded plain, Hilbert's constructions, Mohr-Mascheroni’s constructions, Poncelet Steiner’s constructions, Classical problems, Solvability constructions with ruler and compasses, Solvability constructions of regular polygons.

#### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

#### 1.6. Comments

#### 1.7. Student requirements

Students are obligated to write and explain to the class their own seminars. For evaluation is important that the student know how to use geometrical tools correctly. Student has to be present at ¾ of another students' displays and has to participate actively at seminar's analysis. Public display, presence on seminars and active participation in analysis are the
base for evaluation of students.

1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>1</th>
<th>Seminar paper</th>
<th>2</th>
<th>Experiment</th>
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</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
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<td></td>
<td></td>
<td></td>
<td>Practical work</td>
</tr>
</tbody>
</table>

1.9. Assessment and grade of student’s work during the class and after the final exam

Students are encouraged to active participate at a class and it influences the final assessment. Total number of points a student can achieve during the semester is 100 (evaluating the activities identified in table above).

1.10. Required literature

1. D. Palman: Geometrijske konstrukcije, Element, Zagreb

1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

---

20 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
### Basic description

<table>
<thead>
<tr>
<th>Course coordinator</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Information Systems</td>
</tr>
<tr>
<td>Study programme</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>optional</td>
</tr>
<tr>
<td>Year</td>
<td>II</td>
</tr>
<tr>
<td>ECTS credits and teaching</td>
<td>ECTS student’s workload coefficient</td>
</tr>
<tr>
<td></td>
<td>Number of hours (L+E+S)</td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

**1.1. Course objectives**
- Defining basic concepts in respect to information systems (IS), their development, application, types, authors and users
- Motivating students for further work in the field of IS development,
- Taking part in researches on conditions of IS in organizations.

**1.2. Course enrolment requirements**

**1.3. Expected course learning outcomes**

After completing the course and meeting requirements in respect to course Information system, students are expected to be capable of:
- Analyzing company operations
- Defining company's IS architecture
- Defining application subsystems and their relations

**1.4. Course content**

System theory, organization theory, business system, information system, information technology, management and decision making, models, impact of introducing information technology on organization and individuals, centralization-decentralization, dialogue human-program, database, IS planning, problems in IS development, users, program languages, information technology engineering, 4GL, programming standardization, documenting.
Role of IS and information technology in organizations, business strategies and their impact on IS and information technology, comprehension of present situation, strategies of business information system, application management, technological infrastructure and investment planning, protection of IS.
Quality, ISO 9000, Quality management documentation, quality rules of procedure, quality of software product, configuration management, verification, validation, testing of software product. Models, stages of life cycle, methodologies, IS development methodology, Methods, ISAC, HIPO, SADT, SDM, prototype, interview, SEI-CMM, ESPRIT-BOOTSTRAP. Information technology center, information technology staff, information project management, manager's characteristics, management and control of team, communication. Provision of computers. Problems in IS. Drawing up of questionnaire for researching conditions in IS.

**1.5. Teaching methods**

- lectures
debates and workshops
- exercises
- long distance education
- fieldwork
- individual assignment
- multimedia and network
- laboratories
- mentorship
- other - consultations

**1.6. Comments**

Students will be presented with various IS, both with their internal structure and input/output interface
1.7. **Student’s obligations**

Students should actively participate in all forms of works, produce a seminar paper and pass the exam consisting of written and oral part.

1.8. **Evaluation of student’s work**

<table>
<thead>
<tr>
<th>Course attendance</th>
<th>Activity/Participation</th>
<th>Seminar paper</th>
<th>Experimental work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam</td>
<td>Oral exam</td>
<td>Essay</td>
<td>Research</td>
</tr>
<tr>
<td>Project</td>
<td>Sustained knowledge check</td>
<td>Report</td>
<td>Practice</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.9. **Assessment and evaluation of student’s work during classes and on final exam**

Continuous cooperation with students and continuous monitoring of their engagements and advancement in mastering required knowledge provide continuous follow-up of students’ works and activities. Knowledge of student is evaluated at the exam.

1.10. **Assigned reading (at the time of the submission of study programme proposal)**


1.11. **Elective / additional reading (at the time of proposing study programme)**


1.12. **Number of assigned reading copies with regard to the number of students currently attending the course**

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.13. **Quality monitoring methods which ensure acquisition of output knowledge, skills and competences**

During the last week of classes, a poll will be conducted, where students would evaluate the quality of classes. Students’ achievements will be analyzed.
BASIC INFORMATION

<table>
<thead>
<tr>
<th>Course instructor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Operating Systems</td>
</tr>
<tr>
<td>Study program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>optional</td>
</tr>
<tr>
<td>Year</td>
<td>II</td>
</tr>
<tr>
<td>Credits and teaching</td>
<td>ECTS credits of student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

1. COURSE DESCRIPTION

1.1. Course objectives

The objectives of this course are:
- to familiarise students with operating systems and processes within operating systems;
- to acquire knowledge regarding basic concepts related to operating systems - process, communication, data management, memory management;
- to acquire knowledge and skills needed for advanced use of operating systems.

1.2. Enrolment requirements

1.3. Expected learning outcomes for the course

After successfully passing the final exam, the student will be able to:
- describe the role of the operating system as a part of a computer system;
- define and differentiate between operating system architectures;
- define what process is and describe the states of process execution;
- apply the knowledge about processes to problems of process management: concurrency, synchronisation, deadlocks and processor management;
- differentiate between memory management techniques;
- explain the differences in virtual memory management techniques (paging and segmentation) and their modifications;
- define what directory is and describe the ways of allocating external memory;
- describe what security and protection are, and how they are implemented.

1.4. Course content

Introduction to operating systems: operating systems development, operating systems hierarchy structure, interaction between operating systems and hardware.
Process management: process concurrency, synchronisation, deadlocks and processor management.
Memory management: paging, segmentation, allocation strategies, memory protection, resource allocation.
Data management: files and directories.
Security and protection.

1.5. Modes of instruction

- lectures
- seminars and workshops
- exercises
- distance learning
- field work
- independent work
- multimedia and the Internet
- laboratory work
- mentoring
- other consultation

1.6. Comments
1.7. Student requirements

Students have to actively participate in all modes of instruction, prepare an individual or team seminar paper, and pass the course exam that consists of a written (practical) and an oral part. Student work is monitored and continuously evaluated. At the end of the course, the student is required to take and pass a written and an oral exam, which is used to evaluate her overall knowledge.

1.8. Evaluation

<table>
<thead>
<tr>
<th>Class attendance</th>
<th>1</th>
<th>Class participation</th>
<th>Seminar paper</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam</td>
<td>1</td>
<td>Oral exam</td>
<td>Essay</td>
<td>Research work</td>
</tr>
<tr>
<td>Project work</td>
<td></td>
<td>Continuous assessment</td>
<td>2</td>
<td>Presentation</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.9. Evaluation and assessment during the course and on the final exam

Student work during the course will be evaluated and assessed continuously during classes and on the final exam. The maximum number of points a student can be awarded during classes is 70 (activities marked in the table above are assessed), while the maximum number of points on the final exam is 30. A detailed account of evaluation and assessment will be given in the course plan.

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of required literature compared to the number of students currently enrolled in the course

<table>
<thead>
<tr>
<th>Naslov</th>
<th>Broj primjeraka</th>
<th>Broj studenata</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course related to the acquisition of knowledge, skills and competences upon course completion

During the last week of classes, an anonymous questionnaire will be given out, in which students will evaluate the quality of classes. There will also be an analysis of student success on exams and on in-class practical activities.
# General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Complex Analysis</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>II</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

## 1. COURSE DESCRIPTION

### 1.1. Course objectives

This course aims to give students the basic knowledge about the theory of holomorphic functions and basis of complex analysis (sequences and series of complex numbers, limit, continuity, differentiation and integration of complex functions, conformal maps, Taylor and Laurent series, theory of residue).

### 1.2. Correspondence and correlation with the program

Program of Complex Analysis is correlated with other mathematical courses, especially with Analysis I, II and III.

### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to:
- differ various forms of complex numbers
- know the properties of complex numbers,
- define holomorphic functions, state their properties and cite examples,
- apply Cauchy's integral formula,
- classify singularities and calculate residue,
- expand analytic function in Taylor and Laurent series,
- define Möbius transformation and its properties,
- know and understand presented theorems and their proofs

### 1.4. Course content


### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

### 1.6. Comments

### 1.7. Student requirements

Every student is obliged to fulfill conditions for signature in Complex Analysis and to pass the exam. Conditions for signature: Students are expected to attend and actively participate at all classes.
1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class attendance and class participation</td>
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</tr>
<tr>
<td>Written exam (preliminary exam)</td>
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</tr>
<tr>
<td>Project work</td>
<td>0.3</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Seminar paper</td>
<td></td>
</tr>
<tr>
<td>Experiment</td>
<td></td>
</tr>
<tr>
<td>Oral exam</td>
<td>2.5</td>
</tr>
<tr>
<td>Continuous assessment</td>
<td>0.3</td>
</tr>
<tr>
<td>Presentation</td>
<td></td>
</tr>
<tr>
<td>Practical work</td>
<td></td>
</tr>
<tr>
<td>Research work</td>
<td></td>
</tr>
<tr>
<td>Experiment</td>
<td></td>
</tr>
</tbody>
</table>

1.9. Assessment and grade of student’s work during the class and after the final exam

Students’ work is continually observed. Integral part of observing and evaluating of students is the quality of active contribution in work on the lectures and exercises. The total number of points a student can achieve during the class is 70 (assessed activities are indicated in the table above). Student’s knowledge is evaluated in the exam scored with a maximum of 30 points.

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>H. Kraljević, S. Kurepa, Matematička analiza IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.J. Albowitz, A.S. Fokas, Complex variables, Introduction and application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Bak, D.J. Newman, Complex Analysis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

---

21 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
### General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Discrete Mathematics</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>II</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

#### 1.1. Course objectives

Introduction to:
- basic definitions from graph theory
- planar, Eulerian, and Hamiltonian graphs
- Kruskal’s and Dijkstra’s algorithms
- colouring vertices and edges

#### 1.2. Correspondence and correlation with the program

The program is correspondent to the program of other mathematical courses, especially to Combinatorics and Set Theory. The program is also correlated with courses of computer science: Algorithms and data structures and Formal languages and compilers.

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to understand and apply basic theorems of graph theory, to distinguish terms and graph properties, to analyze Eulerian and Hamiltonian graphs, to analyze shortest path problem and coloring graph problems. They will be acquainted with some algorithms.

#### 1.4. Course content


#### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

#### 1.6. Comments

#### 1.7. Student requirements

Students must attend the lectures and participate in all activities required for the course.

#### 1.8. Evaluation and Assessment

22 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
Class attendance and class participation

| Class attendance and class participation | 1.1 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 2 | Oral exam | 1.3 | Essay | Research work |
| Project work | Continuous assessment | 0.6 | Presentation | Practical work |
| Portfolio | |

1.9. Assessment and grade of student's work during the class and after the final exam

Student's activities are evaluated during the semester. The total number of points a student can achieve during the class is 70 (assessed activities are indicated in the table above). Student's knowledge is evaluated in the oral exam scored with maximum of 30 points.

1.10. Required literature


1.11. Required literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.
Course title: Programming
Program: Undergraduate course in Mathematics
Course status: Compulsory
Year: II
Credits and Teaching:
<table>
<thead>
<tr>
<th>ETCS credits / student workload</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours (L+E+S)</td>
<td>30+30+0</td>
</tr>
</tbody>
</table>

1. COURSE DESCRIPTION

1.1. Course objectives
This course provides basic comprehension of approaches, concepts and methods in programming and gives an introduction to modular program construction. The course familiarises the student with commonly used algorithms, using the C++ programming language.

1.2. Correspondence and correlation with the program
Course program is in correlation with the program of the course Algorithms and Data Structures. This course provides the necessary background for that course.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)
The student should become familiar with the:
- basic operation of the programming environment and computer literacy,
- Boolean expressions, variable types and memory storage
The student should learn:
- how to develop an algorithm and implementation to compute a mathematical function,
- to convert a set of Mathematical statements into a C++ Boolean expression,
- to develop an algorithm using programming language selection constructs,
- to develop an algorithm and implementation that repeatedly executes a sequence of steps,
- to debug a simple program and remove all syntax errors and all logic errors,
- to use preprogrammed functions to implement an algorithm,
- to implement a hierarchical design using methods/functions,
- to properly document code to a given standard,
- to develop and write a program that uses one or more array structures to store information,
- to develop and write a program that uses simple data files to store and retrieve information

1.4. Course content

1.5. Modes of instruction (mark in bold)
- Lectures
- Independent work
- Seminars and workshops
- Multimedia and the Internet
- Exercises
- Field work
- Distance learning
### 1.6. Comments

### 1.7. Student requirements

Students are expected to:
- attend classes regularly
- make necessary preparations for classes
- do practical work
- present seminar paper
- pass two midterm exams and a final exam

### 1.8. Evaluation$^{23}$ and Assessment

| Class attendance and class participation | 1 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 1.5 | Oral exam | 1.5 | Essay | Research work |
| Project work | Continuous assessment | Presentation | Practical work | 1 |
| Portfolio | |

### 1.9. Assessment and grade of student’s work during the class and after the final exam

Students are encouraged to active participate at a class and it influences the final assessment. The maximum of points student can get during the class is 70. Final exam is scored with maximum of 30 points.

### 1.10. Required literature


### 1.11. Recommended literature


### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

### 1.13. Quality assurance of course and/or module

Quality of the course will be monitored and measured through the success of examinations and through the anonymous inquiry reflecting students opinions regarding the course.

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$^{23}$ Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
# General information

<table>
<thead>
<tr>
<th>Lecturer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Set Theory</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>II</td>
</tr>
</tbody>
</table>
| Credit values and modes of instruction | ECTS credits / student workload 5  
Hours (L+E+S) 30 + 30 + 0 |

## 1. COURSE DESCRIPTION

### 1.1. Course objectives

This course aims to acquaint students with:
- basic notions of intuitive set theory
- basic notions of infinity in set theory
- basic notions and principles of cardinal arithmetic
- basic notions of ordinal numbers
- problematics of the intuitive set theory (paradoxes)

### 1.2. Course prerequisite

None.

### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to understand and apply basic notions of set theory, i.e.:
- to know and understand notion of set and basic set operations
- to know and understand notion of relation, types of relations and cite examples
- to know and understand notion of function, difference between relation and function and properties of functions
- to know and understand notion of infinite set, denumerable and non-denumerable sets and use them accordingly
- to know and understand notion of cardinal numbers and determine cardinality of different examples of sets
- to be capable of argumented application of theorems from arithmetics and ordering of cardinal numbers
- to know and understand notion of well-ordered set and identify their examples
- to know and understand notion and properties of similarities mappings and ordering characterization of some of the well known sets of numbers
- to know and understand notion of ordinal number, differentiate and compare ordinal numbers
- to be capable of argumented application of theorems of arithmetic and ordering of ordinal numbers
- to be aware of and understand the problematics of the intuitive set theory and the need for axiomatization in set theory
- mathematically prove procedures and formulas used within this course

### 1.4. Course content


### 1.5. Modes of instruction

- [x] lectures
- [ ] seminars and workshops
- [x] exercises
- [x] independent work
- [x] multimedia and the internet
- [ ] laboratory
1.6. Comments

1.7. Student requirements

Students' work will be evaluated and assessed during the semester and at the final exam. The total number of points a student can earn during the semester is 70 (the activities listed in the table are assessed), while at the final exam, a student can achieve 30 points. The detailed elaboration of the monitoring and evaluation of students' work will be presented in the course curriculum.

1.8. Evaluation and assessment

| Class attendance & class participation | 0.7 | Seminar paper | Experiment |
| Written exam | 2 | Oral exam | 1.3 | Essay | Research work |
| Project | Continuous assessment | 1 | Presentation | Practical work |
| Portfolio | | | |

Comment: ECTS distribution from above is made for studies and/or modules with courses which have 7 ECTS. For studies and/or modules with different number of total ECTS the distribution should be used for calculating percentages.

1.9. Assessment and evaluation of students' work during the semester and in the final exam

Students' work will be evaluated and assessed during the semester and at the final exam. The total number of points a student can earn during the semester is 70 (the activities listed in the table are assessed), while at the final exam, a student can achieve 30 points.

1.10. Required literature (when proposing the program)


1.11. Recommended literature (when proposing the program)


1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. At the end of each semester (1st March and 30th September of the current academic year) the analysis of the exam results will be conducted.

24 IMPORTANT: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
# General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Geometry</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
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<tr>
<td>Course status</td>
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<tr>
<td>Year</td>
<td>II</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload 5</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S) 30+30+0</td>
</tr>
</tbody>
</table>

## 1. COURSE DESCRIPTION

### 1.1. Course objectives

The aim of this course is to acquaint the students with certain geometrical facts and to provide a link between classical geometry and modern geometry, with the aim of preparing students for further study and research.

### 1.2. Correspondence and correlation with the program

The program is correspondent to the program of other mathematical courses, especially to Euclidean Spaces and elective course Projective geometry.

### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this class, students should be able to:
- recognize and compare different geometries,
- analyze problems; formulate them into mathematical terms and use the appropriate strategies to solve them;
- verify and interpret the solutions and present their mathematical arguments and solutions in a logical and clear fashion.

### 1.4. Course content

Historical introduction. Three approaches to the study of geometry.

- Incidence. Distance. Klein’s model.

### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

### 1.6. Comments

### 1.7. Student requirements

Attendance at all classes and active participation is expected.
1.8. **Evaluation and Assessment**

| Class attendance and class participation | 1.1 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 2 | Oral exam | 1.3 | Essay | Research work |
| Project work | Continuous assessment | 0.6 | Presentation | Practical work |
| Portfolio | |

**1.9. Assessment and grade of student’s work during the class and after the final exam**

Student’s activities are evaluated during the semester, the total number of points student can gain during the class is 70 and in the exam is 30.

**1.10. Required literature**

1. A. I. Fetisov, O euklidskoj i neeuklidskim geometrijama, Školska knjiga, Zagreb, 1981.

**1.11. Recommended literature**


**1.12. Number of copies of recommended literature in regard to the number of students who attend the class**

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

**1.13. Quality assurance of course and/or module**

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

---

25 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
General Information

Course organiser
Course title Using Computers in Mathematics
Program Undergraduate course in Mathematics
Course status Compulsory
Year II
Credits and Teaching ETCS credits / student workload 5
Hours (L+E+S) 15+30+15

1. COURSE DESCRIPTION

1.1. Course objectives
Development of the mathematical and logical thinking, learning and using packages in mathematics: Mathematica for mathematical expressions manipulation, differential and integral calculus, graph constructions and LaTeX for text and mathematical formulas and symbols writing, table constructions, new commands definition.

1.2. Correspondence and correlation with the program
Prerequisite for this course is Computer Laboratory I, II.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)
After completing this course, it is expected students can use packages for writing seminars and for advance problems solving with the aid of a computer (Mathematica and LaTeX).

1.4. Course content
TeX, LaTeX, AMS-LaTeX, versions of LaTeX, distributions (MikTeX), the structure of a LaTeX document, from input file to final document. LaTeX basics: The anatomy of an article, typing text and math, error messages, document classes, fonts. Texts and math: Boxes, footnotes, splitting up the file, text environments, tables, theorem like structure, AMS-LaTeX, math symbols, math environments, multiline math displays. Additional possibilities: Bibliographies and indexes, new commands and environments, including (EPS) graphics.

1.5. Modes of instruction (mark in bold)
- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

1.6. Comments

1.7. Student requirements
Students are obligated to attend classes, actively participated in any form of work that is required and pass the exam.
### 1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>1</th>
<th>Seminar paper</th>
<th>1</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
<td>2</td>
<td>Oral exam</td>
<td>Essay</td>
<td>Research work</td>
</tr>
<tr>
<td>Project work</td>
<td>Continuous assessment</td>
<td>1</td>
<td>Presentation</td>
<td>Practical work</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 1.9. Assessment and grade of student’s work during the class and after the final exam

Students' activities are monitored continuously. During the semester students can get 70 points for their activities in class. The final exam is oral, valued with maximum of 30 points.

### 1.10. Required literature


2. Originalni priručnici i sustavi pomoći za pojedine programske alate koji su dostupni on-line.

### 1.11. Recommended literature


### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

### 1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

---

26 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
<table>
<thead>
<tr>
<th>Course organiser</th>
<th>University of Rijeka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Metric Spaces</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>III</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

#### 1.1. Course objectives

Course objective is to demonstrate the basis of mathematical analysis in metric and topological spaces. In this course student will learn basic notions and properties of metric and topological spaces, understand the term of sequence convergence and continuity of function.

#### 1.2. Correspondence and correlation with the program

Program of course Metric Spaces is correlated with other mathematical courses, especially with Analysis I, Analysis II and Analysis III.

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to:
- define metric and cite examples of metric spaces,
- know and understand elementary notions and characteristics of metric and topological spaces,
- classify topological spaces based on axioms of separation,
- know and understand notion of uniformly continuous function and convergence of functional sequence,
- define Cauchy sequence and complete metric space; know and understand Banach's Fix Point Theorem,
- describe compact spaces

#### 1.4. Course content


#### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

#### 1.6. Comments

#### 1.7. Student requirements
Every student is obliged to fulfill conditions for signature in Metric Spaces and to pass the exam. Conditions for signature: Students are expected to attend and actively participate at all classes.

1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>1.2</th>
<th>Seminar paper</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
<td>2.4</td>
<td>Oral exam</td>
<td>1.4</td>
</tr>
<tr>
<td>Project work</td>
<td>Continuous assessment</td>
<td>Presentation</td>
<td>Practical work</td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.9. Assessment and grade of student’s work during the class and after the final exam

Students’ work is continually observed. Integral part of observing and evaluating of students is the quality of active work contribution at the lectures and exercises (70 points). Student’s knowledge is evaluated in the exam (30 points).

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

---

Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
1. COURSE DESCRIPTION

1.1. Course objectives

Main course objective is to get students acquainted with basic ideas, results and methods of probability theory and mathematical statistics. For that purpose it is necessary within the course to:
- define probability and analyse its properties
- describe basic examples of probability spaces
- define conditional probability and analyse its properties
- describe Bernoulli trials
- define random variables and their probability density and distribution functions
- describe various examples of probability distributions
- define and analyse numerical characteristics of probability distributions
- enable students to apply tools for statistical data processing (MS Excel)

1.2. Course prerequisite

1.3. Expected outcomes for the course

After completing this course students should be able to:
- distinguish probabilistic and deterministic experiments
- apply probability properties in problem solving
- apply combinatorial methods in solving probability problems
- know probability models: classical model and Bernoulli trials
- use random variables and their properties in problem solving
- know basic examples of probability distributions
- apply statistical data processing using software package MS Excel
- mathematically prove foundation of procedures and formulas which they use within the course

1.4. Course content


1.5. Modes of instruction

- lectures
- seminars and workshops
- exercises
- e-learning
- field work
- independent work
- multimedia and the internet
- laboratory
- project strategies
- tutorials
1.6. Comments

15 hours of exercises will be performed on the computers.

1.7. Student requirements

Students must satisfy requirements for obtaining the signature and pass the final exam from the course (details will be listed in the executive program).

1.8. Evaluation and assessment

| Class attendance & class participation | 1.2 | Seminar paper | Experiment |
| Written exam | 2.0 | Oral exam | 1.6 | Essay | Research work |
| Project | | Continuous assessment | 1.2 | Presentation | Practical work |
| Portfolio | | | | | |

Comment: ECTS distribution from above is made for studies and/or modules with courses which have 6 ECTS. For studies and/or modules with different number of total ECTS the distribution should be used for calculating percentages.

1.9. Assessment and evaluation of students' work during the semester and in the final exam

Students' work will be evaluated and assessed during the semester and in the final exam. Total number of points student can achieve during the semester is 70 (to assess the activities listed in the table), while in the final exam student can achieve 30 points.

The detailed work out of monitoring and evaluation of students' work will appear in the executive program.

1.10. Required literature (when proposing the program)

1. N. Sarapa, Teorija vjerojatnosti, Školska knjiga, Zagreb, 2002.

1.11. Recommended literature (when proposing the program)


1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of the semester students will evaluate the quality of the lectures. At the end of each semester (March 1 and September 30 of the current academic year) results of the exams will be analyzed.

IMPORTANT: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
### Course Description

1. **Course Objectives**

The objective of this course is to acquaint the students with basic notions of mathematical logic: to define syntax and semantics in the first-order logic and classical sentential logic, to analyze normal form and its properties and application, to analyze a base of truth-functional connectives, to analyze propositional calculus, to differ validity tests in first-order logic and classical sentential logic, to analyze Hilbert system and its properties, to review natural deduction system for first-order logic, to describe and compare interpretations and models, the first-order logic calculus and generalized completeness and soundness theorem.

1. **Correspondence and Correlation with the Program**

The program of the course Mathematical logic is in correlation with the other mathematical courses, especially Set theory and Computer organization and architecture.

1. **Expected Outcomes of the Course and/or Module**

After completing this course students will be able to understand and apply basic notions of mathematical logic: to apply syntax and semantics of sentential and first-order logic, to analyze and apply normal form, to differ validity tests in first-order and sentential logic, to use the propositional calculus in problem solving, to apply the natural deduction system, to give examples of first-order theory and to prove mathematically procedures and formulas given in this course.

### Course Content


### Modes of Instruction (Mark in Bold)

- Lectures
- Seminars and workshops
- Exercises

### Independent Work

- Multimedia and the Internet

### Other

- Laboratory work
- Tutorials

### Consultations

1. **Comments**

1. **Student Requirements**
Students must attend the lectures and participate in all activities required for the course.

1.8. Evaluation** and Assessment

| Class attendance and class participation | 1.1 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 1.7 | Oral exam | 2.8 | Essay | Research work |
| Project work | Continuous assessment | 0.4 | Presentation | Practical work |
| Portfolio |  |

1.9. Assessment and grade of student’s work during the class and after the final exam

Student’s activities are continuously being monitored. Quality of student’s active participation during classes and exercises is a component of the monitoring and evaluation scored with maximum of 70 points. Complete knowledge of the student is evaluated at the exam scored with maximum of 30 points.

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
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</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

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**Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Course organiser</strong></td>
</tr>
<tr>
<td><strong>Course title</strong></td>
</tr>
<tr>
<td><strong>Program</strong></td>
</tr>
<tr>
<td><strong>Course status</strong></td>
</tr>
<tr>
<td><strong>Year</strong></td>
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<tr>
<td><strong>Credits and Teaching</strong></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>

### 1. COURSE DESCRIPTION

#### 1.1. Course objectives
This course aims to acquaint students with:
- numerical errors,
- theoretical knowledge of polynomial interpolation of function and practical usage of learned methods,
- theoretical knowledge about numerical solution of non-linear and algebraic equations and practical usage of learned methods,
- theoretical knowledge of numerical integration and practical usage of learned methods,
- theoretical knowledge of differential equations and practical usage of learned methods

#### 1.2. Correspondence and correlation with the program
Program of the course Introduction to Numerical Mathematics is in correlation with the other courses of mathematics and with the courses of computer science.

#### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)
After completing this course, it is expected from students to understand numerical methods for polynomial interpolation, spline interpolation (linear and cubic), non-linear equations, integrals and differential equations and to be able to apply those methods in practice.

#### 1.4. Course content

#### 1.5. Modes of instruction (mark in bold)
- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

#### 1.6. Comments

#### 1.7. Student requirements
Students are obligated to attend classes, actively participated in any form of work that is required and pass the exam.

<table>
<thead>
<tr>
<th>1.8. Evaluation and Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class attendance and class participation</td>
</tr>
<tr>
<td>Written exam (preliminary exam)</td>
</tr>
<tr>
<td>Project work</td>
</tr>
<tr>
<td>Portfolio</td>
</tr>
</tbody>
</table>

1.9. Assessment and grade of student’s work during the class and after the final exam

Student’s work and activity in class are constantly monitored; the total number of points achieved during the class is 70. Knowledge of student is evaluated at the exam scored with maximum of 30 points.

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

---

Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
**1. COURSE DESCRIPTION**

1.1. **Course objectives**

On the contemporary projects in different technical areas (civil engineering, mechanical engineering, naval architecture etc.) teamwork of mathematicians, programmers, physicists and engineers of the appropriate calling is needed. The objective of this course is to prepare students for such teamwork. In particular, the objective is to introduce mathematicians, programmers, and physicists to the typical engineering problems so that they are prepared to work in industry, and on the other hand, to prepare engineers of different branches, with the scientific language and methods of mathematics and physics.

1.2. **Correspondence and correlation with the program**

Elementary knowledge in linear algebra and differential and integral calculus is necessary. Some experience in programming, numerical methods or particular technical field can facilitate the learning process. However, everything that is new to students is presented through lectures. This course can be part of the education of mathematicians, programmers, physicists, and engineers of different technical specializations.

1.3. **Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)**

It is expected that the student, which attends this course acquires knowledge needed to deal with some of the practical engineering problems in all the phases of this process: defining the problem, problem modeling, solving it with the aid of existing software or by programming new software, and presenting simulations, i.e., computed results.

1.4. **Course content**


1.5. **Modes of instruction (mark in bold)**

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

1.6. **Comments**

1.7. **Student requirements**

The student is required to attend class, to participate in all the forms of the work during lectures and to present a seminar paper.
### 1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class attendance and class participation</td>
<td>1</td>
<td>Seminar paper</td>
<td>1.5</td>
</tr>
<tr>
<td>Written exam (preliminary exam)</td>
<td>0.5</td>
<td>Oral exam</td>
<td></td>
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<tr>
<td>Project work</td>
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<td>Continuous assessment</td>
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<tr>
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</tr>
<tr>
<td>Continuous assessment</td>
<td></td>
<td>Practical work</td>
<td></td>
</tr>
</tbody>
</table>

#### 1.9. Assessment and grade of student’s work during the class and after the final exam

Students’ activities will be assessed during the semester and in the exam. Student can achieve the maximum of 70 points during the class and the maximum of 30 points in the exam.

#### 1.10. Required literature


#### 1.11. Recommended literature


#### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
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</tr>
</thead>
</table>

#### 1.13. Quality assurance of course and/or module

Quality and success of the realization of the course are evaluated primarily through continuous supervision of the quality of the seminar papers of the students. Continuous consultations and dialog with students are applied, and particular teaching content is adjusted to students’ interests.

---

31 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th>Projective Geometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Projective Geometry</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Elective</td>
</tr>
<tr>
<td>Year</td>
<td>III</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload 5</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S) 30+30+0</td>
</tr>
</tbody>
</table>

1. COURSE DESCRIPTION

1.1. Course objectives

- learn basic facts and properties of projective geometry
- learn Desargues' and Pappus' theorem
- learn properties of perspectivities, projectivities, correlations and polarity

1.2. Correspondence and correlation with the program

Program of course Projective Geometry is in correlation with the other courses of mathematics, especially with courses Linear algebra I and II, Euclidean spaces, Geometry and Vectors spaces I.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course, it is expected from students to know definitions, axioms and properties of projective geometry, Desargues' and Pappus' theorem and basic facts and properties of perspectivities, projectivities, correlations and polarity. Student will differ axiomatic from analytic approach to study of Projective Geometry and be able to interpret mathematical terms defined in this course.

1.4. Course content


1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Field work
- Other
- Consultations

1.6. Comments

1.7. Student requirements

Students are obligated to attend classes, actively participate in any form of work that is required and pass the exam.
1.8. Evaluation and Assessment

| Class attendance and class participation | 1.1 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 1 | Oral exam | 1.2 | Essay | Research work |
| Project work | Continuous assessment | 1.7 | Presentation | Practical work |
| Portfolio | |

1.9. Assessment and grade of student’s work during the class and after the final exam

Student’s work and activity in class are constantly monitored and scored with maximum of 70 points during the class. Knowledge of student is evaluated at the exam scored with maximum of 30 points.

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

32 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Introduction to Number theory</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Elective</td>
</tr>
<tr>
<td>Year</td>
<td>III.</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

1. COURSE DESCRIPTION

1.14. Course objectives

The Number theory is the field of mathematics known for simplicity in statements but complexity in problems, whose solving demands theory of algebra, analysis and geometry. This course aims to:

- analyze basic properties of integers (divisibility, prime numbers, integer factorization, Euclidean algorithm, congruence),
- analyze solvability of quadratic congruence using Legendre symbols; law of quadratic reciprocity,
- analyze quadratic forms,
- define arithmetical function and compare basic examples,
- differ various types of diophantine equations and describe the solving methods,
- define elliptic curves, analyze their properties and application in number theory,
- describe algebraic methods in number theory and their application,
- describe analytic methods in number theory and their application.

1.15. Correspondence and correlation with the program

Program of the course is in correlation with other mathematical courses, especially with the courses: Elementary Mathematics I, II, Algebraic structures, Algebra and Complex Analysis.

1.16. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to:

- analyze basic properties of integers and to apply them in the number theory problems, - analyze quadratic forms and apply the law of quadratic reciprocity,
- analyze basic arithmetical functions, state their properties and compare them,
- define basic types of diophantine equations and describe the solving methods,
- define elliptic curves, analyze their properties and application in number theory,
- describe and analyze algebraic methods in number theory and application,
- describe and analyze analytic methods in number theory and application.

1.17. Course content
Quadratic forms. Binary quadratic form reduction. Sums of two and four squares.
Arithmetic functions. Euler and Möbius function. Distribution of primes.
Quadratic fields. Units and prime elements in quadratic fields. Application to diophantine equations.
**General Information**

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Algebraic Structures</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in mathematics</td>
</tr>
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<td>Course status</td>
<td>Compulsory</td>
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<tr>
<td>Year</td>
<td>III</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload 7</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S) 30 + 30 + 0</td>
</tr>
</tbody>
</table>

**1. COURSE DESCRIPTION**

**1.1. Course objectives**

The aim of the course is to give students the basic knowledge on algebraic structures. For that purpose it is necessary within the course to:
- describe and distinguish algebraic structures with one and two binary operations,
- describe and distinguish different examples of some algebraic structures and analyze their properties,
- for a specific algebraic structure describe and distinguish the substructure and distinguish the other structures associated with the initial structure and analyze their properties,
- define and describe algebraic structures mappings and analyze the properties of these mappings,
- define Sylow subgroups and analyze the properties of these subgroups,
- define group action and permutation group and analyze their properties,
- define and distinguish modules and algebras.

**1.2. Course prerequisite**

**1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)**

After completing this course students should be able to:
- distinguish and analyze certain algebraic structures and to argumentedly execute mathematical procedures in problem solving,
- argumentedly use properties of certain algebraic structures in problem solving,
- argumentedly apply the theorems of homomorphisms,
- argumentedly apply Sylow theorems,
- distinguish and describe the action on the set and can apply appropriate procedures in problem solving,
- use the classical results in the theory of groups and rings, such as Lagrange’s theorem and Chinese remainder theorem to describe the group structure and ring structure,
- mathematically prove the states and procedures stated in this course.

**1.4. Course content**


**1.5. Modes of instruction (mark in bold)**

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and
1.6. Comments

1.7. Student requirements

It is compulsory for students to satisfy requirements (listed in the executive program) and to pass the final exam.

1.8. Evaluation\(^{33}\) and Assessment

| Class attendance and class participation | 1.7 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 2.3 | Oral exam | 1.8 | Essay | Research work |
| Project work | Continuous assessment | 1.2 | Presentation | Practical work |
| Portfolio | |

1.9. Assessment and grade of student's work during the class and after the final exam

Students' work will be evaluated and assessed during the semester and in the final exam. Total number of points student can achieve during the semester is 70 (to assess the activities listed in the table), while in the final exam student can achieve 30 points. The detailed work out of monitoring and evaluation of students' work will appear in the executive program.

1.10. Required literature (when proposing the program)

1. N. Grbac, V. Mikulić-Crnković, Algebarske strukture, skripta, zima 2010/11


4. B. Širola, Algebarske strukture. Grupe, PMF - Matematički odjel, Zagreb, 2008,

5. B. Širola, Algebarske strukture. Prsteni, polja i algebre, PMF – Matematički odjel, Zagreb, 2008,
   [http://web.math.hr/nastava/alg/200708/predavanjaPRSTENI.pdf](http://web.math.hr/nastava/alg/200708/predavanjaPRSTENI.pdf)

1.11. Recommended literature (when proposing the program)


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

In the last week of the semester students will evaluate the quality of the lectures. At the end of each semester (March 1 and September 30 of the current academic year) results of the exams will be analyzed.

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\(^{33}\) Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
## General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Introduction to Differential Geometry</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>III</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

## 1. COURSE DESCRIPTION

### 1.1. Course objectives

This course aims:
- acquisition a fundamental terms of curves in the plane and in the space and theirs differential attributes
- acquisition a fundamental terms of surface, differential attributes and a special category of surfaces
- acquisition a types of curves on surfaces

### 1.2. Correspondence and correlation with the program

Program of the course Introduction to Differential Geometry is in the correlation with other mathematical courses, especially with the courses Analysis I, Analysis II, Analysis III, Linear Algebra I and Linear Algebra II.

### 1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to understand basic properties of curves and surfaces and to apply this knowledge. They will be capable of:
- distinguishing curves in the plane and in the space,
- explaining and applying Frenet's formulas,
- stating Fundamental theorem of the theory of curves, Theorema Egregium and Fundamental theorem of curves,
- explaining and applying the three fundamental forms,
- stating Meusnier's theorem,
- explaining and comparing the total and mean curvatures

### 1.4. Course content


### 1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Field work
- Other
- Consultations

### 1.6. Comments

### 1.7. Student requirements
Attendance at all classes and active participation is expected.

1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>1.4</th>
<th>Seminar paper</th>
<th>0.35</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
<td>2.1</td>
<td>Oral exam</td>
<td>2.1</td>
<td>Essay</td>
</tr>
<tr>
<td>Project work</td>
<td>Continuous assessment</td>
<td>1.05</td>
<td>Presentation</td>
<td></td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
<td>Practical work</td>
</tr>
</tbody>
</table>

1.9. Assessment and grade of student's work during the class and after the final exam

Students' activities are monitored continuously. During the semester students can get 70 points for their activities in class. The final exam is oral, valued with maximum of 30 points.

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

---

34 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
General Information

Course organiser
Course title
Program
Course status
Year
Credits and Teaching

| ETCS credits / student workload | 5 |
| Hours (L+E+S)                  | 30+30+0 |

1. COURSE DESCRIPTION

1.1. Course objectives

The course studies the concept of an algorithm, some basic algorithms commonly used in programming, and the efficiency of these algorithms. It introduces abstract data types and the data structures commonly used to represent them. The student should become familiar with the basic data structures, the operations that are naturally connected to these structures and how they can be used in solving a number of algorithmic problems.

1.2. Correspondence and correlation with the program

Course program is in correlation with the program of the course Programming which provides the necessary background for this course.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

The student should become familiar with the:
- fundamental data types of computing (lists, stacks, queues, priority queues, sets, maps, trees, etc.)
- major techniques for implementing the fundamental data types (linked lists, binary search trees, hashing, heaps, etc.)
- fundamental sorting and searching algorithms of computing and how to analyze them.

The student should understand how recursion works and how to write recursive algorithms.

The student should learn:
- to use language-provided data structure libraries
- basic algorithm analysis
- to identify the most important abstract data types and the ways in which they may be implemented
- to describe an implementation using plain natural language or pseudocode.

1.4. Course content


1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

1.6. Comments

Laboratory work will be done in a computer laboratory.

1.7. Student requirements
Students are expected to:
- attend classes regularly
- make necessary preparations for classes
- do practical work
- present seminar paper
- pass a final exam.

### 1.8. Evaluation and Assessment

| Class attendance and class participation | 1 | Seminar paper | 0.5 | Experiment |
| Written exam (preliminary exam) | 1 | Oral exam | 1 | Essay | Research work |
| Project work | Continuous assessment | 1 | Presentation | Practical work | 0.5 |
| Portfolio | |

### 1.9. Assessment and grade of student's work during the class and after the final exam

Students' activities are monitored continuously. During the semester students can get 70 points for their activities in class. The final exam is oral, valued with maximum of 30 points.

### 1.10. Required literature


### 1.11. Recommended literature


### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

### 1.13. Quality assurance of course and/or module

Quality of the course will be monitored and measured through the success of examinations and through the anonymous inquiry reflecting students opinions regarding the course.

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35 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Seminar / B. Sc. thesis</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Year</td>
<td>III</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload 3</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S) 0 + 0 + 30</td>
</tr>
</tbody>
</table>

1. COURSE DESCRIPTION

1.1. Course objectives

This seminar is the first step towards elaboration of undergraduate thesis. The seminar objective is to further enable students for independent research and work with mathematical reading, and also for presentation of mathematical contents.

1.2. Correspondence and correlation with the program

The program of the course is in correlation with the other mathematical courses. Depending on the subject of the seminar there is a closer correlation with the specific mathematical course.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

This seminar will enable students to do independent research and work with mathematical reading and presentation of mathematical contents.

1.4. Course content

All lecturers will participate in determining the content of this seminar by proposing the themes for the seminars. Every student will present the theme in public and hand over the work in written form to the mentor. The work will present the basis for the undergraduate thesis which will be elaborated in conjunction with the mentor.

1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

1.6. Comments

U ovisnosti o temi seminara, prisutna je čvrsta korelacija s određenim matematičkim kolegijem.

1.7. Student requirements

Students must prepare the seminar, hand over the work in written form and present the work in public. Also students have to attend ¾ of all other public presentations. Students will be evaluated on the basis of written work, public presentation, attendance of the seminar and participation in discussions.

1.8. Evaluation and Assessment

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Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
### Class attendance and class participation

<table>
<thead>
<tr>
<th>Written exam (preliminary exam)</th>
<th>Oral exam</th>
<th>Seminar paper</th>
<th>1</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project work</td>
<td>Continuous assessment</td>
<td>Essay</td>
<td>2</td>
<td>Research work</td>
</tr>
<tr>
<td>Portfolio</td>
<td>Continuous assessment</td>
<td>Presentation</td>
<td>Practical work</td>
<td></td>
</tr>
</tbody>
</table>

#### 1.9. Assessment and grade of student’s work during the class and after the final exam

The total number of points student can achieve is 100.

#### 1.10. Required literature

To be assigned by the mentor on the basis of theme of the work.

#### 1.11. Recommended literature

#### 1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

#### 1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures.
General Information

<table>
<thead>
<tr>
<th>Course organiser</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course title</td>
<td>Introduction to Topology</td>
</tr>
<tr>
<td>Program</td>
<td>Undergraduate course in Mathematics</td>
</tr>
<tr>
<td>Course status</td>
<td>Elective</td>
</tr>
<tr>
<td>Year</td>
<td>III.</td>
</tr>
<tr>
<td>Credits and Teaching</td>
<td>ETCS credits / student workload</td>
</tr>
<tr>
<td></td>
<td>Hours (L+E+S)</td>
</tr>
</tbody>
</table>

1. COURSE DESCRIPTION

1.1. Course objectives

Primary objective of this course is introducing students to standard ways of analysing problems and proving facts in topology. Therefore, the course includes:

- Definition of topological spaces and analysis of different ways of defining topology on a set
- Comparison of basis, subbasis and open set families in a topological space
- Comparison of different concepts of connectedness of a topological space
- Definition of compactness
- Construction of new topological spaces using products, coproducts, subspaces, quotient spaces
- Analysis of hereditary properties of topological spaces in these constructions
- Definition of separation axioms
- Definition and description of homeomorphisms, as well as continuous, open, closed functions and analysis of their properties

1.2. Correspondence and correlation with the program

Program of the course Introduction to Topology is in correlation with other mathematical courses, especially with the courses: Vector spaces II, Set theory and Metric spaces.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

Students will acquire fundamental terms and properties of topological spaces. The expected outcomes, after students complete the course and pass the exam, are for the students to be able to:

- Analyse spaces endowed with families of open or closed sets, or families of neighbourhoods, and be able to determine which of these are topological spaces, using characterisations of topological spaces, basis or subbasis;
- Describe, with argumentation, the properties of a topological space: connectedness, compactness, separability;
- Analyse if a topological space fulfils a particular separation axiom property and compare these properties on various examples of topological spaces;
- Compare, with argumentation, the properties of topological spaces with the properties of their products, coproducts, subspaces, quotient spaces;
- Apply Urysohn Lemma, Tietze’s extension of maps Theorem and Tikhonov Theorem to examples;
- Analyse homeomorphisms, continuous, open, closed maps of topological spaces, and describe their properties;
• Examine continuity of the binary operation and operation of taking inverses in a topological group, analyse relationship between algebraic and topological properties of a topological group.

### 1.4. Course content


### 1.5. Modes of instruction

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work
- Independent work
- Multimedia and internet
- Laboratory work
- Tutorials
- Other
- Consultations

### 1.6. Comments

### 1.7. Student requirements

Attendance of all classes and active participation is expected. Students are expected to solve homework, take all written tests and short quizzes, and take the final oral exam.

### 1.8. Evaluation and Assessment

| Class attendance and class participation | 2 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 2.5 | Oral exam | 1.5 |
| Essay | | Research work |
| Continuous assessment | 1 | Presentation | Practical work |
| Portfolio | |

### 1.9. Assessment and grading of student’s work during class and the final exam

Students’ progress will be monitored continuously. The total number of points student can achieve during class (evaluated activities are indicated in the table above) is 70; the end of semester (oral) exam is scored with maximum of 30 points.

### 1.10. Required literature


### 1.11. Recommended literature

2. J. Dugundji, *Topology*, Callyn and Bacon, Boston, 1966

### 1.12. Number of copies of required literature books compared to the number of students in class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.13.</td>
<td><strong>Quality assurance of course and/or module</strong></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>After the last lecture of the course students will be asked to fulfil a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.</td>
<td></td>
</tr>
</tbody>
</table>
General Information

Course organiser
Course title
Program
Course status
Year
Credits and Teaching

<table>
<thead>
<tr>
<th>ETCS credits / student workload</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours (L+E+S)</td>
<td>45 + 30 + 0</td>
</tr>
</tbody>
</table>

1. COURSE DESCRIPTION

1.1. Course objectives

A course objective is to teach students the basics of the theory of hyperbolic conservation and balance laws, and to introduce them to the state of the art numerical schemes for these types of PDE. In particular, the course objective is to give them the knowledge about the broad variety of applications, from simulations of water flow in rivers and flooding to elastic wave propagation etc.

1.2. Correspondence and correlation with the program

Knowledge in linear algebra (eigenvalues and eigenvectors of matrices) and in mathematical analysis (differential and integral calculus, basics about partial differential equations, and similar) is necessary. Knowledge about some numerical methods for PDE and about physics of the fluid dynamics can facilitate the process of learning, but it is not necessary.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

The course program enables the student to acquire knowledge in the area of hyperbolic conservation laws. Introducing the student to some basic conservation laws and numerical methods needed to compute numerical solutions, enables him to independently work on projects concerning related problems.

1.4. Course content


1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations
- Field work

1.6. Comments

1.7. Student requirements

Students are required to actively participate in all the forms of work that are present in the course and in particular to finish a seminar paper (70 points). The acquired knowledge of the students is evaluated through exams (30 points).
1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>3</th>
<th>Seminar paper</th>
<th>2</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam (preliminary exam)</td>
<td>2</td>
<td>Oral exam</td>
<td></td>
<td>Experiment</td>
</tr>
<tr>
<td>Project work</td>
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<td>Presentation</td>
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</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.9. Assessment and grade of student’s work during the class and after the final exam

Students’ activities are monitored continuously. During the semester students can get 70 points for their activities in class. The final exam is oral, valued with maximum of 30 points.

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

Quality and success of the course outcomes from the quality of the seminar papers and oral exam of the students. Adaptation to the interests of students is carried out continuously, and it is based on the dialog with students and inquiries.

Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
1. COURSE DESCRIPTION

1.1. Course objectives

The objective of the course is to learn about different approaches in the linear systems solving; to analyze the errors of the considered methods and their price; to solve the overdetermined systems. Moreover, the iterative methods are considered, in particular their convergence and error analysis. Furthermore, the objective is to get familiar with numerical methods for solving symmetrical and nonsymmetrical eigenvalue problems, to learn about the consequences of the perturbation of eigenvalues and eigenvectors, and the errors appearing in that case. The generalization of the eigenvalue problem is considered.

1.2. Correspondence and correlation with the program

The course is in correlation with Linear algebra I, Linear algebra II and Numerical mathematics.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

Course program enables the student to acquire knowledge in numerical linear algebra, i.e., in methods and algorithms needed to solve related problems, which are often the outcome of a practical engineering problem. Furthermore, the accent is on the advantages and shortcomings of the presented methods in specific situations, and on the errors that appear in numerical computations.

1.4. Course content

Introduction into numerical computations.

1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Independent work
- Multimedia and the Internet
- Laboratory work
- Tutorials
- Other
- Consultations

1.6. Comments

1.7. Student requirements

Students are required to attend lectures and exercises, to solve given individual tasks and to pass the exam.
1.8. Evaluation and Assessment

<table>
<thead>
<tr>
<th>Class attendance and class participation</th>
<th>3</th>
<th>Seminar paper</th>
<th>2</th>
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<td>Portfolio</td>
<td></td>
<td></td>
<td></td>
<td>Practical work</td>
</tr>
</tbody>
</table>

1.9. Assessment and grade of student's work during the class and after the final exam

Students’ activities are monitored continuously. During the semester students can get 70 points for their activities in class. The final exam is oral, valued with maximum of 30 points.

1.10. Required literature


1.11. Recommended literature

3. W. Press et al: Numerical Recipes for C/Pascal/Fortran

1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
<th>Number of students</th>
</tr>
</thead>
</table>

1.13. Quality assurance of course and/or module

Quality assurance of the course includes supervision of the lecture realization and attendance, supervision of the realization of the course program and in particular it is tested through students inquiry. The success of the course realization is evaluated on the basis of the quality and accuracy of the individual student’s tasks, and through knowledge tests.

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38 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.
General Information

Course organiser

Course title  Theoretical Computer Science

Program  Undergraduate course in Mathematics

Course status  Elective

Year  III

Credits and Teaching  ETCS credits / student workload  7
  Hours (L+E+S)  45+30+0

1. COURSE DESCRIPTION

1.1. Course objectives
- to acquaint students with basic notions of induction and recursion
- to acquaint students with basic notions of grammar, automata, semantics and \( \lambda \)-calculus

1.2. Correspondence and correlation with the program

The programme of the course Set theory is in correlation with the other mathematical courses, especially Mathematical Logic and Set theory.

1.3. Expected outcomes of the course and/or module (development of general and specific competencies, knowledge and skills)

After completing this course students will be able to understand and apply basic notions of theoretical computer science; to define the principle of induction, grammar, language and automata; to know relations between grammar and automata classes; to apply \( \lambda \)-calculus.

1.4. Course content


1.5. Modes of instruction (mark in bold)

- Lectures
- Seminars and workshops
- Exercises
- Distance learning
- Field work

- Independent work

- Multimedia and the Internet

- Laboratory work
- Tutorials
- Other
- Consultations

1.6. Comments

1.7. Student requirements

Students must attend the lectures and participate in all activities required for the course.
1.8. Evaluation and Assessment

| Class attendance and class participation | 1.4 | Seminar paper | Experiment |
| Written exam (preliminary exam) | 2.8 | Oral exam | 2.8 | Essay | Research work |
| Project work | Continuous assessment | Presentation | Practical work |
| Portfolio | |

1.9. Assessment and grade of student’s work during the class and after the final exam

Student’s activities are continuously being monitored. Quality of student’s active participation during classes and exercises is a component of the monitoring and evaluation (70 points). Complete knowledge of the student is evaluated at the exam (30 points).

1.10. Required literature


1.11. Recommended literature


1.12. Number of copies of recommended literature in regard to the number of students who attend the class

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of copies</th>
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</thead>
</table>

1.13. Quality assurance of course and/or module

After the last lecture of the course students will be asked to fulfill a questionnaire about the quality of the lectures. At the end of each semester results of the exams will be analyzed.

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39 Mark in bold only the relevant categories and fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.