

Introductory mathematical course

Introductory mathematical course in calculus for students of IT, engineering, economics etc.
Teaching and learning strategies implemented: Flipped classroom (FC), Instruction-based learning and Project-based learning (PBL-WBL)

Planirani ECTS: 5, **Broj polaznika:** 200, **Način izvođenja:** Mješovito

Status: U PLANIRANJU, **Javni pristup tečaju:** Javno

Suradnici: Blaženka Divjak, Barbi Svetec, Mihaela Bosak, Damjan Klemenčić, Marija Maksimović

Course learning outcome	Level	Weight
Explain the concept of the derivative of a real function of one real variable and its geometric interpretation	Razumijevanje	10
Analyze an elementary function using derivatives and sketch its graph	Analiziranje	12
Apply differential calculus to find local extrema of a function with one variable and inflection points of the function.	Primjena	12
Determine the primitive function and apply integral calculus in calculating surface area and volume.	Primjena	12
Analyze and solve a problem task in the area of mathematical analysis of the function of one variables	Analiziranje	10
Create a program solution for a specific mathematical problem and present the solution in written format	Stvaranje	16
Explain the concept of primitive function and integrals of a function with one variable	Razumijevanje	10
Define elementary functions of a real variable, analyze their properties and sketch their graphs.	Analiziranje	10
Explain a concept of a limit and determine standard limits of functions	Primjena	8
		Total Weight: 100

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja			Grupe	Suradnja	Povratne informacije	Vrednovanje		
									Points	Types	Providers
Introduction											
Introduction of the course and TLAs											
Introduction of the course Content, assessment and TLAs	45 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne		
Discussion Students use discussion online and ask questions, propose ideas	60 min	Rasprava	Hibrid	Asinkroni	Nastavnik nije prisutan	ne	da	Kolega	ne		
Ukupno radno opterećenje cjeline	1.75h										

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja			Grupe	Suradnja	Povratne informacije	Vrednovanje		
									Points	Types	Providers
<h2>Real functions of real variables</h2> <p>Analyze and solve a problem task in the area of mathematical analysis of the function of one variables (40%), Define elementary functions of a real variable, analyze their properties and sketch their graphs. (60%)</p>											
<p>The domain of the function. Composition. Bijection. Graph of the function.</p>											
<p>Repetition of basic concepts Students receive a pre-prepared video with which they repeat basic concepts of function and graphs of elementary functions.</p>	30 min	Stjecanje znanja	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne		
<p>Discussion Students participate in discussions related to the introductory video. They can ask questions that can be answered by other students or a teacher.</p>	15 min	Rasprava	Online	Asinkroni	Nastavnik prisutan	ne	ne	Kolega, Nastavnik	ne		

Quiz (basic concepts) Students take a short quiz which cover the basic notions from the video.	10 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano
Lecture Professor checks how many students watched the video lesson and what the quiz results were. Based on the results of the quiz, teacher repeats concepts that are less well understood and designs lecture to upgrade and broad the topic. Students have possibility for additional questions.	120 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne		

Practice Assistants work with students. During the exercises, students do standard tasks related to the topic. In a group, they solve slightly more complex tasks.	90 min	Vježba	Hibrid	Sinkroni	Nastavnik prisutan	da	ne	Nastavnik, Kolega	ne
Ukupno radno opterećenje cjeline	4.41h								
Properties of real functions of a real variable									
Properties of real functions Students receive a pre-prepared video with which they repeat basic properties of real functions.	30 min	Stjecanje znanja	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne

<p>Discussion Students participate in discussions related to the introductory video. They can ask questions that can be answered by other students or a teacher.</p>	15 min	Rasprava	Online	Asinkroni	Nastavnik prisutan	ne	ne	Kolega	ne		
<p>Quiz (properties of real function) Students take a short quiz which cover the basic notions from the video.</p>	10 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano

<p>Lecture Professor checks how many students watched the video lesson and what the quiz results were. Based on the results of the quiz, teacher repeats concepts that are less well understood and designs lecture to upgrade and broad the topic. Students have possibility for additional questions.</p>	<p>120 min</p>	<p>Stjecanje znanja</p>	<p>Hibrid</p>	<p>Sinkroni</p>	<p>Nastavnik prisutan</p>	<p>ne</p>	<p>ne</p>	<p>ne</p>	<p>ne</p>
---	----------------	-------------------------	---------------	-----------------	---------------------------	-----------	-----------	-----------	-----------

Practice Assistants work with students. During the exercises, students do standard tasks related to the topic. In a group, they solve slightly more complex tasks.	90 min	Vježba	Hibrid	Sinkroni	Nastavnik prisutan	da	ne	Nastavnik, Kolega	ne		
Independent practical work Students work independently using the material in LMS Moodle and textbook.	90 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	da	Automatizirano, Kolega	ne		
Quiz (properties of real function-math problems) Students take a short quiz which cover the basic math problems.	30 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	2	Sumativno	Automatizirano
Ukupno radno opterećenje cjeline	6.41h										

Examples of functions and their graphs

<p>Examples (real functions of real variable)</p> <p>Students receive a pre-prepared video with which they repeat basic properties of real functions.</p>	30 min	Stjecanje znanja	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne		
<p>Discussion</p> <p>Students participate in discussions related to the introductory video.</p>	15 min	Rasprava	Online	Asinkroni	Nastavnik prisutan	ne	ne	Kolega, Nastavnik	ne		
<p>Quiz (examples)</p> <p>Students take a short quiz which cover the basic notions from the video.</p>	10 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano

<p>Lecture Professor checks how many students watched the video lesson and what the quiz results were. Based on the results of the quiz, teacher repeats concepts that are less well understood and designs lecture to upgrade and broad the topic. Students have possibility for additional questions.</p>	<p>120 min</p>	<p>Stjecanje znanja</p>	<p>Hibrid</p>	<p>Sinkroni</p>	<p>Nastavnik prisutan</p>	<p>ne</p>	<p>ne</p>	<p>ne</p>	<p>ne</p>
---	----------------	-------------------------	---------------	-----------------	---------------------------	-----------	-----------	-----------	-----------

Practice Assistants work with students. During the exercises, students do standard tasks related to the topic. In a group, they solve slightly more complex tasks.	90 min	Vježba	Hibrid	Sinkroni	Nastavnik prisutan	da	ne	Nastavnik, Kolega	ne
Independent practical work Students work independently using the material in LMS Moodle and textbook.	90 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	da	Automatizirano, Kolega	ne
Ukupno radno opterećenje cjeline	5.91h								
Sequences of real numbers and their properties									

<p>Examples (real functions of real variable) Students receive a pre-prepared materials with which they repeat basic properties of sequences. Students have to independently investigate and repeat the basic concepts of arithmetic and geometric series.</p>	90 min	Istraživanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne
<p>Lecture Teacher repeats basic concepts of sequences (definition, arithmetic and geometric sequences, properties and examples of sequences) and upgrades and broad the topic with limit of sequence.</p>	180 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne

Quiz (sequences) Students take a short quiz which cover the basic notions from lecture.	10 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano
Practice Assistants work with students. During the exercises, students do standard tasks related to the topic. In a group, they solve slightly more complex tasks.	180 min	Vježba	Hibrid	Sinkroni	Nastavnik prisutan	da	ne	Nastavnik, Kolega	ne		
Independent practical work Students work independently using the material in LMS Moodle and textbook.	120 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	da	Automatizirano, Kolega	ne		

<p>Quiz (sequences-math problems) Students take a short quiz which cover basic math problems.</p>	30 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	2	Sumativno	Automatizirano
<p>Ukupno radno opterećenje cjeline</p>	10.16h										

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja			Grupe	Suradnja	Povratne informacije	Vrednovanje		
									Points	Types	Providers
<h3>Limit of functions</h3> <p>Explain a concept of a limit and determine standard limits of functions (100%), Analyze an elementary function using derivatives and sketch its graph (10%), Define elementary functions of a real variable, analyze their properties and sketch their graphs. (10%)</p>											
<h3>Limit of function</h3>											
Motivational example Students receive a pre-prepared video with motivational example for limit of function and intuitive definition.	60 min	Stjecanje znanja	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne		

<p>Lecture Professor checks how many students watched the video lesson. Professor explains basic concepts and designs lecture to upgrade and broad the topic (Heine's and Cauchy's definition of function limit, main properties and theorems with proofs, continuity of function). Students have possibility for additional questions.</p>	180 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne		
<p>Quiz (limit of function) Students take a short quiz which cover the basic notions from lecture.</p>	15 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano

<p>Practice Assistants work with students. During the exercises, students do standard tasks related to the topic. In a group, they solve slightly more complex tasks.</p>	120 min	Vježba	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne		
<p>Independent practical work Students work independently using the material in LMS Moodle and textbook.</p>	180 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	da	Automatizirano, Kolega	ne		
<p>Quiz (limit of function-math problems) Students take a short quiz which cover the basic math problems.</p>	60 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	2	Sumativno	Automatizirano
<p>Ukupno radno opterećenje cjeline</p>	10.25h										

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja			Grupe	Suradnja	Povratne informacije	Vrednovanje		
									Points	Types	Providers
Monthly test 1											
Analyze and solve a problem task in the area of mathematical analysis of the function of one variables (10%) , Define elementary functions of a real variable, analyze their properties and sketch their graphs. (20%)											
Preparation for the test											
Independent practical work Students work independently	200 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	da	Automatizirano, Kolega	ne		
Discussion about technical and content related issues Students are given information in LMS and then they can ask questions.	60 min	Rasprava	Online	Asinkroni	Nastavnik nije prisutan	ne	da	Nastavnik, Kolega	ne		
Ukupno radno opterećenje cjeline	4.33h										
Monthly test (kolokvij)											

Test The test is prepared in hybrid delivery mode using individualised assignments from the databases in LMS.	90 min	Vrednovanje	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	Nastavnik, Automatizirano	20	Formativno	Nastavnik, Automatizirano
Ukupno radno opterećenje cjeline	1.5h										
Analysis of the test											
Students' feedback A questionnaire with open and closed questions is used. Students give feedback to teachers (technical and content wise).	20 min	Rasprava	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne	ne	ne

Analysis of the test Reliability, validity, students' satisfaction survey, explaining solutions	45 min	Rasprava	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	Nastavnik	ne
Further student investigation Students investigate application areas of mathematics learned.	90 min	Istraživanje	Online	Asinkroni	Nastavnik nije prisutan	da	da	Kolega	ne
Ukupno radno opterećenje cjeline	2.58h								

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja			Grupe	Suradnja	Povratne informacije	Vrednovanje		
									Points	Types	Providers
<h2>The Derivative - basic concepts, techniques and rules</h2> <p>Explain the concept of the derivative of a real function of one real variable and its geometric interpretation (90%), Apply differential calculus to find local extrema of a function with one variable and inflection points of the function. (30%), Analyze an elementary function using derivatives and sketch its graph (20%), Define elementary functions of a real variable, analyze their properties and sketch their graphs. (10%)</p>											
<h3>Concept and definition of the derivative</h3>											
Introduction of problems - motivation FC approach Video on problems that lead to the derivative: the slope of a tangent, velocity, optimization	30 min	Stjecanje znanja	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne		
Discussion Students participate in discussions related to the introductory video.	30 min	Rasprava	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Kolega	0	Sumativno	Kolega

Lecture - concept of derivative Professors work with students in a hybrid format on the development of the concept of the derivative, geometric interpretation and definition.	60 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne		
Quiz Students take a short quiz based on the concept of the derivative.	20 min	Vrednovanje	Online	Asinkroni	Nastavnik prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano
Practice Assistants work with students on derivatives; techniques and rules application.	90 min	Vježba	Na lokaciji	Sinkroni	Nastavnik prisutan	ne	da	Nastavnik	ne		

Independent practical work. Students practice different differentiation techniques based on material in LMS and textbooks.	90 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	ne
Ukupno radno opterećenje cjeline	5.33h								
Derivatives of implicit functions, chain rule, higher-order derivatives									
Video lecture - advanced techniques Students listen to a short video on the introduction advanced techniques of differentiation and then participate in a face to face presentation by the teacher on these techniques.	60 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne

Quiz Students take a short quiz based on advanced techniques of differentiation.	20 min	Vrednovanje	Online	Asinkroni	Nastavnik prisutan	ne	ne	ne	2	Sumativno	Automatizirano
Practice Assistants work with students on examples of derivation of implicit functions and chain rule.	90 min	Vježba	Na lokaciji	Sinkroni	Nastavnik prisutan	ne	da	Nastavnik	ne		
Independent practical work - advanced techniques. Students learn and practice higher-order derivatives based on material in LMS and textbooks.	90 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	ne		

<p>Independent investigation Students are required to investigate on their own the application areas and history of calculus.</p>	90 min	Istraživanje	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne
<p>Ukupno radno opterećenje cjeline</p>	5.83h								

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja			Grupe	Suradnja	Povratne informacije	Vrednovanje		
									Points	Types	Providers
<h2>Application of derivatives</h2> <p>Apply differential calculus to find local extrema of a function with one variable and inflection points of the function. (60%), Analyze an elementary function using derivatives and sketch its graph (50%), Analyze and solve a problem task in the area of mathematical analysis of the function of one variables (10%)</p>											
<h3>Finding local extrema</h3>											
<p>Video-lecture - function extrema</p> <p>Student listen video lecture about finding the absolute (or global) minimum and maximum values of a function.</p>	30 min	Stjecanje znanja	Online	Sinkroni	Nastavnik nije prisutan	ne	ne	Nastavnik	ne		
<p>Quiz</p> <p>Students take a short quiz based on finding extrema of function.</p>	20 min	Vrednovanje	Online	Asinkroni	Nastavnik prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano

Practice Assistants work with students on finding function increasing or decrease intervals by use of local extrema.	90 min	Vježba	Na lokaciji	Sinkroni	Nastavnik prisutan	ne	da	Nastavnik	ne		
Independent practical work-finding extrema Students practice finding increasing or decreasing intervals based on material in LMS and textbooks.	90 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	ne		
Self-assessment Students take self-assessment based on the assessment tasks in LMS (database). Based on the results they are instructed to further investigate.	90 min	Istraživanje	Online	Asinkroni	Nastavnik nije prisutan	ne	da	Nastavnik	0	Sumativno	Nastavnik

Ukupno radno opterećenje cjeline	5.33h										
Plotting graph											
Reading- graph plotting Students read material about applying derivatives on plotting graph functions.	60 min	Stjecanje znanja	Online	Sinkroni	Nastavnik nije prisutan	ne	ne	ne	0	Sumativno	Automatizirano
Independent practical work - graph plotting Students practice graph plotting based on material in LMS and textbooks.	90 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	ne		
Practice Assistants work with students on plotting graphs.	90 min	Vježba	Na lokaciji	Sinkroni	Nastavnik prisutan	ne	da	Nastavnik	ne		

<p>Self-assessment Students in small group take self-assessment based on the assessment tasks in LMS (database).</p>	90 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	da	da	Nastavnik, Automatizirano	2	Sumativno	Nastavnik
<p>Ukupno radno opterećenje cjeline</p>	5.5h										
<p>Curvature- Concavity and convexity</p>											
<p>Video-lecture- Concavity and convexity Student watch video lecture that explains points of inflection, and concavity and convexity of a function.</p>	25 min	Stjecanje znanja	Online	Sinkroni	Nastavnik nije prisutan	ne	ne	Nastavnik	ne		

<p>Independent practical work - concavity and convexity</p> <p>Students practice finding point of inflection based on material in LMS and texbooks.</p>	90 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	ne		
<p>Quiz</p> <p>Students take a short quiz about function concavity and convexity.</p>	20 min	Vrednovanje	Online	Asinkroni	Nastavnik prisutan	ne	ne	Automatizirano	2	Sumativno	Automatizirano
<p>Practice</p> <p>Assistants work with students on describing the shape or curvature of a curve.</p>	90 min	Vježba	Na lokaciji	Sinkroni	Nastavnik prisutan	ne	da	Nastavnik	ne		

<p>Self-assessment Students take self-assessment based on the assessment tasks in LMS (database). Based on the results they are instructed to further investigate.</p>	90 min	Istraživanje	Online	Asinkroni	Nastavnik nije prisutan	ne	da	Nastavnik	0	Sumativno	Nastavnik
<p>Ukupno radno opterećenje cjeline</p>	5.25h										

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja	Grupe	Suradnja	Povratne informacije	Vrednovanje		
							Points	Types	Providers
<h2>Monthly test 2</h2> <p>Explain the concept of the derivative of a real function of one real variable and its geometric interpretation (10%), Apply differential calculus to find local extrema of a function with one variable and inflection points of the function. (10%), Analyze an elementary function using derivatives and sketch its graph (20%)</p>									
Preparation for the test									
Independent practical work Students work independently	200 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	da	Automatizirano, Kolega	ne
Discussion about technical and content related issues Students are given information in LMS and then they can ask questions.	60 min	Rasprava	Online	Asinkroni	Nastavnik nije prisutan	ne	da	Nastavnik, Kolega	ne
Ukupno radno opterećenje cjeline	4.33h								
Monthly test (kolokvij)									

Test The test is prepared in hybrid delivery mode using individualised assignments from the databases in LMS.	90 min	Vrednovanje	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	Nastavnik, Automatizirano	20	Formativno	Nastavnik, Automatizirano
Ukupno radno opterećenje cjeline	1.5h										
Analysis of the test											
Students' feedback A questionnaire with open and closed questions is used. Students give feedback to teachers (technical and content wise).	20 min	Rasprava	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne		

Analysis of the test Reliability, validity, students' satisfaction survey, explaining solutions	45 min	Rasprava	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	Nastavnik	ne
Further student investigation Students investigate application areas of mathematics learned.	90 min	Istraživanje	Online	Asinkroni	Nastavnik nije prisutan	da	da	Kolega	ne
Ukupno radno opterećenje cjeline	2.58h								

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja	Grupe	Suradnja	Povratne informacije	Vrednovanje		
							Points	Types	Providers
Project team work - PEER ASSESSMENT Analyze and solve a problem task in the area of mathematical analysis of the function of one variables (5%) , Create a program solution for a specific mathematical problem and present the solution in written format (100%)									
Preparation for the project									

<p>Presentation of teamwork Professors and assistants present the way of working on the project, the choice of the project topic and the formation of the project team. The link of the project assignment (PBL) with the learning outcomes is explained, and how the PBL will contribute to students' future jobs. Teachers present the initial proposal of evaluation criteria for the project. The initial criteria include: research on the theoretical background, investigation of possible methodology for a solution, problem solution, presentation of the solution, quality of teamwork. Number of students: cca 100, 3-4 per team</p>	45 min	Rasprava	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne
--	--------	----------	--------	----------	--------------------	----	----	----	----

<p>Choice of project topic and team Students form teams of 3-4 (based on their own choice) and then choose a project topic from the list. Students investigate the research topics before making a final choice. Each team will be provided with their own virtual environment for teamwork (wiki).</p>	75 min	Rasprava	Online	Asinkroni	Nastavnik nije prisutan	da	da	ne	ne
<p>Initial research, discussion and questions Students research the project topic and discuss the topic within the team, but can also ask questions in a discussion forum in the LMS.</p>	90 min	Istraživanje	Online	Asinkroni	Nastavnik nije prisutan	da	da	Nastavnik, Kolega	ne
<p>Ukupno radno opterećenje cjeline</p>	3.5h								
<p>Work on project</p>									

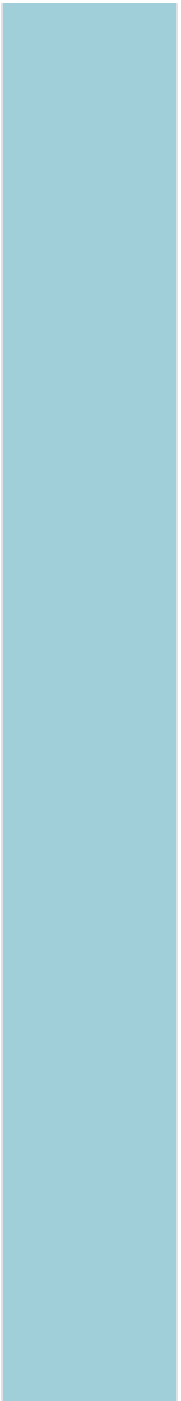
<p>Discussion of peer-assessment criteria Teachers and students discuss the criteria for project assessment, the level of achievement, and how to recognize the level of achievement. At the end, a rubric is finalized and hopefully understood by all the students. The initial criteria may be changed based on discussion. The levels of achievement will be described, ranging from 0 do 4 (depending on a specific criterion - some may have 2, and other 3 or 4 levels).</p>	45 min	Rasprava	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne
---	--------	----------	--------	----------	--------------------	----	----	----	----

<p>Excercise peer-assessment (peer-grading) Students are supposed to peer-assess two projects (for previous years - including one better and one not-so-good) to practice how to use the LMS, criteria, and rubrics. After that, discussion about the process is performed and the criteria are clarified if necessary. Students discuss (mutually and with the teacher) the issues related to academic integrity, fair assessment and ethical issues related to cheating.</p>	90 min	Vježba	Online	Asinkroni	Nastavnik prisutan	ne	da	Nastavnik, Automatizirano, Kolega	ne
---	--------	--------	--------	-----------	--------------------	----	----	-----------------------------------	----

<p>Project work Students research the chosen topic and collaborate within their teams. Students solve a project task, create a software solution and/or use adequate tools, and prepare written material(s) and other necessary documentation. Finally, they upload all the artifacts into the LMS (workshop in Moodle).</p>	640 min	Produkcija	Hibrid	Asinkroni	Nastavnik nije prisutan	da	da	Nastavnik, Kolega	ne		
<p>Ukupno radno opterećenje cjeline</p>	12.91h										
<p>Project assessment and presentation</p>											
<p>Presentation Students' teams present their projects to teachers and other students. Teachers and other students ask questions and discuss the solutions.</p>	120 min	Rasprava	Hibrid	Sinkroni	Nastavnik prisutan	da	da	Nastavnik, Kolega	ne		
<p>Assessment and</p>	90 min	Vrednovanje	Hibrid	Asinkroni	Nastavnik	ne	ne	Nastavnik,	20	Formativno	Nastavnik,

**peer-assessment
(peer-grading)**

Students participate in peer-assessment based on the pre-defined assessment criteria and levels of achievement given in the assessment rubric in the Moodle workshop. Each student is assigned with 2 projects to assess - the distribution is done automatically in the Moodle workshop. Peer-assessment is double-blinded: students are not given information about whose work they are assessing or who is assessing their work. The final grade is calculated based on teacher assessment (higher weight) and student peer-assessment (lower weight). Students are given grades for (1) their project submission and (2) their peer-



prisutan

Kolega

Kolega

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja		Grupe	Suradnja	Povratne informacije	Vrednovanje			
								Points	Types	Providers	
<h2>Integration - basic concepts, techniques and rules</h2> <p>Explain the concept of primitive function and integrals of a function with one variable (45%), Determine the primitive function and apply integral calculus in calculating surface area and volume. (20%), Analyze and solve a problem task in the area of mathematical analysis of the function of one variables (35%)</p>											
<h3>Concept and definition of integration</h3>											
<p>Introduction of problems - motivation</p> <p>Video on problems that lead to the integral: calculating surface of area, concept of primitive function and integrals of a function (upper and lower Darboux sum).</p>	30 min	Stjecanje znanja	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne		
<p>Discussion</p> <p>Students participate in discussions related to the introductory video</p>	15 min	Rasprava	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	Kolega	0	Sumativno	Kolega

Lecture - concept of integral Professors work with students in a hybrid format on the development of the concept of the integral, geometric interpretation and definition.	120 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne			
Quiz Students take a short quiz based on the concept of the integral	10 min	Vrednovanje	Online	Asinkroni	Nastavnik prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano	
Ukupno radno opterećenje cjeline	2.91h											
Integration techniques												
Lecture - advanced techniques Professor presents advanced techniques of integration. Students can ask questions.	90 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne			

Practice Assistants work with students on integrals; techniques and rules application.	120 min	Vježba	Na lokaciji	Sinkroni	Nastavnik prisutan	ne	da	Nastavnik	ne		
Independent practical work. Students learn and practice based on material in LMS and textbooks.	120 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	ne		
Quiz (Integration-math problems) Students take a short quiz based on the concept of the derivative.	30 min	Vrednovanje	Online	Asinkroni	Nastavnik prisutan	ne	ne	Automatizirano	2	Sumativno	Automatizirano
Ukupno radno opterećenje cjeline	6h										

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja			Grupe	Suradnja	Povratne informacije	Vrednovanje		
									Points	Types	Providers
<h3>Application of integral calculus</h3> <p>Explain the concept of primitive function and integrals of a function with one variable (35%), Determine the primitive function and apply integral calculus in calculating surface area and volume. (60%)</p>											
<h3>Calculating surface area</h3>											
Lecture - calculating surface Student listen video lecture about calculating surface area.	45 min	Stjecanje znanja	Online	Sinkroni	Nastavnik nije prisutan	ne	ne	Nastavnik	ne		
Quiz Students take a short quiz based on calculating surface area.	20 min	Vrednovanje	Online	Asinkroni	Nastavnik prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano

<p>Lecture Professor checks how many students watched the video lesson and what the quiz results were. Based on the results of the quiz, teacher repeats concepts that are less well understood and designs lecture to upgrade and broad the topic. Students have possibility for additional questions.</p>	120 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne
<p>Practice Assistants work with students on calculating surface area.</p>	120 min	Vježba	Na lokaciji	Sinkroni	Nastavnik prisutan	ne	da	Nastavnik	ne

Independent practical work-calculating surface area Students practice calculating surface area.	180 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	ne		
Self-assessment Students take self-assessment based on the assessment tasks in LMS (database).	90 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	da	Nastavnik	2	Sumativno	Nastavnik
Ukupno radno opterećenje cjeline	9.58h										
Calculating volume											
Lecture - calculating volume Student listen video lecture about calculating volume.	30 min	Stjecanje znanja	Online	Sinkroni	Nastavnik nije prisutan	ne	ne	Nastavnik	ne		

Quiz Students take a short quiz based on calculating volume.	20 min	Vrednovanje	Online	Asinkroni	Nastavnik prisutan	ne	ne	Automatizirano	1	Sumativno	Automatizirano
Lecture Professor checks how many students watched the video lesson and what the quiz results were. Based on the results of the quiz, teacher repeats concepts that are less well understood and designs lecture to upgrade and broad the topic. Students have possibility for additional questions.	90 min	Stjecanje znanja	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	ne	ne		
Practice Assistants work with students on calculating volume.	90 min	Vježba	Na lokaciji	Sinkroni	Nastavnik prisutan	ne	da	Nastavnik	ne		

Independent practical work-calculating volume Students practice calculating volume.	120 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	ne	Automatizirano	ne		
Self-assessment Students take self-assessment based on the assessment tasks in LMS (database).	90 min	Vrednovanje	Online	Asinkroni	Nastavnik nije prisutan	ne	da	Nastavnik	2	Sumativno	Nastavnik
Ukupno radno opterećenje cjeline	7.33h										

Naziv teme / cjeline	Radno opterećenje	Vrsta učenja	Način izvođenja			Grupe	Suradnja	Povratne informacije	Vrednovanje		
									Points	Types	Providers
<h3>Monthly test 3</h3> <p>Explain the concept of primitive function and integrals of a function with one variable (20%), Determine the primitive function and apply integral calculus in calculating surface area and volume. (20%)</p>											
Preparation for the test											
Independent practical work Students work independently	200 min	Vježba	Na lokaciji	Asinkroni	Nastavnik nije prisutan	ne	da	Automatizirano, Kolega	ne		
Discussion about technical and content related issues Students are given information in LMS and then they can ask questions.	60 min	Rasprava	Online	Asinkroni	Nastavnik nije prisutan	ne	da	Nastavnik, Kolega	ne		
Ukupno radno opterećenje cjeline	4.33h										
Monthly test (kolokvij)											

Test The test is prepared in hybrid delivery mode using individualised assignments from the databases in LMS.	90 min	Vrednovanje	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	Nastavnik, Automatizirano	20	Formativno	Nastavnik, Automatizirano
Ukupno radno opterećenje cjeline	1.5h										
Analysis of the test											
Students' feedback A questionnaire with open and closed questions is used. Students give feedback to teachers (technical and content wise).	20 min	Rasprava	Online	Asinkroni	Nastavnik nije prisutan	ne	ne	ne	ne	ne	ne

Analysis of the test Reliability, validity, students' satisfaction survey, explaining solutions	45 min	Rasprava	Hibrid	Sinkroni	Nastavnik prisutan	ne	ne	Nastavnik	ne
Further student investigation Students investigate application areas of mathematics learned.	90 min	Istraživanje	Online	Asinkroni	Nastavnik nije prisutan	da	da	Kolega	ne
Ukupno radno opterećenje cjeline	2.58h								

Ukupno opterećenje tečaja: 138.66h