Introductory mathematical course

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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: Miješano

Status: U PLANIRANJU

Javni pristup tečaju: Javno

Suradnici:
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Ishod učenja tečaja	Razina	Težina
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	Kreiranje	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
		Ukupna težina: 100

Naziv teme / cjeline	Opterećenje	Vrsta učenja	Način izvođenja	Grupe	Suradnja	Povratne informacije	Obavezna aktivnost	Vrednovanje		
								Bodovi	Tip	Pružatelji

Introduction										
Introduction of the course and TLAs										
Introduction of the course Content, assessment and TLAs	45 min	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne
Disscusssion Students use disscusion online and ask questions, propose ideas	60 min	Diskusija	Hibridno	Asinkrono	Nastavnik nije prisutan	Ne	Da	Vršnjak	Ne	Ne
Ukupna opterećenja cjeline	1.75h									

Real functions of real variables 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%)**	
The domain of the function. Composition. Bijection. Graph of the function.	

Repetition of basic concepts Students receive a pre-prepared video with which they repeat basic concepts of function and graphs of elementary functions.	30 min	Usvajanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne		
Disscusion Students participate in discussions related to the introductory video. They can ask questions that can be answered by other students or a teacher.	15 min	Diskusija	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Vršnjak, Nastavnik	Ne	Ne		
Quiz (basic concepts) Students take a short quiz which cover the basic notions from the video.	10 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	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	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	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	Vježbanje	Hibridno	Sinkrono	Nastavnik prisutan	Da	Ne	Nastavnik, Vršnjak	Ne	Ne
Ukupna opterećenja 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	Usvajanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne		
Disscusion Students participate in discussions related to the introductory video. They can ask questions that can be answered by other students or a teacher.	15 min	Diskusija	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Vršnjak	Ne	Ne		
Quiz (properties of real function) Students take a short quiz which cover the basic notions from the video.	10 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	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	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	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	Vježbanje	Hibridno	Sinkrono	Nastavnik prisutan	Da	Ne	Nastavnik, Vršnjak	Ne	Ne
Independent practical work Students work independently using the material in LMS Moodle and textbook.	90 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Da	Automatizirano, Vršnjak	Ne	Ne

Quiz (properties of real function-math problems) Students take a short quiz which cover the basic math problems.	30 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	2	Formativno	Automatizirano
Ukupna opterećenja cjeline	6.41h											
Examples of functions and their graphs												
Examples (real functions of real variable) Students receive a pre-prepared video with which they repeat basic properties of real functions.	30 min	Usvajanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne		
Disscusion Students participate in discussions related to the introductory video.	15 min	Diskusija	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Vršnjak, Nastavnik	Ne	Ne		
Quiz (examples) Students take a short quiz which cover the basic notions from the video.	10 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	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	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	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	Vježbanje	Hibridno	Sinkrono	Nastavnik prisutan	Da	Ne	Nastavnik, Vršnjak	Ne	Ne
Independent practical work Students work independently using the material in LMS Moodle and textbook.	90 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Da	Automatizirano, Vršnjak	Ne	Ne

Ukupna opterećenja cjeline	5.91h									
Sequences of real numbers and their properties										
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.	90 min	Istraživanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne
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.	180 min	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne

Quiz (sequences) Students take a short quiz which cover the basic notions from lecture.	10 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	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	Vježbanje	Hibridno	Sinkrono	Nastavnik prisutan	Da	Ne	Nastavnik, Vršnjak	Ne	Ne		
Independent practical work Students work independently using the material in LMS Moodle and textbook.	120 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Da	Automatizirano, Vršnjak	Ne	Ne		
Quiz (sequences-math problems) Students take a short quiz which cover basic math problems.	30 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	2	Formativno	Automatizirano
Ukupna opterećenja cjeline	10.16h											

Limit of functions 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%)**										
Limit of function										
Motivational example Students receive a pre-prepared video with motivational example for limit of function and intuitive definition.	60 min	Usvajanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne

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.	180 min	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne		
Quiz (limit of function) Students take a short quiz which cover the basic notions from lecture.	15 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	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.	120 min	Vježbanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne		
Independent practical work Students work independently using the material in LMS Moodle and textbook.	180 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Da	Automatizirano, Vršnjak	Ne	Ne		
Quiz (limit of function-math problems) Students take a short quiz which cover the basic math problems.	60 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	2	Formativno	Automatizirano
Ukupna opterećenja cjeline	10.25h											

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 fot the test										
Independent practical work Students work independently	200 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Da	Automatizirano, Vršnjak	Ne	Ne
Disscussion about technical and content related isssues Students are given information in LMS and then they can ask questions.	60 min	Diskusija	Online	Asinkrono	Nastavnik nije prisutan	Ne	Da	Nastavnik, Vršnjak	Ne	Ne

Ukupna opterećenja 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	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Nastavnik, Automatizirano	Ne	20	Sumativno	Nastavnik, Automatizirano
Ukupna opterećenja 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	Diskusija	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne		

Analysis of the test Reliability, validity, students' satisfaction survey, explaining solutions	45 min	Diskusija	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Nastavnik	Ne	Ne
Further student investigation Students investigate application areas of mathematics learned.	90 min	Istraživanje	Online	Asinkrono	Nastavnik nije prisutan	Da	Da	Vršnjak	Ne	Ne
Ukupna opterećenja cjeline	2.58h									
The Derivative - basic concepts, techniques and rules 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%)**										
Concept and definition of the derivative										
Introduction of problems - motivation FC approach Video on problems that lead to the derivative: the slope of a tangent, velocity, optimization	30 min	Usvajanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne

Disscusion Students participate in discussions related to the introductory video.	30 min	Diskusija	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Vršnjak	Ne	0	Formativno	Vršnjak
Lecture - concept of derivative Professors work with students in a hybrid format on the development od the concept of the derivative, geometric interpretation and definition.	60 min	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne		
Quiz Students take a short quiz based on the concept od the derivative.	20 min	Vrednovanje	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	Automatizirano
Practice Assistants work with students on derivatives; techniques and rules application.	90 min	Vježbanje	Na lokaciji	Sinkrono	Nastavnik prisutan	Ne	Da	Nastavnik	Ne	Ne		

Independent practical work. Students practice different differentiation techniques based on material in LMS and texbooks.	90 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	Ne
Ukupna opterećenja 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	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne

Quiz Students take a short quiz based on advanced techniques of differentiation.	20 min	Vrednovanje	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	2	Formativno	Automatizirano
Practice Assistants work with students on examples of derivation of implicit functions and chain rule.	90 min	Vježbanje	Na lokaciji	Sinkrono	Nastavnik prisutan	Ne	Da	Nastavnik	Ne	Ne		
Independent practical work - advanced techniques. Students learn and practice higher-order derivatives based on material in LMS and texbooks.	90 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	Ne		
Independent investigation Students are required to investigate on their own the application areas and history of calculus.	90 min	Istraživanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne		
Ukupna opterećenja cjeline	5.83h											

Application of derivatives 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%)**	
Finding local extrema	

Video-lecture - function extrema Student listen video lecture about finding the absolute (or global) minimum and maximum values of a function.	30 min	Usvajanje	Online	Sinkrono	Nastavnik nije prisutan	Ne	Ne	Nastavnik	Ne	Ne		
Quiz Students take a short quiz based on finding extrema of function.	20 min	Vrednovanje	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	Automatizirano
Practice Assistants work with students on finding function increasing or decrease intervals by use of local extrema.	90 min	Vježbanje	Na lokaciji	Sinkrono	Nastavnik prisutan	Ne	Da	Nastavnik	Ne	Ne		
Independent practical work- finding extrema Students practice finding increasing or decreasing intervals based on material in LMS and texbooks.	90 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	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	Asinkrono	Nastavnik nije prisutan	Ne	Da	Nastavnik	Ne	0	Formativno	Nastavnik
Ukupna opterećenja cjeline	5.33h											
Curvature-Concavity and convexity												
Video-lecture-Concavity and convexity Student watch video lecture that explains points of inflection, and concavity and convexity of a function.	25 min	Usvajanje	Online	Sinkrono	Nastavnik nije prisutan	Ne	Ne	Nastavnik	Ne	Ne		

Independent practical work - concavity and convexity Students practice finding point of inflection based on material in LMS and texbooks.	90 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	Ne		
Quiz Students take a short quiz about function concavity and convexity.	20 min	Vrednovanje	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Automatizirano	Ne	2	Formativno	Automatizirano
Practice Assistants work with students on describing the shape or curvature of a curve.	90 min	Vježbanje	Na lokaciji	Sinkrono	Nastavnik prisutan	Ne	Da	Nastavnik	Ne	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	Asinkrono	Nastavnik nije prisutan	Ne	Da	Nastavnik	Ne	0	Formativno	Nastavnik
Ukupna opterećenja cjeline	5.25h											

Plotting graph												
Reading- graph plotting Students read material about applying derivatives on plotting graph functions.	60 min	Usvajanje	Online	Sinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	0	Formativno	Automatizirano
Independent practical work - graph plotting Students practice graph plotting based on material in LMS and texbooks.	90 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	Ne		
Practice Assistants work with students on plotting graphs.	90 min	Vježbanje	Na lokaciji	Sinkrono	Nastavnik prisutan	Ne	Da	Nastavnik	Ne	Ne		
Self-assessment Students in small group take self-assessment based on the assessment tasks in LMS (database).	90 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Da	Da	Nastavnik, Automatizirano	Ne	2	Formativno	Nastavnik
Ukupna opterećenja cjeline	5.5h											

Monthly test 2 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%)**										
Preparation fot the test										
Independent practical work Students work independently	200 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Da	Automatizirano, Vršnjak	Ne	Ne

Disscussion about technical and content related isssues Students are given information in LMS and then they can ask questions.	60 min	Diskusija	Online	Asinkrono	Nastavnik nije prisutan	Ne	Da	Nastavnik, Vršnjak	Ne	Ne		
Ukupna opterećenja 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	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Nastavnik, Automatizirano	Ne	20	Sumativno	Nastavnik, Automatizirano
Ukupna opterećenja 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	Diskusija	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne
Analysis of the test Reliability, validity, students' satisfaction survey, explaining solutions	45 min	Diskusija	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Nastavnik	Ne	Ne
Further student investigation Students investigate application areas of mathematics learned.	90 min	Istraživanje	Online	Asinkrono	Nastavnik nije prisutan	Da	Da	Vršnjak	Ne	Ne
Ukupna opterećenja cjeline	2.58h									

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										
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	45 min	Diskusija	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne

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										

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).	75 min	Diskusija	Online	Asinkrono	Nastavnik nije prisutan	Da	Da	Ne	Ne	Ne
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.	90 min	Istraživanje	Online	Asinkrono	Nastavnik nije prisutan	Da	Da	Nastavnik, Vršnjak	Ne	Ne
Ukupna opterećenja cjeline	3.5h									
Work on project										

Disscusion 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).	45 min	Diskusija	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne

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.	90 min	Vježbanje	Online	Asinkrono	Nastavnik prisutan	Ne	Da	Nastavnik, Automatizirano, Vršnjak	Ne	Ne

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).	640 min	Kreacija	Hibridno	Asinkrono	Nastavnik nije prisutan	Da	Da	Nastavnik, Vršnjak	Ne	Ne		
Ukupna opterećenja cjeline	12.91h											
Project assessment and presentation												
Presentation Students' teams present their projects to teachers and other students. Teachers and other students ask questions and discuss the solutions.	120 min	Diskusija	Hibridno	Sinkrono	Nastavnik prisutan	Da	Da	Nastavnik, Vršnjak	Ne	Ne		
Assessment and	90 min	Vrednovanje	Hibridno	Asinkrono	Nastavnik	Ne	Ne	Nastavnik,	Ne	20	Sumativno	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				prisutan			Vršnjak				Vršnjak	

given grades for (1) their project submission and (2) their peer-assessment.												
Reflection on results Students and teachers discuss the results of the PBL and peer-assessment, based on the learning analytics provided in Moodle and not on an individual basis. Each team has the opportunity to propose improvements to their artifact based on the feedback received. Improved artifacts can be resubmitted and teachers decides on whether the grades should be modified based on that.	90 min	Istraživanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Da	Nastavnik, Automatizirano, Vršnjak	Ne	Ne		
Ukupna opterećenja cjeline	5h											

Integration - basic concepts, techniques and rules 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%)**	
Concept and definition of integration	

Introduction of problems - motivation 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).	30 min	Usvajanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne		
Disscusion Students participate in discussions related to the introductory video	15 min	Diskusija	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Vršnjak	Ne	0	Formativno	Vršnjak
Lecture - concept of integral Professors work with students in a hybrid format on the development od the concept of the integral, geometric interpretation and definition.	120 min	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne		
Quiz Students take a short quiz based on the concept od the integral	10 min	Vrednovanje	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	Automatizirano

Ukupna opterećenja cjeline	2.91h												
Integration techniques													
Lecture - advanced techniques Professor presents advanced techniques of integration. Students can ask questions.	90 min	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne			
Practice Assistants work with students on integrals; techniques and rules application.	120 min	Vježbanje	Na lokaciji	Sinkrono	Nastavnik prisutan	Ne	Da	Nastavnik	Ne	Ne			
Independent practical work. Students learn and practice bsed on material in LMS and texbooks.	120 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	Ne			
Quiz (Integration-math problems) Students take a short quiz based on the concept od the derivative.	30 min	Vrednovanje	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Automatizirano	Ne	2	Formativno	Automatizirano	

Ukupna opterećenja cjeline	6h									
Application of integral calculus 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%)**										
Calculating surface area										
Lecture - calculating surface Student listen video lecture about calculating surface area.	45 min	Usvajanje	Online	Sinkrono	Nastavnik nije prisutan	Ne	Ne	Nastavnik	Ne	Ne

Quiz Students take a short quiz based on calculating surface area.	20 min	Vrednovanje	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	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	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne		
Practice Assistants work with students on calculating surface area.	120 min	Vježbanje	Na lokaciji	Sinkrono	Nastavnik prisutan	Ne	Da	Nastavnik	Ne	Ne		
Independent practical work-calculating surface area Students practice calculating surface area.	180 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	Ne		

Self-assessment Students take self-assessment based on the assessment tasks in LMS (database).	90 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Da	Nastavnik	Ne	2	Formativno	Nastavnik
Ukupna opterećenja cjeline	9.58h											
Calculating volume												
Lecture - calculating volume Student listen video lecture about calculating volume.	30 min	Usvajanje	Online	Sinkrono	Nastavnik nije prisutan	Ne	Ne	Nastavnik	Ne	Ne		
Quiz Students take a short quiz based on calculating volume.	20 min	Vrednovanje	Online	Asinkrono	Nastavnik prisutan	Ne	Ne	Automatizirano	Ne	1	Formativno	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	Usvajanje	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Ne	Ne	Ne		
Practice Assistants work with students on calculating volume.	90 min	Vježbanje	Na lokaciji	Sinkrono	Nastavnik prisutan	Ne	Da	Nastavnik	Ne	Ne		
Independent practical work-calculating volume Students practice calculating volume.	120 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Automatizirano	Ne	Ne		
Self-assessment Students take self-assessment based on the assessment tasks in LMS (database).	90 min	Vrednovanje	Online	Asinkrono	Nastavnik nije prisutan	Ne	Da	Nastavnik	Ne	2	Formativno	Nastavnik

Ukupna opterećenja cjeline	7.33h									
Monthly test 3 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%)**										
Preparation fot the test										
Independent practical work Students work independently	200 min	Vježbanje	Na lokaciji	Asinkrono	Nastavnik nije prisutan	Ne	Da	Automatizirano, Vršnjak	Ne	Ne

Disscussion about technical and content related isssues Students are given information in LMS and then they can ask questions.	60 min	Diskusija	Online	Asinkrono	Nastavnik nije prisutan	Ne	Da	Nastavnik, Vršnjak	Ne	Ne		
Ukupna opterećenja 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	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Nastavnik, Automatizirano	Ne	20	Sumativno	Nastavnik, Automatizirano
Ukupna opterećenja 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	Diskusija	Online	Asinkrono	Nastavnik nije prisutan	Ne	Ne	Ne	Ne	Ne
Analysis of the test Reliability, validity, students' satisfaction survey, explaining solutions	45 min	Diskusija	Hibridno	Sinkrono	Nastavnik prisutan	Ne	Ne	Nastavnik	Ne	Ne
Further student investigation Students investigate application areas of mathematics learned.	90 min	Istraživanje	Online	Asinkrono	Nastavnik nije prisutan	Da	Da	Vršnjak	Ne	Ne
Ukupna opterećenja cjeline	2.58h									
Ukupna opterećenja tečaja	**138.66h**									