CORSO CLIL IPRASE 2017-2018

CLIL Module/Lesson Plan

Title: Indefinite and Definite Integrals of univariate functions, and applications

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School Grade	Primary ☐		Middle ☐		High X
School Year	1 ☐	2 ☐	3 ☐	4 ☐	5 X
Subject :	Mathematics - Calculus		**Topic:**	Integrals and applications	
CLIL language	English ☒			Deutsch ☐	

Personal and social-cultural preconditions of all people involved	**Institutional framework conditions and school situation:** The school class is an Electronics/Automation one, and it belongs to a Technical Institute, where students can learn about Electronics, Informatics or Mechatronics: each course is five years long, with a final exam ruled by national standards. In the Institute, there are 800 students, who live in Rovereto or in the nearby valleys. In the classroom there are 24 learners: 23 boys and 1 girl. One of the learners has North-African origins, but he is fully integrated in the Italian school system. There aren't any students with special needs.
	Learning preconditions: There are different learning spaces: traditional classrooms with a personal computer, educational softwares, Internet connection and Interactive Whiteboard; Electronics, Informatics, Mechatronics and Robotics laboratories; two laboratories for foreign language lessons; gym for PE. Therefore, learners are used to study in different environments, and most of them are highly motivated and willing to learn, with methodological competence. I have been working in this School since 2009, but it is my first year in this school class.
	Teacher profile: I teach Mathematics in this school class, and I am the class' coordinator.
	Student group profile: most learners are B1 level in English language; there aren't any English mother tongue students; the class has experience in CLIL activities during Electronics and History lessons.

	Subject	Language
Students' prior knowledge, skills, competencies	**Mathematics:** learners have attended regular Math courses in the previous four years. As regards Calculus, they have competences about functions, limits, derivatives and their applications. They have high order skills in the use of ICT tools for learning, too.	**English:** learners have attended regular English courses in the previous four years. During this school year they are attending a regular English course, with classroom and laboratory activities. As regards CLIL they have experience in Electronics and History lessons, so they have speaking skills both with vocabulary and grammar structure in a non-native language.

Timetable fit	o Module	Module length: 31 hours (Unit 1: 15 hours. Unit 2: 9 hours; Unit 3: 7 hours).
	o Lesson	Lesson length: every week, first lesson 1 hour, and second lesson 2 hours.

Description of teaching and learning strategies	During the first two units the main topics will be introduced with the support of digital resources written by the teacher using the Notebook software embedded in the Interactive Whiteboard. The same digital resources are available in the relevant Google Classroom, where learners can find other resources to study and to deepen the topics, before solving exercises and problems at home and during the following lessons (Flipped Classroom methodology). The digital resources about the solved exercises and problems will be uploaded in the relevant Google Classroom, after each lesson. In the third unit the focus is to solve real problems (about Astronomy, Electronics, Mechanics) using indefinite and definite integrals, with a strong interaction between teacher and learners. They have to upload the documents related to problems' solution in Google Classroom. Choice of media: digital resources written by the teacher, the standard course book, other recommended books about units' topics, and some selected Calculus course books in English language available in the Web and recommended by the teacher. E-mail and course's on line diary for communication between teacher and learners. ICT learning tools: Google Drive and Google Classroom, Interactive Whiteboard and its embedded Notebook software, GeoGebra software (https://www.geogebra.org/), on-line softwares for Mathematics learning, in English language (http://functions.wolfram.com/ , http://www.wolframalpha.com/calculators/integral-calculator/ , http://www.wolframalpha.com/calculators/derivative-calculator/).

Overall Module Plan

Unit 1 **Indefinite integrals** Unit length: 15 hours	Lesson 1 - Introduction to indefinite integrals: the surface problem, the search for solutions, anti-derivative and indefinite integrals (1 hour).
	Lesson 2 - The main formulas to calculate indefinite integrals; examples and exercises (2 hours).
	Lesson 3 - The main formulas to calculate indefinite integrals; examples and exercises (1 hour).
	Lesson 3 - The main formulas to calculate indefinite integrals: integration by parts. Examples and exercises (2 hours).
	Lesson 4 - Integration by parts: examples and exercises (1 hours).
	Lesson 5 – Rational functions and their integration: examples and exercises (2 hours).
	Lesson 6 – Integration by substitution: examples and exercises (1 hours).
	Lesson 7 – Integration by substitution: examples and exercises (2 hours).
	Lesson 8 – Exercises to prepare the unit assessment (1 hour).
	Lesson 9 – Unit assessment (summative assessment - 2 hours).

Unit 2 **Definite integrals** Unit length: 9 hours	Lesson 1: The Fundamental Theorem and its consequences. Use of the fundamental theorem and its consequences to calculate definite integrals and surfaces (1 hour).
	Lesson 2: Use of the fundamental theorem and its consequences to calculate definite integrals and surfaces: exercises (2 hours).
	Lesson 3: Use of the fundamental theorem and its consequences to calculate definite integrals and surfaces: surface between two curves (1 hour).
	Lesson 4: Use of the fundamental theorem and its consequences to calculate definite integrals and surfaces: exercises (2 hours).
	Lesson 5: Exercises to prepare the unit assessment (1 hour).
	Lesson 6: Unit assessment (summative assessment - 2 hours).

Unit 3 **Applications** Unit length: 7 hours	Lesson 1: use of definite integrals to solve problems related to space's exploration (NASA educational resources – 1 hour).
	Lesson 2: use of definite integrals to solve problems in Electronics and Mechanics (2 hours).
	Lesson 3: use of definite integrals to solve problems in Electronics and Mechanics (1 hour).
	Lesson 4: use of definite integrals to calculate volume of rotational solids: method, examples, exercises. Task-based learning as unit's final product - Assignment of a real problem to each student, with the task to solve it using indefinite and definite integrals: the digital documentation about the solution must be uploaded in Google Classroom within ten days (2 hours).
	Lesson 5: Discussion in the classroom about the final product (difficulties, interesting stimuli, proposals - 1 hour).

CLIL Lesson Plan

Unit number **3**	Lesson number **1**	Title: **Use of definite integrals to solve problems related to space's exploration**

Activity	Timing	Learning Outcomes	Activity Procedure	Language	Interaction	Materials	Assessment
1	5 minutes	*Previous units' knowledge: learners have to be ready to use previously learned topics and materials, by recalling terms, basic concepts, formulas and methods about indefinite and definite integrals.*	*Activating prior knowledge.* Teacher's role: appealing to previous units' topics about indefinite and definite integrals. Learners' role: to have materials where indefinite and definite integrals formulas can be found and read.	*Skills* [L] [S] [R] [W] *Key vocabulary* Calculus, function, indefinite and definite integrals, antiderivative, Fundamental Theorem, formulas, surface. *Communicative structures* Can you list…?; Can you recall…?; What is….?; Which one…?; Why does…?	**X Whole class** ○ Group work ○ Pair work ○ Individual work	Digital resources of Unit 1 and Unit 2. Web resources: http://mathworld.wolfram.com/topics/Integrals.html http://tutorial.math.lamar.edu/Classes/CalcI/AreaBetweenCurves.aspx	See summative assessments of Unit 1 and Unit 2.
2	10 minutes	*Comprehension: learners have to be able to read and to understand a content text, with a*	*Presentation of the problem.*	*Skills* [L] [S] [R] [W]			Formative assessment: teacher takes

				Key vocabulary Astronomy, Integrals, Mathematics, NASA, Radiation, Spacecraft, Space exploration, other specific nouns in the pdf attachment.	o Whole class o Group work **X Pair work** o Individual work	https://spacemath.gsfc.nasa.gov/calculus.html ; document for the learners (see pɑr attachment).	note during learners' pair work, to check if learners understand the text and questions of the problem. Difficulties in specific vocabulary are solved during this phase of the lesson.
		specific vocabulary about Astronomy, Space exploration, Mathematics. Reading the same text, learners have to be able to understand the questions, and to ask the teacher if they don't know some words.	*Teacher's role: to prepare the content and to provide it in a suitable way (both paper and digital format). Learners' role: working in pair, they have to read and to understand the problems and questions introduced by the text. They have to take note during teacher's answers.*	*Communicative structures* Can you explain what is meant…? How could you classify the type of…? How would you rephrase the meaning…? What can you say about…? Which statements support…?			
3	20 minutes	*1) Application: solving problem by applying acquired knowledge, facts, techniques and rules in a different way; 2) Analysis: examining information by identifying causes, and finding evidence to support generalisations; 3) Synthesis: compiling information together by*	*Problem's solution. Teacher's role: to observe learners' behaviour and working method searching for the solution. Learners' role: working in pair, they search for the problem's solution, answering to its questions. They have to write solution, creating*	*Skills* | L	S	R	W | *Key vocabulary* Accumulated total dose; definite integrals; milliGrays/hour; radial distance; radiation dose rate.	o Whole class o Group work **X Pair work** o Individual work	Document for the classroom with the problem's text (see pdf attachment).	Formative assessment: the teacher gathers learners' documents, to understand learning process and for activity 4.

		combining elements in a new pattern.	*a new document, and each pair has to deliver it to the teacher.*	*Communicative structures* How would you solve...using what you have learned…? How would you organize….to show…? What approach would you use to….? What would result if…? Can you make use of the facts to…? How is….related to…? Can you identify the different parts…? What evidence can you find…? What is the relationship between…? What is the function of…? What ideas justify..? Can you propose an alternative…? What way would you design…? Suppose you could….: what would you do..? How would you test….? Can you formulate a theory for…? Can you predict the outcome if…? Can you construct a model that would change….?			
4	15 minutes	*Evaluation: presenting and defending opinions by making judgements about information, validity of ideas or quality of work based on a set of criteria.*	*Plenary: discussion about the problem's solutions.* *Teacher's role: he/she delivers the document with problem's solution.* *Learners' role: pairs verify their solutions, searching for*	*Skills* L S R W *Key vocabulary* Solutions, analogies, differences, mistakes, proposals for other solutions.	**X Whole class** o Group work **X Pair work** o Individual work	Problem's solutions written during pair work (activity 3).	Formative assessment: during the discussion the teacher takes note about learners' proposals for other solutions,

			differences and analogies.	*Communicative structures* How would you prove…? Would it be better if…? How could you determine…? What choice would you have made…? Based on what you know, how would you explain…? What information would you use to support the view…? How would justify…? What data was used to make the conclusion…?			connected to other subjects' content.