<table>
<tr><td>Name of the course</td><td colspan="5">TEACHING METHODS IN PHYSICS I</td></tr>
<tr><td>Code</td><td>PMP050</td><td>Year of study</td><td colspan="3">1st year of Masters</td></tr>
<tr><td>Course lecturer</td><td>Assoc. Prof. Ivica Aviani, PhD</td><td>Credits (ECTS)</td><td colspan="3">6</td></tr>
<tr><td rowspan="2">Associate Lecturer</td><td rowspan="2">Lucija Krce</td><td rowspan="2">Type of subject teaching (number of hours)</td><td>L</td><td>S</td><td>LE</td></tr>
<tr><td>30</td><td>30</td><td>30</td></tr>
<tr><td>Course status</td><td>Obligatory</td><td>Percentage of application of e-learning</td><td colspan="3">20</td></tr>
<tr><td colspan="6">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="5">• To gain knowledge, skills and attitudes required in the field of teaching physics.
• To link knowledge in physics with pedagogical knowledge and their methodological aspects.
• To deepen understanding of basic physical concepts.
• To develop the ability of teaching of physical concepts in an appropriate way for pupil’s age and foreknowledge.
• To capacitate students in writing lecture plans and teaching lessons in physics in elementary school using different teaching tools and experiments.
• To be acquainted with the latest accomplishments in educational physics and to be acquainted with the application of newer and different methods in active learning and teaching.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="5">• General physics
• Pedagogy
• Didactics</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="5">• To demonstrate knowing and understanding of basic physical laws
• To interconnect physics with other subjects
• To adduce and explain pupil’s most common conceptual and mathematical–logical difficulties in basic physical concepts as well as modes of their solution
• To prepare/design, perform and interpret appropriate school experiments
• To show knowledge in the usage of professional literature and other relevant information sources for lecture plans
• To apply key ideas, models and laws in physics in manners appropriate for pupils
• To design, prepare and execute a teaching lesson in elementary school
• To apply modern approaches in physics teaching as well as teaching in general
• To apply basic elements of scientific reasoning ((hypothetical - deductive reasoning, proportional reasoning, control of variables)</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule</td><td colspan="5">*Lectures* (L) – 30 hours:
1. Introduction lesson (introducing students and lecturers, description of work methods, student obligations and assessments of achievements, short description of methodology in physics teaching).
2. Purpose and goals in physics education. Methods and language in physics. Goals and tasks of physics teaching in elementary schools.
3. Knowledge and the nature of science. Didactics of natural sciences. Modeling in physics.</td></tr>
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	4. Lecture plans for teaching physics. Physics curriculum for elementary school. Learning outcomes. 5. Resources for physics lecture plans in elementary school (methodological handbooks, textbooks, workbooks, web content) 6. Structure of a physics class. Interactive ways of teaching. 7. Phases of cognitive development. Development of formal thinking and gaining of procedural knowledge. Development of mental structures. 8. Physical concepts. Pupil's preconceptions and misconceptions. Conceptual change. 9. Teaching tools for physics classes in elementary school. 10. Role of experiments and observations in a physics class. Hypothetical - deductive reasoning, proportional reasoning, control of variables. 11. Problems solving in elementary school (conceptual and numerical problems, representations, nontraditional problems, distractors, test construction). 12. Methods in learning and teaching physics (theory of learning, teaching approaches, teaching strategies). 13. Teaching based on conceptual understanding (constructivism, problem and research based teaching). 14. Planning, preparing and class realization. Preparing a physics class (written lecture plan). 15. Evaluation as a constituent part of teaching physics. Tracking and grading work of pupils. Assessment of teaching efficacy (internal and outer – PISA, TIMSS). *Laboratory exercises* (LE) – 30 hours: Students prepare experimental setup, run experiments, describe and explain results that will be done by them or their pupils in elementary schools. *Seminar and praxis in elementary school* (S) – 30 hours: Sitting in on classes and experiential participations in classes, writing seminar papers under supervision of a mentor (school teacher), course lecturer and associate lecturer.
Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work ☒ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	Attendance of at least 50% of lectures and 80% of laboratory exercises. Sitting in on 30 classes in elementary school. Written lecture plan for at least two lessons and at least two lectures given in front of an elementary school class. Seminar given on the sit in classes and classes given by their peers.

Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)

Class attendance	1	Research		Practical work	1.5
Experimental work	1	Report		Homework	0.5
Essay		Seminar essay	0.5	(Other)	
Colloquia		Oral exam	1	(Other)	
Written exam	0.5	Project		(Other)	

Grading and evaluating student work in class and at the final exam	Student's achievements and activities are graded as follows: • class attendance and homework - up to 10 points • Written lecture plans – up to 14 points • Two lectures given in an elementary school– up to 16 points

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Seminar given on the sit in classes and classes given by their peers – analysis and self-analysis, notes from sit in classes – up to 10 points
written exam - up to 10 points
oral exam – up to 20 points
laboratory exercises - up to 20 points

Written exam is consisted of problems (exercises) that are appropriate for 7th and 8th grade physics level. Oral exam is consisted of 5 conceptual questions randomly selected from a pre-given list of questions. Each question is from a different teaching unit.
Final grade is given as follows:

89 - 100 points: excellent
76 - 88 points: very good
63 - 75 points: good
50 - 62 points: enough

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<tr><td rowspan="9">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>R. Krsnik, Suvremene ideje u metodici nastave fizike, Školska knjiga, Zagreb, 2008.</td><td></td><td></td></tr>
<tr><td>V. Mešić, Uvod u didaktiku fizike, PMF Univerziteta u Sarajevu, Sarajevo 2015.</td><td></td><td></td></tr>
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<tr><td>Optional literature</td><td colspan="3">

B. Arons, Teaching Introductory Physics, John Wiley & Sons Inc. 1996.
E. F. Redish, Teaching Physics with the Physics Suite, John Wiley & Sons Inc. 2003.

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<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">

Evaluation of student achievements in accordance with expected outcomes
Lecturer's self-evaluation
Student feedback through questionnaires
In-institution and out-institution review

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<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
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