<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Dynamical Systems in the Environment</td></tr>
<tr><td>Code</td><td>PMP267</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>Žarko Kovač,
PhD, Assistant Professor</td><td>Credits (ECTS)</td><td colspan="5">4</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td colspan="2">F</td></tr>
<tr><td>30</td><td>20</td><td></td><td colspan="2"></td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="5"></td></tr>
<tr><td colspan="8">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="7">- acquiring basic knowledge of dynamical systems and mathematical physics
- provide knowledge on the use of differential equations in the description of physical systems, and extension of the methodology to the description of non-physical systems
- get acquainted with the basics of the theory of deterministic chaos
- provide basic knowledge of ecological, population and epidemiological modeling in relation to physical processes in the environment</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="7">- Mathematical Methods of Physics 2
- differential equations
- basic programming</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="7">- describe physical systems in the environment using differential equations
- knowledge of the method of solving differential equations describing dynamical systems
- perform linearization and stability analysis of systems
- formulation of simple mathematical models of dynamic systems in the environment
- introductory knowledge of ecological modelling
- introductory knowledge of population modelling
- introductory knowledge of epidemiological modelling</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="7">1. Linear systems with examples from environmental physics (4 hours of lectures and 10 hours of seminar)
2. Nonlinear systems with examples from environmental physics (4 hours of lectures and 10 hours seminar)
3. Linearization (2 hours of lectures)
4. System stability (2 hours of lectures)
5. Feedback (2 hours of lectures)
6. Phase space (2 hours of lectures)
7. Deterministic chaos (2 hours of lectures)
8. Ecological modelling (4 hours of lectures)
9. Population modelling (4 hours of lectures)
10. Epidemiological modelling (4 hours of lectures)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☒ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☒ independent assignments
☐ multimedia
☐ laboratory
☒ work with mentor
☒ homework</td></tr>
<tr><td>Student responsibilities</td><td colspan="7">Attend at least 70% of lectures and 70% of exercises.</td></tr>
<tr><td rowspan="2">Screening student work (name the proportion of ECTS credits for each</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td colspan="2">1</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Homework</td><td colspan="2">1</td></tr>
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activity so that the total number of ECTS credits is equal to the ECTS value of the course)	Essay		Seminar essay		(Other)	
	Tests		Oral exam	2	(Other)	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the first 7 weeks of classes, students receive 5 homework assignments from the first 5 teaching units. These assignments are handed over at the end of the 8th week of classes. During the next 7 weeks of classes, students receive 5 new homework assignments from the next 5 teaching units. These assignments are handed over at the end of the 15th week of class. Students who submit assignments on time and achieve more than 50% of the possible points are exempted from writing the written part of the exam. Students who do not pass assignments or achieve less than 50% of the possible points must take a written exam. In the first 7 weeks of classes, the teacher holds seminars on specific models of dynamical systems and together with students solves more complex problems analytically and numerically. In the 8th week of classes, students choose a model of a dynamic system that they analyse analytically, and implement a numerical version of the model and conduct simulations. Students present the obtained simulations at the end of the semester. The final grade is formed on the basis of homework / exam (1/3 grade), simulation (1/3 grade) and answers to the oral exam (1/3 grade).

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	Steven H. Strogatz **Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering** Perseus Books, 1994.	0	yes
	J. D. Murray **Mathematical Biology: An Introduction** Springer, 2002.	0	yes

Optional literature (at the time of submission of study programme proposal)	Rudy Slingerland & Lee Kump **Mathematical Modeling of Earth's Dynamical Systems** Princeton University Press, 2011. Eugene M. Izhikevich **Dynamical Systems in Neuroscience** MIT Press, 2007. Edward Ott **Chaos in dynamical systems** Cambridge University Press, 1993.
Quality assurance methods that ensure the acquisition of exit competences	Exam results statistics and student evaluation through an anonymous survey at the end of the course. The survey is conducted according to the regulations of the University of Split.
Other (as the proposer wishes to add)	