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<tr><td>NAME OF THE COURSE</td><td colspan="6">Environmental Fluid Dynamics</td></tr>
<tr><td>Code</td><td>PMP26D</td><td>Year of study</td><td colspan="4">2</td></tr>
<tr><td>Course teacher</td><td>Žarko Kovač,
PhD, Assistant Professor</td><td>Credits (ECTS)</td><td colspan="4">6</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>F</td></tr>
<tr><td>30</td><td>20</td><td>10</td><td></td></tr>
<tr><td>Status of the course</td><td>Compulsory</td><td>Percentage of
application of e-learning</td><td colspan="4"></td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">- provide knowledge of differential equations describing fluids in the environment
- provide knowledge on methods of temporal integration and spatial discretization of partial differential equations
- gain knowledge about analytical solutions of advection and diffusion equations and their application to fluids in the environment
- get acquainted with numerical methods for solving advection and diffusion equations
- acquire introductory knowledge about turbulence
- get acquainted with the models of advection, diffusion and reaction
- acquire basic knowledge on modelling biological and chemical interactions that take place in the environment</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">- Introduction to Fluid Mechanics
- Meteorology 1
- Ocean Physics 1
- Meteorology 2
- Ocean Physics 2</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">- understanding the basic dynamics of fluids in the environment
- knowledge of the application of methods of temporal integration and spatial discretization of partial differential equations
- knowledge of elementary analytical solutions of advection and diffusion equations
- knowledge of solving advection and diffusion equations by numerical methods
- application of analytical and numerical methods for solving differential equations which describe fluids in the environment
- knowledge of implementing numerical methods via computers
- basic knowledge of biological and chemical interactions that take place in the environment and how to model them</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1. Finite differences (2 hours of lectures and 2 hours of seminars)
2. Methods of time integration (4 hours of lectures and 2 hours of exercises)
3. Methods of spatial discretization (2 hours of lectures)
4. Advection equation: analytical approach (2 hours of lectures and 1 hour of exercises)
5. Advection equation: numerical approach (2 hours of lectures and 2 hours of exercises)
6. Defining the subject of the seminar paper (10 hours of the seminar)
7. Diffusion equation: analytical approach (2 hours of lectures and 1 hour of exercises)
8. Diffusion equation: numerical approach (2 hours of lectures and 2 hours of exercises)
9. Advection-diffusion equation (2 hours of lectures and 2 hours of exercises)
10. Reynolds averaging (2 hours of lectures)
11. Turbulent advection-diffusion equation (4 hours of lectures)
12. Physical, chemical and biological transformations (4 hours of lectures)
13. Turbulent advection-diffusion-reaction equation (2 hours of lectures)
14. Presentation of the seminar paper (10 hours of seminar)</td></tr>
<tr><td></td><td colspan="2">☒ lectures</td><td colspan="4">☒ independent assignments</td></tr>
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<tr><td>Format of instruction</td><td colspan="4">☒ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="2">☐ multimedia
☐ laboratory
☒ work with mentor
☒ homework</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attend at least 70% of lectures and 70% of exercises.</td></tr>
<tr><td rowspan="5">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)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Homework</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>2</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the first 7 weeks of classes, students receive 5 homework assignments from the first 6 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 last 7 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 gives lectures on possible seminar topics. In the 8th week of classes, students choose the topic of the seminar to be submitted by the end of the semester. In the seminar, they analyse the analytical model, discretize the model, and compare analytical and numerical results. Students present the seminar at the end of the semester and submit a written version of the seminar before the exam deadline. The final grade is formed on the basis of homework / exam (1/3 grade), seminar (1/3 grade) and the oral exam (1/3 grade).</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="4">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="4">Benoit Cushman-Roisin & Jean-Marie Beckers
Introduction to Geophysical Fluid Dynamics: Physical and Numerical Aspects
Academic Press, 2007.</td><td>0</td><td>yes</td></tr>
<tr><td colspan="4">James C. McWilliams
Fundamentals of geophysical fluid dynamics
Cambridge university press, 2006.</td><td>1</td><td>yes</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">Stanley J. Farlow
Partial Differential Equations for Scientists and Engineers
Dover Publications, 1993.

Stanislaw R. Massel
Fluid Mechanics for Marine Ecologists
Springer, 1999.

Benoit Cushman-Roisin</td></tr>
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	Environmental fluid dynamics URL: http://www.dartmouth.edu/~cushman/books/EFM-old.html Scott A. Socolofsky & Gerhard H. Jirka **Environmental fluid dynamics** URL: https://ceprofs.civil.tamu.edu/ssocolofsky/OCEN677/book.html
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)	