**SYLLABUS** (MODULE-ERASMUS+)

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| Course/module (as specified in the approved curriculum for the field of study)  **Open channel flow** | | | | | | ECTS  **3** | | Component code  **ENVI 1.2** | |
| Name in Polish  **Przepływy w kanałach otwartych** | | | | | |
| Unit(-s) providing the course/module (Faculty, Institute/Department)  **Faculty of Environmental and Mechanical Engineering, Department of Hydraulic and Sanitary Engineering** | | | | | | | | | |
| Head of course/module (e-mail address)  **Tomasz Dysarz, PhD (**[**tomasz.dysarz@up.poznan.pl**](mailto:tomasz.dysarz@up.poznan.pl)**)** | | | | | | | | | |
| Other teachers | | | | | | | | | |
| Course category  **Open** | | Language  **English** | | Level  **Bachelor/Master** | Profile  **Academic-general** | | Semester  **Winter** | | |
| **TYPE OF CLASSES/LECTURES AND THE NUMBER OF HOURS**  (organised classes/lectures and self-study) | | | | | | | | | |
| Type of studies: full-time | | |  | Type of studies: extramural | | | | |  |
| * lectures | | | 15 | * lectures | | | | | - |
| * practical classes | | | 15 | * practical classes | | | | | - |
| * field exercise | | |  | * field exercise | | | | | - |
| * other lessons | | | - | * other lessons | | | | | - |
| * self-study | | | 45 | * self-study | | | | | - |
| Total number of hours: | | | 75 | Total number of hours: | | | | | - |
| **PRE-REQUSITES**  Basics of mathematics and physics. | | | | | | | | | |
| **OBJECTIVE OF COURSE/MODULE**  Explanation of basic hydrodynamic principles governing fluid flow with free surface observed in natural systems as rivers and reservoirs; Advance physical concepts as well as modern simulation methods are presented during the lectures and classes; The students should understand the complex interactions and forces involved in free surface flows; They should be able to apply this knowledge to solve practical problems with help of model simulation software. | | | | | | | | | |
| **TEACHING METHODS**  Lectures in the form of presentations with real examples; Classes with application of modern computational methods and software used for solution of problems related to design and regulation of river channels. Possibility to use distance learning tools and techniques. | | | | | | | | | |
| **LEARNING OUTCOMES** | | | | | | | Reference  to field outcomes | | |
| Knowledge | O1: Students will have advanced knowledge about free surface flows in natural systems.  O2: Students will know the reasons for decrease of river channel capacity and reservoir degradation. | | | | | | Not  applicable | | |
| Skills | O3: Students will have skills to determine the capacity of the river channel and performance of reservoirs with help of mathematical models of fluid flow.  O4: Students will be able to design the systems applied in environmental engineering . | | | | | | Not  applicable | | |
| Social  competences | O5: Students will understand the importance of social, professional and ethical responsibility for state of the environment; Student understands the need for explaining to the community the rules and sustainable use of the environment including importance of the environmental engineering.  O6: Students will be able to identify and assess the problems related to his/her professional activity. | | | | | | Not  applicable | | |
| **METHODS TO VERIFY LEARNING OUTCOMES**  Preparation of report describing exercise done in classes  Basic test on preparation and run of simple flow model  Written exam in the form of the test | | | | | | | Outcome Reference  Numbers  O1 – O6 | | |
| **TEACHING CONTENT**  **Lectures**: Basic fluid properties: compressibility and viscosity. Molecular structure of liquids and gases. The fundamental fluid features: fluidity and continuity. The impact of molecules on the processes in the macro scale. Characteristics of natural systems with free surface waters: cross-section profile, longitudinal profile, etc.. Fundamental classes of flows in channels. Steady uniform flow in open channels. Friction and roughness in rivers. Steady non-uniform flow in open channels. Water surface profiles. Compound channels and their specific features. Special cases: junctions, bifurcations, structures. Application of numerical methods in simulation of free surface flows.  **Practical classes:** Application of modern computer methods and software for modelling of water surface profiles in the natural channel or reservoir; The assessment of hydraulic structure impact on the water surface profile | | | | | | | | | |
| **Forms and criteria for passing of course/module**  The evaluation of the classes is composed of two elements: (1) written report on exercise explained during the classes, (2) test on usage of computer model presented during the classes.  The positive evaluation of the classes is necessary to access the final exam. | | | | | | | Percentage of final mark  10% written report  20% test on computer model  70% final exam | | |
| **LIST OF LITERATURE**   1. Szymkiewicz R. (2010): *Numerical Modeling in Open Channel Hydraulics*, Springer 2. Wu W. (2008): *Computational River Dynamics*, Taylor & Francis Group 3. Chow V.T. (1959): *Open-Channel Hydraulics*, McGraw-Hill Book Company 4. Brunner G.W. (2010): *HEC-RAS, River Analysis System Hydraulic Reference Manual*, Report No. CPD-69, US Army Corps of Engineers, Hydrologic Engineering Center (HEC), Davis CA | | | | | | | | | |