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КОНКУРС ЗА ОБАВЉАЊЕ ВИРТУАЛНЕ МОБИЛНОСТИ - СТРУЧНЕ ПРАКСЕ У ОБЛАСТИ УПРАВЉАЊА ВОДНИМ РЕСУРСИМА

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УНИВЕРЗИТЕТ У НИШУ

ГРАЂЕВИНСКО - АРХИТЕКТОНСКИ ФАКУЛТЕТ

УНИВЕРЗИТЕТСКИ ТРГ 2

ERASMUS+ СВНЕ КА2

УНИВЕРЗИТЕТ У НИШУ РАСПИСУЈЕ КОНКУРС У ОКВИРУ ПРОЈЕКТА SWARM ЗА ОБАВЉАЊЕ ВИРТУАЛНЕ МОБИЛНОСТИ СТУДЕНАТА ЗА СТРУЧНУ ПРАКСУ НА СЛЕДЕЋИМ ИНСТИТУЦИЈАМА:

1. **ARISTOTLE UNIVERSITY OF THESSALONIKI (AUTH)**
2. **UNIVERSIDADE DE LISBOA (UL)**
3. **UNIVERSITY OF NATURAL RESOURCES AND LIFE SCIENCES, VIENNA (BOKU)**
4. **UNIVERSITY OF RIJEKA, FACULTY OF CIVIL ENGINEERING (UNIRIFCE)**
5. **UNIVERSITY OF ARCHITECTURE, CIVIL ENGINEERING AND GEODESY (UACEG)**

Рок за пријаву на конкурс је 05.11.2021. године

Период реализације мобилности:

1. **AUTH – 06. 12. 2021. године – 17. 12. 2021. године**
2. **UL – 31. 01. 2022. године – 11. 02. 2022. године**
3. **BOKU – 15. 11. 2021. године – 26. 11. 2021. године**
4. **UNIRIFCE – 15. 11. 2021. године – 26. 11. 2021. године**
5. **UACEG – 29. 11. 2021. године – 10. 12. 2021. године**

Ко може да се пријави на конкурс?

- Студенти мастер академских студија Грађевинско-архитектонског факултета Универзитета у Нишу. Приоритет у случају више пријављених кандидата имаће студенти Модула за хидротехнику и Управљања пројектима у градитељству.

Трајање стручне праксе на свим установама:

- 14 (четрнаест) дана

Стипендија се додељује за максимално 1 (једног) студента по установи. Студенти се могу пријавити на више институција, а Комисија ће на основу пријава извршити избор кандидата по појединим установама.

Обавезна документација за пријаву:

- Попуњен пријавни образац (у прилогу),
- Биографија на енглеском језику (препорука: користити Europass формат),
- Доказ о познавању енглеског језика,
- Доказ да је кандидат студент Грађевинско–архитектонског факултета Универзитета у Нишу.

Документацију у PDF формату потребно је послати путем следеће адресе swarmuni@gmail.com. За додатна појашњења и питања кандидати се могу обратити путем исте адресе.

Рок за слање докумената: 05.11.2021. године до 12:00 сати.

Након завршетка конкурса, пријаве кандидата који прођу техничку проверу и евалуацију од стране Комисије, биће достављене институцији домаћину као номинације за обављање стручне праксе. Изабрани кандидати биће у обавези да након спроведене мобилности доставе следећу документацију:

- Потврду (сертификат) са институције домаћина о обављеној стручној пракси,
- Извештај са стручне праксе.

Студенти ће након обављања праксе од институција домаћина добити сертификат о обављеној мобилности.

ПРИЈАВА

Име и презиме:_____

Датум:_____

Овим путем пријављујем се на Конкурс за обављање виртуалне мобилности - стручне праксе у оквиру Erasmus+ пројекта SWARM на следећој институцији (заокружити понуђену институцију):

1. **ARISTOTLE UNIVERSITY OF THESSALONIKI (AUTH)**
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Уколико сте одабрали више од једне иституције испод рангирајте Ваше приоритете:

1. _____
2. _____
3. _____
4. _____
5. _____

UACEG

Monday	Tuesday	Wednesday	Thursday	Friday
Topic – **Hydrological and Hydraulic modelling**	Topic – **Irrigation Systems and Drought Management**	Topic – **Investments in Irrigation Infrastructure**	Topic – **Water Management Optimization Problems**	Topic – **Water Management Examples - Vit river case study**
Lectures • Introduction • Types of models • Rainfall – Runoff models • Hydraulic models • 1D, 2D and 3D models • Model applications • Floodplain modelling • Flood early warning systems Practical work with 1D or 2D models Students work (in groups or individually)	Lectures • Introduction • Irrigation Schemes in Bulgaria • Irrigation Schemes and Systems – general • Crop Response to Water. Yield-Water relationship • Management Issues of Irrigation Schemes. • Water Metering and Efficiency of Irrigation Schemes • Structuring the GIS database for need of Management of Irrigation Schemes	Lectures • Introduction • Investments in Irrigation Infrastructure and Water Saving Requirements • Determining Potential Water Savings due to investments **Assignment of Task # 1** – Estimation of Efficiency of an Irrigation Scheme and Determination of Potential Water Saving due to Investments in Irrigation Infrastructure Students work (in groups or individually)	Lectures • Optimization Problems in Water Management • Linear Programming • Resource Allocation Problem • Transportation Problem • Prioritization of Investments in Irrigation Infrastructure – Multicriteria analysis **Assignment of Task # 2** – Solving a simple Optimization Task related to Water Resources Management Students work (in groups or individually)	Lectures • Introduction • Vit Watershed • WEAP modelling • Optimization • Scenarios and scenarios optimization • Water account tables **Consultation Time**

Monday	Tuesday	Wednesday	Thursday	Friday
Topic – **Hydraulic structures / Dams and reservoirs-1**	Topic – **Hydraulic structures / Dams and reservoirs-2**	Topic – **Hydraulic structures / Dams and reservoirs-3**	Topic – **Climate change and water management**	**Discussion and Presentation**
Lectures Elements of dam engineering • Planning of water resource projects • Embankment dam types; Concrete dam types • Spillways, outlets and ancillary works • Loads on dams • Presentation of interesting examples of dams and reservoirs Students work (in groups)	Lectures Embankment dam engineering • Classification and engineering characteristics of soils • Principles of embankment dam design • Seepage, stability, and stress analysis • Settlement and deformation • Rockfill embankments • Examples Students work (in groups)	Lectures Concrete dam engineering • Principles of concrete dam design • Gravity dam analysis • Concrete for dams; The roller-compacted concrete gravity dam • Design features and construction • Dam Monitoring and Operation • Examples Students work (in groups)	Lectures • Introduction • Climate change/variations and its impact on water resources • How to evaluate climate change • Mitigation measures • Presentation of projects Students work (in groups)	• Students present the results of Tasks # 1 and # 2. • Students present their work on themes assigned in lectures in previous days of the course • Discussion

AUTH

Week 1, 10:00-13:00

Date	Course	Short description
Monday	Sustainable Water resources management and EU legislation (Prof. Kolokytha)	Principles of sustainable water resources management. The WFD, shortcomings in implementation. Major relevant EU water legislation
Tuesday	Hydraulics of open channels, rivers and dams (Prof. Prinos)	Flow in open channels and rivers. Calculation methods. Culverts and Bridges. Dam classification. Design Discharge. Spillways. Structures for energy dissipation.
Wednesday	*«Άριστον μεν ύδωρ». Best is Water Pindar 518 – 438 BC* Valuing the water (Prof. Kolokytha)	The value, the price and the cost of water. "The Diamond-Water Paradox". Public or private? Social or economic? The changing water scene.
Thursday	Water resources management and GIS (part 1) (Dr. Skoulikaris)	Use of GIS for the management of environmental information. Open source GIS tools and on line data sources. Creation of water related maps.
Friday	Water resources management and GIS (part 2) (Dr. Skoulikaris)	Spatial analyst techniques for the management of hydro-meteorological data.

Week 2, 10:00-13:00

Date	Course	Short description
Monday	Water resources management and hydrological modelling (Dr. Skoulikaris)	The use of HEC-HMS model for hydrologic simulations. Data preparation and simulations.
Tuesday	Global water crisis. SDG6 as a driver for sustainable development. (Prof. Kolokytha)	UN Agenda23, 2015-2030 SDG6 and its role to achieve sustainable development of our planet.
Wednesday	Hydraulics of water supply and sewerage systems (Prof. Prinos)	Design of gravity and pumping systems. Tanks. Design of water distribution networks. Valves for flow and pressure control. Design of separate and combined sewer systems. Manholes. Weirs
Thursday	Water resources management and climate change (Dr. Skoulikaris)	Management of water resources under climate change conditions. Climate change models and data. Statistical and dynamic downscaling of climatic data for use in regional scales.
Friday	Floods and Risk Management. (Prof. Prinos)	Types of Floods. Flood Mapping. Extreme Floods. Flood Risk Analysis. Vulnerability Analysis. Risk Assessment. Measures for risk reduction.

BOKU

Computational Methods in Hydrodynamics for Water Resources Management

1 Concept and Intended Learning Outcomes

The aim of this summer school is to support students in developing technical and computational skills for managing a variety of problems in water resources management. The main focus is on applications in numerical hydrodynamics, but also physical laboratory experiments will be covered.

The attendees of the summer school will acquire the following knowledge and abilities:
• mathematical formulation of hydrodynamic problems using differential equations
• discretization of differential equations for the numerical solution
• implementation of models for the numerical solution of simple hydrodynamic problems
• use of open-source code for the solution of more complex computational fluid dynamics models

Training of teaching staff is held simultaneously within the first week of the summer school. Lecturers will be presented with illustrative ways of presenting highly technical topics such as numerical hydrodynamics to a group of students. In addition they will be provided with relevant teaching materials including Excel Worksheets for the numerical solution of basic hydrodynamic problems.

2 Program

2.1 Week 1: Summer School and training of teaching staff

Monday
• morning: Welcome session, presentation of University, Department and Institute (Michael Tritthart and Daniel Wildt)
• afternoon: Unsteady problems in hydrodynamics (Daniel Wildt)
– Balancing of the water levels of two tanks connected through a pipe
– Heat and mass transport in free-surface waterbodies

Tuesday
• morning: Ordinary Differential Equations: Water surface estimation in nonuniform flow (Daniel Wildt)
• afternoon: Self-organised learning

Wednesday
• morning: Partial Differential Equations: Development of a flood wave (Daniel Wildt)
• afternoon: Theory on computer-based river modelling (Michael Tritthart)

Thursday
• morning (Daniel Wildt):
– Set-up of a 1D model of a channel system using the Excel worksheets UNDA
– Error estimation in physical lab experiments
• afternoon: Hydraulic lab tour

Friday
• morning: Unsteady pipe flow (hydraulic surge; Daniel Wildt)
• afternoon: Excursion and get-together with the IAHR Young Professional Network Vienna (Daniel Wildt)

2.2 Week 2: Summer School

Monday
• morning: Introduction to Linux operating systems and the Unix command line (Michael Tritthart)
• afternoon: Self-organised learning

Tuesday
• morning: Introduction to OpenFOAM (Daniel Wildt)
• afternoon: Self-organised learning

Wednesday
• morning: *"An Introduction to OpenFOAM: A User View"* presentation by Prof. Hrojve Jasak at the University of Ghent (May 2016) Part I
• afternoon: Group project assignment and work on group projects

Thursday
• morning: *"An Introduction to OpenFOAM: A User View"* presentation by Prof. Hrojve Jasak at the University of Ghent (May 2016) Part II
• afternoon: Group project work
Friday
• morning: Summary / Project Presentation
• afternoon: Recap of the summer school and feedback meeting

3 Teaching Materials

Participants will be supplied with various teaching materials in digital form:
• handouts
• MSExcel Worksheets
• literature list and weblinks
• OpenFOAM test cases
The materials will be shared with the participants via an E-Learning platform (e. g. Moodle).

4 Literature and resources

4.1 Unsteady flow in water resources management

4.1.1 Textbooks

J. H. Ferziger and M. Peric (2002). *Computational Methods for Fluid Dynamics*. 3rd ed. Berlin Heidelberg NewYork: Springer-Verlag. 423 pp. isbn: 3-540-42074-6

H. K. Versteeg and W. Malalasekera (2007). *An introduction to computational fluid dynamics: the finite volume method*. 2nd ed. Essex: Pearson Education Limited. 503 pp. isbn: 978-0-13-127498-3

4.1.2 Scientific articles and reports

P. C. Chatwin (1980). 'Presentation of Longitudinal Dispersion Data'. In: *Journal of Hydraulics Division* 106 (1), pp. 71–83

H. B. Fischer et al. (1979). *Mixing in Inland and Coastal Waters*. San Diego: Academic Press, Inc. Harcourt Brace Jovanovich, Publishers

C. M. Hanif (1986). 'Boundary conditions for analysis of waterhammer in pipe systems'. Master Thesis. The University of British Columbia

A. van Mazijk et al. (1991). *Rheinalarmmodell Version 2.0 Kalibrierung und Verifikation*. Internationale Kommission zum Schutze des Rheins gegen Verunreinigung. url: https://www.chr-khr.org/de/veroffentlichung/rheinalarmmodell-version-20-kalibrierung-und-verifikation

4.2 Unix and Linux

Lecture notes and exercises by William Knottenbelt:

W. Knottenbelt (2021). *Introduction to Unix*. url: http://www.doc.ic.ac.uk/~wjk/UnixIntro/ (visited on 28/07/2021)

4.3 OpenFOAM

4.3.1 Documentation by distributors

OpenFOAM v9 by The OpenFOAM Foundation (www.openfoam.org and http://cfd.direct/)

The OpenFOAM Foundation (2021c). *OpenFOAM v9 User Guide*. url: https://cfd.direct/openfoam/user-guide/ (visited on 28/07/2021)

The OpenFOAM Foundation (2021b). *OpenFOAM v9 C++ Source Code Guide*. url: https://cpp.openfoam.org/v9/ (visited on 28/07/2021)

The OpenFOAM Foundation (2021a). *OpenFOAM Technical Guides*. url: https://openfoam.org/guides/ (visited on 28/07/2021)

– Fluid Dynamics

* Computational Fluid Dynamics
* Tensor Mathematics
* Energy Equation in OpenFOAM

– Multiphase Flows and Particles

* OpenFOAM Barycentric Tracking

* Water Waves in OpenFOAM
* Interface Capturing in OpenFOAM
* Guide to CFD for Polydisperse Flows
– Computers and Software
* OpenFOAM Linux Guide
* Parallel I/O in OpenFOAM
* Redesigning OpenFOAM for the Future

OpenFOAM v2012 by ESI Group (www.openfoam.com)
OpenCFD, Ltd. (2020c). *OpenFOAM User Guide*. url: https://www.openfoam.com/documentation/user-guide (visited on 26/07/2021)
OpenCFD, Ltd. (2020b). *OpenFOAM Tutorial Guide*. url: https://www.openfoam.com/documentation/tutorial-guide (visited on 26/07/2021)
OpenCFD Ltd. (2021). *OpenFOAM Programmer's Guide*
OpenCFD, Ltd. (2020a). *OpenFOAM Extended Code Guide*. url: https://www.openfoam.com/documentation/guides/latest/doc/ (visited on 28/07/2021)

4.3.2 Wikkis and useful tools

OpenFOAM tutorials collection and a "3 weeks self-learning course":
OpenFOAM Community (2021). *Tutorial Wiki*. Ed. by OpenCFD, Ltd. url: https://wiki.openfoam.com/Main_Page (visited on 28/07/2021)
Unofficial OpenFOAM Wikki:
OpenFOAM Wiki (2021). *Unofficial OpenFOAM wiki*. url: www.openfoamwiki.net (visited on 06/08/2021)

OpenFOAM Forum at CFD Online:
CFD Online (2021a). *OpenFOAM Forum*. url: https://www.cfd-online.com/Forums/openfoam/ (visited on 06/08/2021)
A tool for optimizing blockMesh grading:
OpenFOAMWiki (2020). *Scripts/blockMesh grading calculation*. url: https://openfoamwiki.net/index.php/Scripts/blockMesh_grading_calculation (visited on 28/07/2021)
Tool for estimating required wall resolution:
CFD Online (2021b). *y+ Wall Distance Estimation*. url: https://www.cfd-online.com/Tools/yplus.php (visited on 28/07/2021)

4.3.3 CFD with OpenSource Software at Chalmers University of Technology

Prof. Håkan Nillson is offering a free course on OpenFOAM for PhD students and provides his course materials online. In the course of "The 3rd UCL OpenFOAM Workshop", 24th February 2021 he received the "OpenFOAM community contribution award" for this course.
H. Nilsson, ed. (2020). *Proceedings of CFD with OpenSource Software*. Chalmers University of Technology. url: http://dx.doi.org/10.17196/OS_CFD#YEAR_2020

4.3.4 Further reading

PhD thesis by Prof. Jasak:
H. Jasak (1996). 'Error analysis and estimation for the finite volume method with applications to fluid flows'. Thesis of Dissertation. Imperial College London. url: https://spiral.imperial.ac.uk/handle/10044/1/8335

UL

WATER RESOURCES MODELING: PART 1: FLOOD ANALYSIS				
Monday Topic – **General concepts related to flood analysis**	Tuesday Topic – **Components of the flood hydrographs**	Wednesday Topic – **Components of the rainfall hyetographs**	Thursday Topic – **Rainfall/runoff models**	Friday Topic – **Synthesis and discussion**
Lectures: • Introduction • Basic concepts of flood analysis • Peak flood discharges and flood hydrographs models - Statistical models - Empirical formulae - Regional models - Flood routing models - Unit hydrograph model Students work (in groups)	Lectures: • Introduction • Components of the observed flood hydrographs • Models to separate the direct runoff from the baseflow • Estimation of the recession constant Students work (in groups)	Lectures • Introduction • Components of the observed rainfall hyetographs • Rainfall losses: initial losses and continuous losses • Relevance of the curve number approach • Models for rainfall losses • Intensity-duration-frequency curves • Establishment of design hyetographs Students work (in groups)	Lectures • Introduction • Flood modeling base on the Hydrologic Engineering Center – Hydrologic Modeling System model (HEC-HMS model) Students work (in groups)	• Based on the lectures of the previous for 4 days, each group must prepare a presentation on one of the subjects and discuss it with the other students and professors, including the relevance of the chosen subject in WB countries

WATER RESOURCES MODELING: PART 2: RESERVOIR OPERATION				
Monday Topic – **Introduction to water management**	Tuesday Topic – **Simulation of reservoirs operation**	Wednesday Topic – **Optimization of reservoir operation**	Thursday Topic – **Groundwater management**	Friday **Synthesis and discussion**
Lectures: • Water and civilization. • The importance of water for human development. • Consumptive and non-consumptive water uses. • Fundamentals of water management and the challenges of integrated watershed and water resources management. Students work (in groups)	Lectures: • Types of dams and reservoirs and its main structures. • Performance indicators for reservoir operation: reliability, vulnerability, resilience and sustainability. • Reservoir operation rules. • Risk management and the concept of hedging. • Reservoir operation simulation models and integrated water management models. Students work (in groups)	Lectures: • Simulation vs optimization models. • Linear programming for water management. • Dynamic programming for water management. • Multi-objective optimization. Students work (in groups)	Lectures: • Basic concepts of groundwater resources. • Types of aquifers and aquitards. • Aquifer characterization. • Recharge estimation. • Surface water / groundwater interaction. • Groundwater models. Students work (in groups)	• Based on the lectures of the previous for 4 days, each group must prepare a presentation on one of the subjects and discuss it with the other students and professors, including the relevance of the chosen subject in WB countries

UNIRIFCE

Monday Topic - **Water management**	Tuesday Topic – **Drinking water supply**	Wednesday Topic – **Drainage (waste water / storm water) in urban/rural areas**	Thursday Topic – **Flood protection / Torrents**	Friday **Synthesis and discussion**
Lectures • Introduction • Water management in Croatia • Harmonization with EU directives • Water management institutions/agencies: - Hrvatske vode … - International commissions for protection of major river basins (ICPDR, ISRBC) - … Students work (in groups)	Lectures • Introduction • Water supply systems • Management of WSS • Presentation of WSS in in Croatia - Rijeka and Istria • Challenges in (future) water supply (DRINKADRIA project) Students work (in groups)	Lectures • Introduction • Drainage systems (waste water and storm water) • Management of DS • Presentation of DS in Croatia - Rijeka and Istria • Challenges in (future) drainage in urban/rural areas (RAINMAN project) Students work (in groups)	Lectures • Introduction • Types of floods • Flood mapping • Flood hazard and flood risk • INSPIRE Directive: spatial data sharing • Presentation of DAREFFORT Interreg project (Danube River Basin Enhanced Flood Forecasting Cooperation) Students work (in groups)	• During previous 4 days students have to prepare for each day a presentation on that day topic regarding their country / city /region • Those presentations will be held by students on Friday and based on all material analysed during the week and on Friday there will be a structured discussion • Each group will have to prepare a poster

Monday Topic – **Hydraulic structures / Dams and reservoirs**	Tuesday Topic – **Coastal engineering**	Wednesday Topic – **Climate change and water management**	Thursday Topic – **Laboratory work**	Friday **Synthesis and discussion**
Lectures • Introduction • Dams and reservoirs in Croatia • Hydropower plants and HP systems • Water supply reservoirs • Presentation of interesting HP and other systems with dams and reservoirs (HE Senj, HE Tribalj, HE in Drava river basin, reservoirs in Istria) Students work (in groups)	Lectures • Introduction • Marinas, beaches and other coastal structures • Presentation of interesting marinas, beaches and other coastal structures in Croatia • Advances in using photogrammetry …. Drones … Students work (in groups)	Lectures • Introduction • Climate change/variations and its impact on water resources • Mitigation measures • Green infrastructure • Presentation of Danube Floodplain Interreg project Students work (in groups)	Lectures • Introduction • Presentation of hydraulic laboratory for research and for teaching • Experiment 1 • Experiment 2 Students work (in groups) – regarding the experiments	• During first 3 days students have to prepare for each day a presentation on that day topic regarding their country / city /region • Those presentations will be held by students on Friday and based on all material analysed during the week and on Friday there will be a structured discussion • Each group will have to prepare a poster