Computational hydraulics - BMEEOVVDT72 - 2024/25/2

I. Subject Specification

1. Basic Data

1.1 Title

COMPUTATIONAL HYDRAULICS

1.2 *Code*

BMEEOVVDT72

1.3 *Type*

Module with associated contact hours

1.4 Contact hours

Туре	Hours/week /
	(days)
Lecture	2

1.5 Evaluation

Exam

1.6 Credits

 $\frac{1}{2}$

1.7 Coordinator

name	Dr. Krámer Tamás
academic rank	Professor
email	kramer.tamas@emk.bme.hu

1.8 Department

Department of Hydraulic and Water Resources Engineering

1.9 Website

https://epito.bme.hu/BMEEOVVDT72

https://edu.epito.bme.hu/course/view.php?id=2497

1.10 Language of instruction

hungarian

1.11 Curriculum requirements

Ph.D.

1.12 Prerequisites

1.13 Effective date

1 September 2022

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2. Objectives and learning outcomes

2.1 Objectives

You will understand the basics of classical numerical methods for modelling the motion of water in hydraulic and environmental engineering problems. General topics: governing equations, discretisation, and criteria for judging the quality of various solvers (accuracy, stability). In the context of free-surface flows, we look at the finite difference, finite volume and finite element methods. The topics will be theoretical, considering practical applications but independent of software implementations. The course aims to be valuable to programmers and model users.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

- 1. You will understand the governing equations and numerical methods for solving flow and transport phenomena.
- 2. You will be aware of the limitations and common difficulties in using different numerical methods in solving flow and transport problems

B. Skills

- 1. You will be able to develop a simple algorithm for the solution of the advection equation
- 2. You will be be confident in using computational hydraulics software to solve engineering problems

C. Attitudes

1. You will learn how to

D. Autonomy and Responsibility

1.

2.3 Methods

Weekly lectures, focusing on the theory. Questions will be given to be answered by email until the next class. Solution to these will be discussed on request at the beginning of the lecture.

2.4 Course outline

Hét	Előadások és gyakorlatok témaköre
1.	Introduction
2.	Governing equations.
3.	Discretisation in space and time. Mesh types.
4.	Basic properties of numerical solvers: convergence,
	stability, monotonicity, conservation
5.	Principles of the finite difference method
6.	Principles of the finite difference method continued
7.	The finite difference method applied to the St Venant
	equations (1D)
8.	The finite difference method applied to the St Venant
	equations (1D) continued
9.	The finite difference method applied to the shallow
	water equations (2D)
10.	The finite difference method applied to the Navier
	Stokes equations (3D)
11.	Wave propagation and characteristics – the Riemann
	problem and its solution
12.	Principles of the finite volume method for the shallow
	water equations
13.	Principles of the finite element method for flow

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	problems
14.	Summary

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester. Consult the effective detailed course schedule of the course on the subject website.

2.5 Study materials

- 1. Ferziger and Peric Computational Fluid Dynamics
- 2. J. Cunge-F. Holly-R. Verwey: Practical aspects of computational river hydraulics
- 3. P. Novak, V. Guinot, A. Jeffrey, D.E. Reeve: Hydraulic modelling an Introduction
- 4. PPT slides

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2.7 Consultation

This Subject Datasheet is valid for:

II. Subject requirements

Assessment	and	evaluation	of t	he l	earning	outcomes
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3.1 General rules

3.2 Assessment methods

Teljesítményértékelés neve (típus)	Jele	Értékelt tanulási eredmények

The dates of deadlines of assignments/homework can be found in the detailed course schedule on the subject's website.

3.3 Evaluation system

Jele	Részarány
Összesen	100%

3.4 Requirements and validity of signature

3.5 Grading system

Érdemjegy jeles (5)	Pontszám (P)
jeles (5)	
jó (4)	
közepes (3)	
elégséges (2)	
elégséges (2) elégtelen (1)	

3.6 Retake and repeat

3.7 Estimated workload

Tevékenység	Óra/félév
Összesen	

3.8 Effective date

1 September 2022

This Subject Datasheet is valid for: