SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University Cluj-Napoca
1.2 Faculty	Faculty of Mathematics and Computer Science
1.3 Department	Department of Mathematics
1.4 Field of study	Mathematics
1.5 Study cycle	Master
1.6 Study programme / Qualification	Mathematics for Computer Science

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)	**Introduction in Computational Fluid Dynamics** **Introducere în mecanica fluidelor calculatorie**						
2.2 Course coordinator	**Prof. Dr. Teodor Grosan**						
2.3 Seminar coordinator	**Prof. Dr. Teodor Grosan**						
2.4. Year of study	**2**	2.5 Semester	**3**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**DS/Optional**
2.8 Code of the discipline	MME3405						

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/laboratory	1
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 seminar/laboratory	14
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					33
Additional documentation (in libraries, on electronic platforms, field documentation)					30
Preparation for seminars/labs, homework, papers, portfolios and essays					20
Tutorship					30
Evaluations					20
Other activities:					

3.7 Total individual study hours	133
3.8 Total hours per semester	175
3.9 Number of ECTS credits	7

4. Prerequisites (if necessary)

4.1. curriculum	• Numerical analysis, Fluid Mechanics
4.2. competencies	• Matlab, programming

5. Conditions (if necessary)

5.1. for the course	• Video projector
5.2. for the seminar /lab	• Matlab software

activities	

6. Specific competencies acquired

Professional competencies	C4.1 Defining basic concepts, theory and mathematical models C4.2 Interpretation of mathematical models C4.3 Identifying the appropriate models and methods for solving problems
Transversal competencies	CT1 Application of efficient and rigorous working rules, manifest responsible attitudes towards the scientific and didactic fields, respecting the professional and ethical principles. CT3 Use of efficient methods and techniques for learning, information, research and development of abilities for knowledge acquiring, for adapting to the needs of a dynamic society and for communication in a widely used foreign language

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Knowledge, understanding and use of main concepts and results related to numerical methods for fluid dynamics equations.
7.2 Specific objective of the discipline	• Mathematical manipulation of mathematical theories, concepts and numerical methods.

8. Content

8.1 Course	Teaching methods	Remarks
1. Fluid Mechanics. Introduction	Lecture, discussion, discussion of case.	
2. Fluid Mechanics. Basic equations.	Lecture, discussion, discussion of case.	
3. Heat transfer. Basic equations.	Lecture, discussion, discussion of case.	
4. Numerical methods for ODE	Lecture, discussion, discussion of case. .	
5.Numerical methods for BVP	Lecture, discussion, discussion of case.	
6. Finite difference method for PDE I.	Lecture, discussion, discussion of case.	
7. Case study	Lecture, discussion, discussion of case.	
8. Finite difference method for PDE II.	Lecture, discussion, discussion of case.	
9. Case study	Lecture, discussion, discussion of case.	
10. Finite volume method	Lecture, discussion, discussion of case..	
11. Case study	Lecture, discussion, discussion of case.	
12. Finite elements method.	Lecture, discussion, discussion of case.	
13. Application. Lid driven fluid flow	Lecture, discussion,	

	discussion of case.	
14. Application. Differentially heated cavity	Lecture, discussion, discussion of case.	

Bibliografie

Kundu, Pijush K.; Cohen, Ira M. (2008), Fluid Mechanics (4th revised ed.), Academic Press, ISBN 978-0-12-373735-9

Currie, I. G. (1974), Fundamental Mechanics of Fluids, McGraw-Hill, Inc., ISBN 0-07-015000-1

White, Frank M. (2003), Fluid Mechanics, McGraw–Hill, ISBN 0-07-240217-2

Anderson, John D. (1995). Computational Fluid Dynamics: The Basics With Applications. Science/Engineering/Math. McGraw-Hill Science. ISBN 0-07-001685-2

Patankar, Suhas (1980). Numerical Heat Transfer and Fluid Flow. Hemisphere Series on Computational Methods in Mechanics and Thermal Science. Taylor & Francis. ISBN 0-89116-522-3

Petrila, T; Trif, D. (2005) BASICS OF FLUID MECHANICS AND INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS, Springer.

8.2 Seminar / laborator	Teaching methods	Remarks
1. Fluid Mechanics. Basic Equations	Discussion, problem solving, self-study, team work.	
2. Numerical methods for ODE	Discussion, problem solving, self-study, team work.	
3. Numerical methods for BVP	Discussion, problem solving, self-study, team work. .	
4. Finite difference method I.	Discussion, problem solving, self-study, team work.	
5. Finite difference method II.	Discussion, problem solving, self-study, team work.	
6. Finite volumes method	Discussion, problem solving, self-study, team work.	
7.Applications	Discussion, problem solving, self-study, team work	

Bibliografie

Hoffmann, K.A; Chiang, S.T. (2000) Computational Fluid Dynamics, EES.
H K Versteeg and W Malalasekera (2007), An Introduction to Computational Fluid Dynamics, Pearson Education Limited
Anderson, John D. (1995). Computational Fluid Dynamics: The Basics With Applications. Science/Engineering/Math. McGraw-Hill Science. ISBN 0-07-001685-2
Patankar, Suhas (1980). Numerical Heat Transfer and Fluid Flow. Hemisphere Series on Computational Methods in Mechanics and Thermal Science. Taylor & Francis. ISBN 0-89116-522-3
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9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

The content of this discipline is in accordance with the curricula of the most important universities in Romania and abroad. This discipline is useful in preparing future teachers and researchers in, as well as those who use mathematical models and advanced methods of study in other areas.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Knowledge of concepts and basic results	Final Project	50%
	Ability to apply theory in modeling and solving problems		
10.5 Seminar/lab activities		Mid Term Project	50%
10.6 Minimum performance standards			
➢ At least grade 5 (from a scale of 1 to 10).			

Date	Signature of course coordinator	Signature of seminar coordinator
.14.04.2022.....	...Prof. dr. Teodor Grosan	Prof. .dr. Teodor Grosan

Date of approval

29.04.2022

Signature of the head of department

Professor Octavian AGRATINI