SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeș-Bolyai University
1.2 Faculty	Mathematics and Computer Science
1.3 Department	Department of Computer Science
1.4 Field of study	Computer Science
1.5 Study cycle	Master
1.6 Study programme / Qualification	High Performance Computing and Big Data Analytics

2. Information regarding the discipline

2.1 Name of the discipline			Scientific Data Vizualization				
2.2 Course coordinator			Conf. dr. Mihai SUCIU				
2.3 Seminar coordinator			Conf. dr. Mihai SUCIU				
2.4. Year of study	1	2.5 Semester	2	2.6. Type of evaluation	E	2.7 Type of discipline	Optional
2.8 Code of the discipline		MME8059					

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

3.1 Hours per week	4	Of which: 3.2 course	1	3.3 seminar/laboratory	1sem +1pr.
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	28
Additional documentation (in libraries, on electronic platforms, field documentation)	28
Preparation for seminars/labs, homework, papers, portfolios and essays	28
Tutorship	14
Evaluations	21
Other activities:	

3.7 Total individual study hours	119
3.8 Total hours per semester	175
3.9 Number of ECTS credits	7

4. Prerequisites (if necessary)

4.1. curriculum	• Ability to work with an integrated development environment.
4.2. competencies	• Average programming skills. Basic math literacy is assumed.

5. Conditions (if necessary)

5.1. for the course	• course room with video projector
5.2. for the seminar /lab activities	•

6. Specific competencies acquired

Professional competencies	• Ability to apply knowledge of computing and mathematics appropriate to the discipline; • Ability to analyse a problem, and identify and define the computing requirements appropriate to its solution; • Ability to identify and to specify computing requirements of an application and to design, implement, evaluate, and justify computational solutions; • Ability to use current techniques and skills to integrate available theory and tools necessary for applied computing practices.
Transversal competencies	• Ability to apply mathematical foundations, algorithmic principles, and computer science theory; • Ability to apply design and development principles in the construction of software systems; • Ability to acquire knowledge properly in an application domain in the modelling and design; • Ability to work effectively in a team.

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

7.1 General objective of the discipline	• Be able to apply theories, principles and concepts with technologies to design, develop, and verify computational solutions; • Be able to use data visualization (technique tool used to help researchers understand and/or interpret data)
7.2 Specific objective of the discipline	• To assimilate data visualization techniques and the visualization as a method of studying the real phenomenon. To gain skills related to problem solving through visualization of data. • To teach the students the concepts used in the field of modelling and visualization of simulation and to acquire the methods for validation of simulation using Scientific Data Visualization. • Know the main visualization techniques for scalar, vector, and tensor datasets and understand their strengths and limitations. • Be able to implement sophisticated interactive visualizations using open source software. • Be able to devise a complete visualization solution to study a practical dataset. • After promotion the students should be able to use data visualization as a method of solving real problems.

8. Content

8.1 Course	Teaching methods	Remarks
1. Scientific data, Introduction	Expositions: description, explanation, class lectures, Use of problems: use of problem questions, problems and problem situations.	
2. Data visualization, Overview of Python visualization libraries		
3. Visualization techniques, Plotting basics		
4. Data visualization, Declarative vs. Procedural visualization		
5. Data modelling, Perception		
6. Colors, Vector, and Bitmaps		
7. Grids and interpolation, Data Types and 1-D data		
8. Scalar field visualization		

9. Vector field visualization		
10. Vector field visualization (II)		
11. Tensor field visualization		
12. Topological methods		
13. Advanced flow visualization, Text and Networks		
14. High-dimensional data		

Bibliography

- Andy Kirk. 2016. Data Visualisation: A Handbook for Data Driven Design. Sage Publications Ltd.
- Matthew O. Ward, Georges Grinstein, and Daniel Keim. 2015. Interactive Data Visualization: Foundations, Techniques, and Applications, Second Edition - 360 Degree Business (2nd. ed.). A. K. Peters, Ltd., USA.
- Telea, A. C. 2015. Data visualization: Principles and practice. Boca Raton: CRC Press.
- Georges-Pierre Bonneau, Thomas Ertl, and Gregory M. Nielson. 2005. Scientific Visualization: The Visual Extraction of Knowledge from Data (Mathematics and Visualization). Springer-Verlag, Berlin, Heidelberg.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. The first two seminars are dedicated to surveying information sources available on Internet and Intranet, and planning of the assignments.	Expositions: description, explanation, introductive lectures. Conversations: debate, dialog, introductive conversations. Other methods: individual study, exercise, homework study	
2. The next seven seminars (from three to nine) are dedicated to paper presentations.	Conversations: debate, dialog. Discovery: discovery by documenting. Other methods: case study; cooperation, individual study, homework study, company examples discussion of material.	
3. The project demos will be scheduled in the last three seminars.		

Bibliography

1. Beatriz Sousa Santos, Introduction to Data and Information Visualization, Universidade de Aveiro Departamento de Electrónica, Telecomunicações e Informática, Universidade de Aveiro, 2010 http://www.ieeta.pt/~bss/MAPI/Introduction-to-Vis-5-10.pdf
2. Brodlie, K., L. Carpenter, R. Earnshaw, J. Gallop, R. Hubbold, A. Mumford, C. Osland, P. Quarendon, Scientific Visualization, Techniques and Applications, Springer Verlag, 1992
3. Card, S., J. Mackinlay, B. Schneiderman (ed.), Readings in Information Visualization- Using Vision to Think, Morgan Kaufmann, 1999

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

- This course exists in the curriculum of many universities in the world;
- The results of course are considered by companies of software particularly useful and topical.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	- know the basic elements and concepts of the Scientific Data Visualization;	written exam	50%
10.5 Seminar/Project	- complexity, importance and degree of timeliness of the synthesis made	Paper presentation	10%
	- apply the course concepts - problem solving	Project presentation	40%
10.6 Minimum performance standards			
➢ At least grade 5 at written exam, paper presentations and project realised.			

Date	Signature of course coordinator	Signature of seminar coordinator
April 12, 2021	Conf. Dr. Mihai SUCIU	Conf. Dr. Mihai SUCIU

Date of approval	Signature of the head of department
....	Prof. Dr. Laura DIOȘAN