ANEXA 1

SYLLABUS
University year 2025-2026
Year of study I / Semester II

1. Information on Academic Programme

1.1. Univeristy	**Universitatea „1 Decembrie 1918" din Alba Iulia**
1.2. Faculty	**Of Informatics and Engineering**
1.3. Departament	**Informatics Mathematics and Electronics**
1.4. Field of Study	**Computer Science**
1.5. Cycle of Study	**Undergraduate**
1.6. Academic Programme/Qualification*	**Computer Science/ ESCO: 2512/ Software developers Analyst 251201 Computer System Programmer 251204 Computer System Engineer 251203**

2. Information on Course Matter

2.1. Course	***Graph Algorithms***				2.2. Code	**CSE113**	
2.3. Course Leader			Lect. dr. Andrei Bura				
2.4. Course Tutor			Lect. dr. Andrei Bura				
2.5. Academic Year	**I**	2.6. Semester	**II**	2.7. Type of Evaluation (E – final exam/ CE - colloquy examination / CA - continuous assessment)	**E**	2.8. Type of course (C– Compulsory, Op – optional, F - Facultative)	**C**

3. Timpul total estimat

3.1. Weekly number of hours	4	3.2. course	**2**	3.3. seminar/laboratory	**2**
3.4. Total number of hours in the curriculum	56	3.5. course	**28**	3.6. seminar/laboratory	**28**

Allocation of time	ore
Individual reading time	**15**
Documentation	**10**
Home assignments	**17**
Tutorials	**-**
Assesment	**2**
Other activities …….	**-**

3.7 Total number of hours for individual study	44
3.8 Total number of hours in the curriculum	56
3.9 Total number of hours per semester	100
3.10 Number of ECTS **	4

4. Prerequisites (where applicable)

4.1. curriculum based	-
4.2. competence based	-

5. Requisites (where applicable)

5.1. course related	Room equipped with video projector / board / Microsoft Teams Platform
5.2. laboratory related	Room equipped with video projector / board / Microsoft Teams Platform

6. Specific competences to be aquired

6.1 ESCO competencies

Professional Competencies	Upon completion of the course, students will acquire competencies in using the tools of Graph Theory to translate problems into various programming languages. Thus, the course contributes to the development of general competencies specific to the specialization, including: • Identifying client requirements; • Translating requirements into a mathematical/visual model; • Interpreting technical requirements; • Using technical drawing software; • Managing engineering projects.
Transversal competencies	-

6.2 Learning outcomes specific to the field and branch of science as provided in the current ARACIS standards.

Knowledge	• The student/graduate selects, explains, and specifies the mathematical foundations applied in computer science, including formal logic, algebra, probability, and statistics.
Aptitude	• The student/graduate applies, evaluates, and proposes mathematical methods for modeling, simulating, and solving computer science problems.
Rsponsabilities and Autonomy	• The student/graduate develops interdisciplinary solutions by integrating mathematics with related fields and collaborating effectively with specialized teams.

7. **Course objectives** (as per the programme specific competences grid)

7.1 General objectives of the course	Learning the fundamental concepts in graph theory, with a sense of some of its modern applications.
7.2 Specific objectives of the course	Our aims in this course are twofold. First, to discuss some of the major results of graph theory, and to introduce the language, methods and terminology of the subject. Second, to emphasize various approaches (algorithmic, probabilistic, etc) that have proved fruitful in modern graph theory: these modes of thinking about the subject have also proved successful in areas of informatics, and we hope that students will find the techniques learned in this course to be useful in their future works.

8. Course contents

8.1 Course (learning units)	**Teaching methods**	**Remarks**
Preliminaries. General notions. Ways for representing a graph	***Lecture, conversation***	
Basic concepts in Graph Theory Cyclomatic number	***Lecture, conversation***	
Graph traversal Breadth First Traversal Depth First Traversal	***Lecture, conversation***	
Minimum distances in graphs	***Lecture, conversation***	
Connected components	***Lecture, conversation***	
Bipartite graphs Maximum matching problem in a bipartite graph	***Lecture, conversation***	
Hamiltonian paths and circuits Chen algorithm Foulkes algorithm Kaufmann algorithm	***Lecture, conversation***	
Flow networks Bellman-Kalaba algorithm Ford algorithm Dijkstra algorithm	***Lecture, conversation***	

Maximum flow in transport networks	***Lecture, conversation***	
Trees. Definitions and theorems.	***Lecture, conversation***	
Traversal of a directed tree	***Lecture, conversation***	
Trees of minimum values Kruskal algorithm Sollin algorithm	***Lecture, conversation***	
Binary trees	***Lecture, conversation***	
Structural trees	***Lecture, conversation***	

REFERENCES

1. Behzad, M., Chartrand, G., Lesniak-Foster, L., *Graphs and digraphs*, Prindle, Weber and Schmidt, Boston, Massachusetts, 2014.

2. Bollobas, B., *Graph theory. An introductory course*, Springer-Verlag, New York, Heidelberg, Berlin, 2012.

3. Christo¯des, N., *Graph theory. An algorithmic approach*, Academic Press, 2011.

4. Ford, L., Fulkerson, D. R., *Flows in networks*, Princeton Univ. Press, 1992.

5. Wainberg, D., Breaz, D., Alb Lupaş, A., *Elemente de Algoritmica grafurilor*, Ed. Aeternitas, 2010.

Seminars-laboratories	**Teaching methods**	
Preliminaries. General notions. Ways for representing a graph	***Exercises and problems***	
Basic concepts in Graph Theory Cyclomatic number	***Exercises and problems***	
Graph traversal Breadth First Traversal Depth First Traversal	***Exercises and problems***	
Minimum distances in graphs	***Exercises and problems***	
Connected components	***Exercises and problems***	
Bipartite graphs Maximum matching problem in a bipartite graph	***Exercises and problems***	
Hamiltonian paths and circuits Chen algorithm Foulkes algorithm Kaufmann algorithm	***Exercises and problems***	
Flow networks Bellman-Kalaba algorithm Ford algorithm Dijkstra algorithm	***Exercises and problems***	
Maximum flow in transport networks	***Exercises and problems***	

Trees. Definitions and theorems.	***Exercises and problems***	
Traversal of a directed tree	***Exercises and problems***	
Trees of minimum values Kruskal algorithm Sollin algorithm	***Exercises and problems***	
Binary trees	***Exercises and problems***	
Structural trees	***Exercises and problems***	

REFERENCES

1. Behzad, M., Chartrand, G., Lesniak-Foster, L., *Graphs and digraphs*, Prindle, Weber and Schmidt, Boston, Massachusetts, 2014.

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9. Corroboration of course contents with the expectations of the epistemic community's significant representatives, professional associations and employers in the field of the academic programme

Applying the discipline Graph algorithms in building and developing of a computer network is essential. Any company or institution that owns a computer network would need graduates who have successfully completed this subject. Also, a lot of programming techniques are based on the algorithms presented here. Therefore, we can conclude that Graph algorithms is a fundamental course of computer science.

10. Assesment

Activity	10.1 Evaluation Criteria	10.2 Evaluation Methods	10.3 Percentage of final grade
10.4 Course	*Comprehensive knowledge*	*Written Examination*	50%
10.5 Seminar/laboratory	*Ongoing assessment*	*Active participation in seminar*	50%
10.6 Minimum performance standard: Modeling and solving some medium complexity level problems, using the mathematical and computer sciences knowledge.			

Submission Date

Course Leader Signature
Lect. Dr. Andrei Bura

Course Tutor Signature
Lect. Dr. Andrei Bura

Data of approval by Department

Department Director Signature
Lect. Dr. Mihaela Aldea

Data of approval by Faculty Council

Faculty Dean Signature
Conf. Dr. Corina Rotar