SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computer Science and Information Technology**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Information Engineering**

2. Information regarding the discipline

2.1 Name of the discipline		**Cryptography and data protection**					
2.2 Course coordinator		**Prof.PhD. Septimiu Crivei**					
2.3 Seminar coordinator		**Prof.PhD. Septimiu Crivei**					
2.4. Year of study	**3**	2.5 Semester	**5**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**Optional DS**

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					14
Additional documentation (in libraries, on electronic platforms, field documentation)					8
Preparation for seminars/labs, homework, papers, portfolios and essays					14
Tutorship					14
Evaluations					8
Other activities:					0
3.7 Total individual study hours	58				
3.8 Total hours per semester	100				
3.9 Number of ECTS credits	4				

4. Prerequisites (if necessary)

4.1. curriculum	□
4.2. competencies	□

5. Conditions (if necessary)

5.1. for the course	□
5.2. for the seminar /lab activities	□

6. Specific competencies acquired

Professional competencies	C3.1 Identifying classes of problems and solving methods that are specific to computing systems C3.2 Using interdisciplinary knowledge, solution patterns and tools, making experiments and interpreting their results C3.5 Developing and implementing information system solutions for concrete problems
Transversal competencies	CT1 Honorable, responsible, ethical behavior, in the spirit of the law, to ensure the professional reputation CT2 Identifying, describing and conducting processes in the project management field, undertaking different team roles and clearly and concisely describing own profesional results, verbally or in writing CT3 Demonstrating initiative and pro-active behavior for updating professional, economical and organizational culture knowledge

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

7.1 General objective of the discipline	To present mathematical algorithms used in public-key cryptography.
7.2 Specific objective of the discipline	Number-theoretic and algebra algorithms will be studied and implemented in projects.

8. Content

8.1 Course	Teaching methods	Remarks
1. Classical cryptography. Examples	interactive exposure, explanation, didactical demonstration	
2. Algorithm complexity, elements of number theory	interactive exposure, explanation, didactical demonstration	
3. Public-key cryptography. RSA	interactive exposure, explanation, didactical demonstration	
4. Algorithms for testing primality	interactive exposure, explanation, didactical demonstration	
5. Algorithms for factoring integers	interactive exposure, explanation, didactical demonstration	
6. Quadratic residues. Rabin public-key cryptosystem	interactive exposure, explanation, didactical	

	demonstration	
7. Polynomials. Finite fields	interactive exposure, explanation, didactical demonstration	
8. ElGamal public-key cryptosystem	interactive exposure, explanation, didactical demonstration	
9. Algorithms for computing discrete logarithms	interactive exposure, explanation, didactical demonstration	
10. Factorization of polynomials: Berlekamp's algortihm	interactive exposure, explanation, didactical demonstration	
11. Digital signatures	interactive exposure, explanation, didactical demonstration	
12. Key-related protocols	interactive exposure, explanation, didactical demonstration	
13. Practical aspects of public-key cryptosystems	interactive exposure, explanation, didactical demonstration	
14. Eliptic-curve cryptography	interactive exposure, explanation, didactical demonstration	

Bibliography

1. M. Cozzens, S.J. Miller, The Mathematics of Encryption: An Elementary Introduction, American Mathematical Society, 2013.
2. S. Crivei, A. Marcus, C. Sacarea, C. Szanto, Computational algebra with applications to coding theory and cryptography, Editura EFES, Cluj-Napoca, 2006.
3. C. Gherghe, D. Popescu, Criptografie. Coduri. Algoritmi, Editura Univ. Bucuresti, 2005.
4. A.J. Menezes, P.C. van Oorschot, S.A. Vanstone, Handbook of Applied Cryptography, CRC Press, Boca Raton, 1997. [http://www.cacr.math.uwaterloo.ca/hac]
5. C. Paar, J. Pelzl, Understanding Cryptography, Springer, 2009.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Classical cryptography	interactive exposure, algorithmization	The lab is scheduled as 2 hours every second week
2. Algorithm complexity	interactive exposure, algorithmization	
3. Modular arithmetics	interactive exposure, algorithmization	
4. Algorithms for testing primality	interactive exposure, algorithmization	
5. Algorithms for factoring integers	interactive exposure, algorithmization	
6. Public-key cryptography	interactive exposure, algorithmization	

7. Practical aspects of public-key cryptosystems	interactive exposure, algorithmization	

Bibliography

1. M. Cozzens, S.J. Miller, The Mathematics of Encryption: An Elementary Introduction, American Mathematical Society, 2013.
2. S. Crivei, A. Marcus, C. Sacarea, C. Szanto, Computational algebra with applications to coding theory and cryptography, Editura EFES, Cluj-Napoca, 2006.
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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 contents is directed towards practical applications of public-key cryptography. The topic is present in the computer science study programme of all major universities.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade
10.4 Course	Use of basic concepts in examples	Assessments	50
10.5 Seminar/lab	Implement course concepts and algorithms	Practical examination	50
10.6 Minimum performance standards			
- Grade 5			

Date 30.04.2022

Signature of course coordinator
Prof.PhD. Septimiu CRIVEI

Signature of seminar coordinator
Prof.PhD. Septimiu CRIVEI

Date of approval
24.05.2022

Signature of the head of department
Prof.PhD. Laura Diosan