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 Mathematics**
1.4 Field of study	**Mathematics**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Mathematics**

2. Information regarding the discipline

2.1 Name of the discipline	**Public-Key Cryptography**						
2.2 Course coordinator	**Prof.PhD. Septimiu Crivei**						
2.3 Seminar coordinator	**Prof.PhD. Septimiu Crivei**						
2.4. Year of study	**2**	2.5 Semester	**3**	2.6. Type of evaluation	**VP**	2.7 Type of discipline	**Optionala (DS)**

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
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	16
Additional documentation (in libraries, on electronic platforms, field documentation)	20
Preparation for seminars/labs, homework, papers, portfolios and essays	16
Tutorship	14
Evaluations	3
Other activities:	0
3.7 Total individual study hours	69
3.8 Total hours per semester	125
3.9 Number of ECTS credits	5

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	C1.5 Development of program units and corresponding documentation C3.3 Use of computer science and mathematical models and tools for solving specific problems in the application field

Transversal competencies	CT2 Efficient fulfillment of organized activities in an inter-disciplinary group and development of empathic abilities of inter-personal communication, relationship and collaboration with various groups

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 Laboratory	Teaching methods	Remarks
1. Classical cryptography	interactive exposure, algorithmization	2 weeks
2. Algorithm complexity	interactive exposure, algorithmization	2 weeks
3. Modular arithmetics	interactive exposure, algorithmization	2 weeks
4. Algorithms for testing primality	interactive exposure, algorithmization	2 weeks
5. Algorithms for factoring integers	interactive exposure, algorithmization	2 weeks
6. Public-key cryptography	interactive exposure, algorithmization	2 weeks
7. Practical aspects of public-key cryptosystems	interactive exposure, algorithmization	2 weeks
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.		

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 Lab	Implement course concepts and algorithms	Practical examination	50
10.6 Minimum performance standards			
Grade 5			

Date
22.04.2022

Signature of course coordinator
Prof.PhD. Septimiu CRIVEI

Signature of seminar coordinator
Prof.PhD. Septimiu CRIVEI

Date of approval

Signature of the head of department
Prof.PhD. Octavian AGRATINI