UNIVERSITATATEA din BUCUREȘTI
FACULTATEA de MATEMATICĂ și INFORMATICĂ

SECURITATE și LOGICĂ APLICATĂ

SECURITY and APPLIED LOGIC

INFORMAŢII GENERALE/ GENERAL INFORMATION

Programul de securitate și logică aplicată (SLA) este o parte integrantă a masterelor de cercetare oferite de Facultatea de Matematică și Informatică din cadrul Universității din București. Acest program de master, prin direcțiile sale, combină atributele unui program științific, de cercetare cu cele ale unui master profesionist. În ultimii trei ani, masterul SLA a fost predat în limba română; cu toate acestea, pentru anul universitar 2020-2021, limba sa de predare primară va deveni engleza. Programele de curs și materialele au fost deja disponibile în limba engleză ca parte a procesului de acreditare, iar site-ul web al masterului (https://sla.cs.unibuc.ro/) va fi tradus pentru a reflecta noul public țintă.

The Security and Applied Logic (SLA) program is an integral part of the research masters offered by the Faculty of Mathematics and Computer Science at the University of Bucharest. This master's program, through its directions, combines the attributes of a scientific, research program with those of a professional master. For the past three years, the SLA master was taught in Romanian; however, for the 2020-2021 academic year its primary teaching language will become English. Course syllabi and materials were already made available in English as part of the accreditation process, and the master's website (https://sla.cs.unibuc.ro/) will be translated to reflect the new target audience.

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Misiunea programului SLA este de a instrui profesioniștii în domeniul securității pentru a înțelege în detaliu starea actuală a domeniului Securității informațiilor, îmbunătățind în același timp capacitatea acestora de a primi și integra în activitatea lor cele mai noi evoluții în domeniu. Printre obiectivele sale, programul SLA își propune să dezvolte abilitățile necesare pentru modelarea și analizarea sistemelor de securitate și aplicarea corectă a tehnicilor de securitate, abilitățile de a identifica metode optime de securitate și de a proiecta și implementa sisteme de înaltă securitate. Nu în ultimul rând, ne așteptăm ca unii dintre absolvenții acestui program să continue să-și îmbunătățească expertiza urmând studii de doctorat.

The mission of the SLA program is to train security professionals to gain a thorough understanding of the current status of the Information Security field, while also enhancing their capacity to receive and integrate in their activity the latest developments in the field. Among its objectives, the SLA program aims to develop the skills required to model and analyze security systems and to correctly apply security techniques, the abilities to identify optimal security methods and to design and implement high security systems. Last but not least, we expect that some of the graduates of this program will continue to enhance their expertize by pursuing doctoral studies.

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Programul de învățământ din primul an conține 6 discipline fundamentale, pregătitoare pentru cursurile ulterioare din program. Programul din al doilea an conține 5 discipline de specialitate, îndrumându-i pe studenți să obțină o pregătire complexă și interdisciplinară. Programul fiecărui an este întregit de cursuri opționale pentru a completa cunoștințele elevilor despre subiecte de securitate sau alte domenii conexe informatice. Lista cursurilor opționale va fi actualizată anual în funcție de dinamica domeniului, de programele de masterat existente la facultate și de interacțiunea cu firmele de securitate interesate să ofere pregătire practică specializată în cadrul masterului.

The first year curriculum contains 6 fundamental disciplines, preparatory for the subsequent courses within the program. The second year curriculum contains 5 specialized disciplines, guiding students towards gaining a complex and interdisciplinary training. Each year's program is supplemented by optional courses to complement students' knowledge about security topics or connex computer science fields. The list of the optional courses will be updated annually according to the dynamics of the field, the programs of the existing masters in the faculty and the interaction with the security companies interested in offering specialized practical training within the master.

Plan de învățământ/Curriculum

UNIVERSITATEA DIN BUCUREŞTI/ UNIVERSITY OF BUCHAREST
FACULTATEA DE MATEMATICĂ/ FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
Domeniul de încadrare a programului de studii: ***Informatică/*** COMPUTER SCIENCE
Titlul programului de studii: ***Securitate și logică aplicată/ Security and Applied Logic***
Tipul programului de studii: Zi/Full-time
Durata programului de studii - 4 semestre / 120 ECTS

Anul universitar 2020-2021 (anul/year I) – 60 ECTS

Nr. crt.	Cursuri obligatorii	Semestrul I (14 săpt.)				Semestrul II (14 săpt.)			
		C	S/L	E/V	ECTS	C	S/L	E/V	ECTS
1	Ob.11 **Securitatea spațiului cybernetic** Cybersecurity	2	1	E	6	-	-	-	-
2	Ob.12 **Criptografie avansată** Advanced Cryptography	2	1	E	6	-	-	-	-
3	Ob.13 **Logică avansată pentru informatică** Advanced Logic for Computer Science	2	1	E	6	-	-	-	-
4	Ob.14 **Curs optional** Optional Course	2	1	E	6	-	-	-	-
5	Ob.15 **Practică**/Practical Training	-	2	V	6	-	-	-	-
6	Ob.21 **Sisteme de operare : proiectare și securitate** Operating systems: design and security	-	-	-	-	2	1	E	6
7	Ob.22 **Securitatea rețelelor** Network Security	-	-	-	-	2	1	E	6
8	Ob.23 **Verificarea programelor** Program verification	-	-	-	-	2	1	E	6
9	Ob.24 **Curs optional** Optional Course					2	1	E	6
10	Ob.25 **Practică/** Practical Training	-	-	-	-	-	2	V	6
TOTAL		**8**	**6**	**4E 1V**	**30**	**8**	**6**	**4E 1V**	**30**

C = curs; S = seminar/laborator; Ob.xx = obligatoriu; Op.Xxx = opțional;
EV=evaluare; E = examen; V = verificare; ECTS = număr de credite europene transferabile;

Plan de învățământ/Curriculum

UNIVERSITATEA DIN BUCUREŞTI/ UNIVERSITY OF BUCHAREST
FACULTATEA DE MATEMATICĂ/ FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
Domeniul de încadrare a programului de studii: ***Informatică/*** COMPUTER SCIENCE
Titlul programului de studii: ***Securitate și logică aplicată/ Security and Applied Logic***
Tipul programului de studii: Zi/Full-time
Durata programului de studii - 4 semestre / 120 ECTS

Anul universitar 2020-2021 (anul/year II) – 60 ECTS

Nr. crt.	Cursuri obligatorii şi opționale	Semestrul I (14 săpt.)				Semestrul II (10 săpt.)			
		C	S/L	EV	ECTS	C	S/L	EV	ECTS
1	Ob.31 **Tehnologii Moderne pentru Securizarea Informațiilor** Modern Technologies for Information security	1	2	E	6	-	-	-	-
2	Ob.32 **Securitatea bazelor de date** Database Security	2	1	E	6	-	-	-	-
3	Ob.33 **Topici speciale în securitate și logică aplicată** Special topics in Security and Applied Logic	2	1	E	6	-	-	-	-
4	Op.34 **Curs optional** Optional Course	2	1	E	6	-	-	-	-
5	Op.35 **Pregătirea lucrării de disertație** Dissertation Research Project	-	2	V	6	-	-	-	-
6	Op.41 **Inginerie inversă si exploatarea vulnerabilitatilor** Reverse Engineering and Exploitation	-	-	-	-	1	2	E	6
7	Op.42 **Logică și teoria codurilor** Logic and Code Theory	-	-	-	-	2	1	E	6
8	Op.43 **Curs optional** Optional Course	-	-	-	-	2	1	E	6
9	Op.44 **Pregătirea lucrării de disertație** Dissertation Research Project	-	-	-	-	-	5	V	12
TOTAL		**7**	**7**	**4E 1V**	**30**	**5**	**9**	**3E 1V**	**30**

C = curs; S = seminar/laborator; Ob.xx = obligatoriu; Op.Xxx = opțional;
EV=evaluare; E = examen; V = verificare; ECTS = număr de credite europene transferabile;
NB1. *Ultimele două săptămâni din semestrul IV vor fi dedicate finalizării lucrării de disertație, fiind normate cu 14 ore fiecare săptămână.*
NB2. *Raportul dintre numărul orelor de curs și de laborator/seminar din toți anii de studii*:
372/384= 0,968

FIŞA DISCIPLINEI
COURSE SYLLABUS
Cybersecurity

1. DATE DESPRE PROGRAM
PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ
COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	*Cybersecurity*							
2.2. Titularul activităţilor de curs Course instructor				Asist.Dr. Laurențiu Silviu Vasile				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				Asist.Dr. Mihăiță Drăgan				
2.4. Anul de studiu Year	**I**	**2.5. Semestrul** Semester	**I**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2] Content	**DF**
							Obligativitate [3] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE
ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**4**	**din care** of which	**3.2 Curs** Course	**2**	**3.3 Seminar** Seminar	**1**
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**42**	**din care** of which	**3.5 Curs** Course	**28**	**3.6 Seminar** Seminar	**14**

3.7 Total ore studiu individual Student workload for individual study	138	**3.8 Total ore pe semestru** Total student workload / semester	280	**3.9 Număr de credite** ECTS	**6**

DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes	**50**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)	**34**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)	**50**
	Tutoriat (opţional) Individual consultations (optional)	**-**
	Examinări Evaluations / exams	**4**
	Alte activităţi Other activities	**-**

4. PRECONDIŢII
PRECONDITIONS

4.1 De curriculum Curriculum-related	Basic knowledge of hardware and software
4.2 De competenţe Skills-related	Optimal work with the computer

5. CONDIŢII
CONDITIONS

5.1 De desfăşurare a cursului For running the course	The course takes place in a hall with a projector
5.2 De desfăşurare a seminarului For running the seminar	The lab is hosted in a hall with a projector and dedicated networking equipment. Promotion of on-line platform test assignments.

6. COMPETENŢE SPECIFICE ACUMULATE
ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	The aim of the course is to acquire the necessary knowledge for: - information security, - system security, - network security, - mobile, physical security, - security, ethics and related laws, - technologies, defense and mitigation.
6.2 Competenţe transversale Cross-cutting skills	They will acquire fundamental knowledge and skills in cyber security, as well as career opportunities in IT security. New knowledge in detecting trends, threats and safety conditions in cyberspace, protecting personal data and / or company data.

7. OBIECTIVELE DISCIPLINEI
COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei / Course goal	Understanding the underlying concepts of knowledge accumulation to counter attacks and attacks on IT security that require new strategies on the labor market.
7.2 Obiective specifice Course objectives	•Updates on cyber threats, attacks, and impact • Updates about security vulnerabilities • Legal and ethical aspects of cyber security

8. CONŢINUTURI
CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
1. The need for Cybersecurity	Using the video projector. Explication. Demonstration. Description and exemplification.	Learn the need for and importance of cybersecurity. Understand the characteristics and value of personal data, and data within an organization.
2. Attacks, Concepts and Techniques	Using the video projector. Explication. Demonstration. Description and exemplification.	Recognize the characteristics and operation of a cyber attack. Interpret the trends in the cyber threat landscape.
3. Protecting Your Data and Privacy	Using the video projector. Explication. Demonstration. Description and exemplification.	Understand how to protect devices from threats. Master how to safeguard your privacy.
4. Protecting the Organization	Using the video projector. Explication.	Learn techniques to protect organizations from cyberattacks.

	Demonstration. Description and exemplification.	Recognize the behavior-based approach to cybersecurity.
5. A World of Wizards, Heros and Criminals	Using the video projector. Explication. Demonstration. Description and exemplification.	Describe the cybersecurity world, criminals and professionals . Compare how cybersecurity threats affect individuals, business and organization. Explain the structure and efforts committed to expanding the security workforce.
6. The Cybersecurity Sorcery Cube	Using the video projector. Explication. Demonstration. Description and exemplification.	Explain the three dimensions of the McCumber Cube. Detail the ISO cybersecurity model. Explain the principles of confidentiality, integrity, and availability as they relate to data states and cybersecurity countermeasures.
7. Cybersecurity Threats, Vulnerabilities, and Attacks.	Using the video projector. Explication. Demonstration. Description and exemplification.	Describe tactics, techniques and procedures used by cyber criminals. Explain the types of malware, malicious code and social engineering Compare different types of cyber attacks.
8. Techniques of Protecting Secrets	Using the video projector. Explication. Demonstration. Description and exemplification.	Outline technologies, products and procedures used to protect confidentiality. Explain encryption techniques and access control techniques. Present concepts of obscuring data.
9. Techniques of Ensuring Integrity.	Using the video projector. Explication. Demonstration. Description and exemplification.	Explain technologies, products and procedures used to ensure Integrity. Detail the purpose of digital signature and certificates. Explain the need for database integrity enforcement.
10. The Realm of Five Nines.	Using the video projector. Explication. Demonstration. Description and exemplification.	Explain the concepts of high availability. Describe technologies, products, and procedures used to provide high availability. Represent how incident response plan and disaster recovering planning improves high availability and business continuity.
11. Fortifying the Kingdom.	Using the video projector. Explication. Demonstration. Description and exemplification.	Explain system, servers and data protection. Explain network infrastructure and end device protection. Explain physical security measures used to protect network equipment.
12. Joining the Order of Cybersecurity Specialists	Using the video projector. Explication. Demonstration. Description and exemplification.	Discuss cybersecurity domains and controls within the CIA triad. Explain ethics and cybersecurity laws. Name the cybersecurity tools. Explain how to become a cyber

		security professional.
13. Will Your Future Be in Cybersecurity?	Using the video projector. Explication. Demonstration. Description and exemplification.	Explore the opportunities for pursuing an education and a career in cybersecurity.

Bibliografie/ Bibliography**:**

"Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation" Bruce Dang; 2014
"Threat Modeling: Designing for Security" Adam Shostack; 2014
"Android Hacker's Handbook" Joshua J. Drake; 2014
"The Art of Computer Virus Research and Defense" Peter Szor; 2005
"Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" Michael Sikorski; 2012

8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
1. The need for Cybersecurity	Explication. Demonstration. Description and exemplification.	
2. Attacks, Concepts and Techniques	Explication. Demonstration. Description and exemplification.	
3. Protecting Your Data and Privacy	Explication. Demonstration. Description and exemplification.	
4. Protecting the Organization	Explication. Demonstration. Description and exemplification.	
5. A World of Wizards, Heros and Criminals	Explication. Demonstration. Description and exemplification.	
6. The Cybersecurity Sorcery Cube	Explication. Demonstration. Description and exemplification.	
7. Cybersecurity Threats, Vulnerabilities, and Attacks.	Explication. Demonstration. Description and exemplification.	
8. Techniques of Protecting Secrets	Explication. Demonstration. Description and exemplification.	
9. Techniques of Ensuring Integrity.	Explication. Demonstration. Description and exemplification.	
10. The Realm of Five Nines.	Explication. Demonstration. Description and exemplification.	
11. Fortifying the Kingdom.	Explication. Demonstration. Description and exemplification.	
12. Joining the Order of Cybersecurity Specialists	Explication. Demonstration. Description and exemplification.	
13. Will Your Future Be in Cybersecurity?	Explication. Demonstration. Description and exemplification.	

Bibliografie/ Bibliography**:**

"Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation" *Bruce Dang;*

2014 **"Threat Modeling: Designing for Security"** Adam Shostack; 2014 **"Android Hacker's Handbook"** Joshua J. Drake; 2014 **"The Art of Computer Virus Research and Defense"** Peter Szor; 2005 **"Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software"** Michael Sikorski; 2012		
8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
1. The need for Cybersecurity	Explication. Demonstration. Description and exemplification.	What your online identity and data is, where it is, and why it is of interest to cyber criminals. What organizational data is, and why it must be protected.
2. Attacks, Concepts and Techniques	Explication. Demonstration. Description and exemplification.	The techniques used by attackers to infiltrate a system. The characteristics and operation of a cyber attack. The trends in the cyber threat landscape.
3. Protecting Your Data and Privacy	Explication. Demonstration. Description and exemplification.	Authentication techniques helping you maintain your data securely with tips about what to do and what not to do online. Protecting devices from threats. Safeguarding your privacy.
4. Protecting the Organization	Explication. Demonstration. Description and exemplification.	Equipment, data, and the commonly used security terms such as botnets, the kill chain, and behaviorbased security. Techniques for protecting organizations from cyber attacks. The behavior-based approach to cybersecurity.
5. A World of Wizards, Heros and Criminals	Explication. Demonstration. Description and exemplification.	The role of cyber criminals and what motivates them. The factors that lead to the spread and growth of cybercrime. The structure and efforts committed to expanding the cybersecurity workforce.
6. The Cybersecurity Sorcery Cube	Explication. Demonstration. Description and exemplification.	The three dimensions of the McCumber Cube – the CIA Triad; the three states of data; the three categories of cybersecurity safeguards.
7. Cybersecurity Threats, Vulnerabilities, and Attacks.	Explication. Demonstration. Description and exemplification.	The types of malware and malicious code. The different methods used in social engineering. The different types of cyber attacks.
8. Techniques of Protecting Secrets	Explication. Demonstration. Description and exemplification.	The principles of cryptology used to secure communications. The access control models and techniques used to protect confidentiality.

		The concept of obscuring data, and how data obfuscation and steganography accomplishes data masking.
9. Techniques of Ensuring Integrity.	Explication. Demonstration. Description and exemplification.	The types of data integrity controls. The purpose of digital signatures and certificates as tools for verifying authenticity of messages and documents. The need for database integrity enforcement to ensure stability, performance and maintainability of the database system.
10. The Realm of Five Nines.	Explication. Demonstration. Description and exemplification.	The concepts of five nines, a high availability industry standard. Incident response plan and disaster recovery planning to improves high availability.
11. Fortifying the Kingdom.	Explication. Demonstration. Description and exemplification.	Host-hardening includes securing the operating system, implementing an anti-virus solution, and using host-based solutions such as firewalls and intrusion detection systems. Server hardening includes managing remote access, securing privileged accounts, and monitoring services.
12. Joining the Order of Cybersecurity Specialists	Explication. Demonstration. Description and exemplification.	The security domains and proper controls in each domain. The laws governing security, and ethical behavior. The available cybersecurity tools The opportunities and roles in the cybersecurity profession.
13. Will Your Future Be in Cybersecurity?	Explication. Demonstration. Description and exemplification.	Certification prerequisites for Specialization Certificates in many areas of networking, including cybersecurity. Explore the opportunities for pursuing an education and a career in cybersecurity.

Bibliografie/ Bibliography**:**
"Reversing: Secrets of Reverse Engineering", Eldad Eilam; 2005
"The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities" Mark Dowd; 2006.
"The IDA Pro Book: The Unofficial Guide to the World's Most Popular Disassembler" Chris Eagle; 2011**.**
"The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory" Michael Hale Ligh; 2014.

8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

9. SCURTĂ DESCRIERE*
BRIEF DESCRIPTION*
*** COROBORAREA CONȚINUTURILOR DISCIPLINEI CU AȘTEPTĂRILE REPREZENTANȚILOR COMUNITĂȚII EPISTEMICE, ASOCIAȚIILOR PROFESIONALE ȘI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

By providing access to current theoretical but practical applications, the course aims to develop research and innovation skills, preparing candidates who can pursue doctoral programs and who can become members of research departments of companies in the field, using the knowledge gained in the administration a network that uses multiple routers, switches, firewalls, etc.

10. EVALUARE/EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs / Course	Understanding the notions presented Active participation in the presentation of the materials Examining tests at the end of the course	Computer Written	
10.5.1. Seminar / Seminar	Active participation by presenting news in the field (attacks, solutions).	Colloquy	
10.5.2. Laborator Laboratory	Work done during the lab Scores from platform tests	Computer Practical work Written	
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI
COURSE SYLLABUS
Advanced Cryptography

1. DATE DESPRE PROGRAM
PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ
COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	**Criptografie avansata** Advanced Cryptography							
2.2. Titularul activităţilor de curs Course instructor				**Lector dr. Adela Georgescu**				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				**Lector dr. Adela Georgescu**				
2.4. Anul de studiu Year	**I**	**2.5. Semestrul** Semester	**I**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2] Content	**DS**
							Obligativitate [3] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE
ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**3**	**din care** of which	**3.2 Curs** Course	**2**	**3.3 Seminar** Seminar	**1**	
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**42**	**din care** of which	**3.5 Curs** Course	**28**	**3.6 Seminar** Seminar	**14**	
3.7 Total ore studiu individual Student workload for individual study	179	**3.8 Total ore pe semestru** Total student workload / semester	225	**3.9 Număr de credite** ECTS	**7.5**		
DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF INDIVIDUAL STUDY WORKLOAD	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes						**49**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)						**50**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)						**80**
	Tutoriat (opţional) Individual consultations (optional)						
	Examinări Evaluations / exams						**4**
	Alte activităţi Other activities						

4. PRECONDIŢII

PRECONDITIONS

4.1 De curriculum Curriculum-related	
4.2 De competenţe Skills-related	

5. CONDIŢII

CONDITIONS

5.1 De desfăşurare a cursului For running the course	• **Cursul se va desfăşura într-o sală dotată cu videoproiector** The lectures will be given in a room equipped with projector
5.2 De desfăşurare a seminarului For running the seminar	• **Studenţii trebuie să se implice activ în cadrul seminarului / laboratorului / proiectului** Students must be active during the seminar / laboratory / project work • **În cazul în care studenţii întarzie cu predarea temelor de seminar / laborator / a proiectelor, se vor aplica depunctări sau în funcţie de caz, activitatea se va considera nesatisfăcută** If the students fail to deliver the assignments on time, they will receive penalties, or, depending on the case, the assignment might be considered failed

6. COMPETENŢE SPECIFICE ACUMULATE

ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	• **Cunoaşterea conceptelor de bază şi a principiilor criptografiei** Knowledge of main criptography concepts and principles • **Utilizarea corectă a primitivelor criptografice** Correct usage of the presented criptographic primitives • **Studiul principalelor primitive criptografice actuale** The study of main current criptographic primitives • **Analizarea securitatii sistemelor criptografice** Analysing the security of criptographic systems
6.2 Competenţe transversale Cross-cutting skills	• **Preocuparea pentru perfecţionarea securitatii sistemelor criptografice** Improvement of criptographic systems security • **Dezvoltarea gândirii critice (asupra sistemelor criptografice) prin antrenarea capacităţilor de evidentiere a punctelor vulnerabile** Develop analytical thinking (on cryptographic systems) through training capabilities to highlight vulnerabilities • **Aplicarea regulilor de muncă riguroasă şi eficientă, manifestarea unor atitudini responsabile faţă de domeniul ştiinţific şi didactic, pentru valorificarea optimă şi creativă a propriului potenţial în situaţii specifice, cu respectarea principiilor şi a normelor de etică profesională** Apply rigorous and efficient working rules, responsible attitudes towards the scientific and didactic fields for optimal and creative improvement of the student's potential in specific situations, under the principles and norms of professional ethics • **Utilizarea eficientă a surselor informaţionale şi a resurselor de comunicare şi formare profesională asistată** Effective use of information sources and communication and assisted training resources

7. OBIECTIVELE DISCIPLINEI

COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei Course goal	• **Familiarizarea studentilor cu principiile criptografiei moderne si aplicarea primitivelor si a sistemelor criptografice in situatii concrete din viata reala.** Learn about the principles of modern cryptography and apply primitives and cryptographic systems in real life situations • **Studenţii îsi vor dezvolta capacitatea de a întelege şi analiza diferite primitive criptografice** The students will develop their ability to understand and analyze different cryptographic primitives
7.2 Obiective specifice	• **Întelegerea evolutiei criptografiei si a necesitatii criptografiei moderne**

Course objectives	Understanding of the evolution of cryptography and the need of modern cryptography • **Dezvoltarea abilităţilor de analiză a securităţii** Developing security analysis skills • **Dezvoltarea capacitatii de alegere si utilizare corecta a sistemelor criptografice** Developing the capacity of choosing and using the right cryptographic systems

8. CONŢINUTURI

CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
1. Introducere in criptografie. Introduction to cryptography.	**Prelegeri** Lectures **Videoproiector** Projector	**Resurse folosite:** Used resources: - **Videoproiector** Projector - **Calculator** Computer - **Tablă** Blackboard / whiteboard
2. **Criptanaliza. Modele de adversari.** Cryptanalysis. Types of adversaries.		
3. Criptografie simetrica: criptare simetrica, inetgritatea mesajelor, functii hash, criptare autentificata. Symmetric cryptography: symmetric encryption, message integrity, hash functions, authenticated encryption.		
4. Criptografie asimetrica: criptare asimetrica, semnaturi digitale, protocoale de stabilire a cheilor, infrastructura cu chei publice, signcryption. Asymmetric cryptography: asymmetric encryption, digital signatures, key agreement protocols, public key infrastructure, signcryption.		
5. **Demonstrarea securitatii. Modele de securitate si tehnici de demonstratie.** Security proof. Security models and proof techniques.		
6. Commitment si Oblivious Transfer. Commitment and Oblivious Transfer.		
7. Demonstratii zero-knowledge Zero-knowledge proofs.		

Bibliografie/ Bibliography**:**

1. J.Katz, Y.Lindell - Introduction to Modern Cryptography, Chapman & Hall/CRC Press, 2008

2. N.Smart - Cryptography: An introduction. https://www.cs.umd.edu/~waa/414-F11/IntroToCrypto.pdf

3. C. Paar – Understanding Cryptography, Springer, 2010

4. S.Vaudenay - A Classical Introduction to Cryptography: Applications for Communications Security, Springer, 2006.

5. A.J.Menezes, P.C.van Oorschot, S.A.Vanstone - Handbook of Applied Cryptography, CRC Press, 2001.

8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Aplicaţii ale temelor prezentate în cadrul cursului Applications of the themes presented during the course	**Teme individuale şi/sau de grup.** Individual and/or group themes	**Resurse folosite:** Used resources: - **Videoproiector** Projector - **Tablă** Blackboard/whiteboard
Bibliografie/ Bibliography**:** **Aceeaşi ca la curs** Same as for the course		
8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks

Bibliografie/ Bibliography**:** **Aceeaşi ca la curs** Same as for the course		
8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

9. SCURTĂ DESCRIERE*

BRIEF DESCRIPTION*

*** COROBORAREA CONŢINUTURILOR DISCIPLINEI CU AŞTEPTĂRILE REPREZENTANŢILOR COMUNITĂŢII EPISTEMICE, ASOCIAŢIILOR PROFESIONALE ŞI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

Notiunile introduse in acest curs vor dezvolta capacitatea de analiza a studentilor si vor duce la o mai buna si profunda intelegere a problemelor legate de criptografie. Oferind acces la informatii actuale – teoretice, dar cu aplicabilitate practica – cursul isi propune sa devolte aptitudini de cercetare si inovare, pregatind candidati care pot urma programe doctorale si care pot deveni membrii ai departamentelor de cercetare ale firmelor din domeniu.

The concepts introduced in this course will develop the students' analytical capability and will lead to a better and deeper understanding of cryptography issues. The course provides acces to actual information – theoretic but with practical applicability - and aims to develop research and innovation skills, preparing students that can follow doctoral programs and can become members in research departments of different security companies

10. EVALUARE

EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs Course	**Cunoasterea terminologiei, a sistemelor de criptare si a tehnicilor de criptanaliza prezentate in timpul cursului.** Knowledge of the terminology, of the cryptographic systems and the cryptanalysis techniques introduced during the course. **Abilitatea de a aplica cunoştinţele dobândite în cazuri particulare.** Ability to apply the acquired knowledge in particular cases. **Abilitatea de a argumenta utilizarea / inutilizarea unui anumit sistem criptografic in diferite scenarii.** Ability to argue on using a specific cryptographic system in diferent scenarios. **Abilitatea de a analiza securitatea unui algoritm criptografic.**	**Examen** Exam	**50%**

	Ability to analyze the security of a cryptographic system.		
10.5.1. Seminar Seminar	**Capacitatea de a aplica cunostintele dobandite in cadrul cursului pentru rezolvarea problemelor propuse.** Ability to apply the acquired knowledge in order to solve the proposed problems. **Capacitatea de a alege o temă netratată direct în curs, abilitatea de înţelegere şi prezentare a acesteia.** Ability to select topic not covered by the lecture material, understand and present it.	**Participarea şi activitatea în cadrul seminarului.** Participation and activity during the seminar. **Redactarea şi prezentarea (în faţa colegilor şi a profesorului) unui proiect / eseu tehnic.** Write and present (to the fellow students and the teacher) a technical project / essay.	**50%**
10.5.2. Laborator Laboratory			
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Nota finala 5 (cinci) Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI
COURSE SYLLABUS
Advanced Logic for Computer Science

1. DATE DESPRE PROGRAM
PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ
COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	**Advanced Logic for Computer Science**							
2.2. Titularul activităţilor de curs Course instructor				**Prof. Laurenţiu Leuştean**				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				**Prof. Laurenţiu Leuştean**				
2.4. Anul de studiu Year	**I**	**2.5. Semestrul** Semester	**I**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2)] Content	**DF**
							Obligativitate [3)] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE
ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**4**	**din care** of which	**3.2 Curs** Course	**2**	**3.3 Seminar** Seminar	**2**	
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**56**	**din care** of which	**3.5 Curs** Course	**28**	**3.6 Seminar** Seminar	**28**	
3.7 Total ore studiu individual Student workload for individual study	138	**3.8 Total ore pe semestru** Total student workload / semester	180	**3.9 Număr de credite** ECTS		**6**	
DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF INDIVIDUAL STUDY WORKLOAD	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes						**50**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)						**34**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)						**50**
	Tutoriat (opţional) Individual consultations (optional)						
	Examinări Evaluations / exams						**4**
	Alte activităţi Other activities						

4. PRECONDIŢII
PRECONDITIONS

4.1 De curriculum Curriculum-related	
4.2 De competenţe Skills-related	**Cunoștinţe de bază de logică matematică** Basic knowledge in mathematical logic

5. CONDIŢII
CONDITIONS

5.1 De desfăşurare a cursului For running the course	**Sala dotată cu videoproiector** Seminar room with projector
5.2 De desfăşurare a seminarului For running the seminar	**Sala dotată cu videoproiector** Seminar room with projector

6. COMPETENŢE SPECIFICE ACUMULATE
ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	• **Capacitatea de a formaliza raţionamente, de a opera cu noţiuni şi metode teoretice** • **Insuşirea unor noţiuni de bază din logica matematică** • **Legătura între noţiuni teoretice de logică şi aplicaţii în informatică** • The ability to formalize reasoning, to perate with theoretical notions and methods • Acquiring basic notions of mathematical logic • The relation between theoretical notions in logic and their applications in computer science
6.2 Competenţe transversale Cross-cutting skills	• **Utilizarea eficientă a surselor informaţionale şi a resurselor de comunicare şi formare profesională.** • **Capacitatea de a citi şi prelucra materiale profesionale atat în limba română cât şi în limba engleză.** • **Capacitatea de a redacta şi prezenta proiecte.** • **Desfăşurarea eficientă şi eficace a activităţilor organizate în echipă.** • Effective use of information resources; proper use of communication and training resources. • The ability to read and process professional materials both in Romanian and English. • The ability to write and present projects. • Efficient and effective organization of team activities.

7. OBIECTIVELE DISCIPLINEI
COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei Course goal	**Conceptele și metodele din logică ocupă un asemenea loc central în informatică, încât logica a fost numită "the calculus of computer science", deoarece rolul jucat de logică în informatică este similar cu cel jucat de calculus în fizică și inginerie. Obiectivul general este familiarizarea studenților cu aplicatii ale logicii in informatică.** Concepts and methods of logic occupy a central place in computer science, insomuch that logic has been called "the calculus of computer science", since the role played by logic in computer science is similar with the one played by calculus in Physics and Engineering. The general objective of the lecture is students' familiarization with applications of logic in computer science.
7.2 Obiective specifice Course objectives	**Cursul prezintă clase de logici multimodale și logica clasică de ordinul întâi. Sunt introduse noțiuni și proprietăți de bază, precum și rezultate foarte importante, cum ar fi, teoreme de completitudine, nedecidabilitatea logicii de ordinul întâi sau teorema de incompletitudine a lui Gödel. De asemenea, sunt analizate aplicații ale acestor logici în diverse domenii din informatică. Cursul este flexibil, adaptându-se nevoilor și dezvoltării domeniului.** The course presents classes of multimodal logics and the first-order classical logic. Basic notions and properties are introduced, as well as very important results, such as: completeness theorems, the undecidability of first-order logic or Gödel's incompleteness

	theorem. Furthermore, the course analyzes applications of these logics to different fields of computer science. The course is flexible, adapting to the needs and development of the field.

8. CONŢINUTURI

CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
Logici modale, epistemice, temporale, dinamice și aplicaţii la: **- criptografie și securitate;** **- sisteme cyber-fizice;** **- sisteme mult-agent;** **- reprezentarea cunoștinţelor.** Modal, epistemic, temporal and dynamic logics and their applications to: - cryptography and security; - cyber-physical systems; - multi-agent systems; - knowledge representation.	**Explicația.** **Demonstrația.** **Descrierea și exemplificarea.** **Conversația euristică.** Explanation. Proof. Description and exemplification. Heuristic conversation.	**Resurse necesare:** **Videoproiector, Calculator, Tablă.** Necessary equipment: Projector, Computer, Blackboard.
Logică clasică de ordinul întâi: **- sintaxă și semantică;** **- forme normale;** **- compacitate și completitudine;** **- nedecidabilitate.** First-order classical logic: - syntax and semantics; - normal forms; - compactness and completeness; - undecidability.		
Teorema de incompletitudine a lui Gödel. Gödel's incompleteness theorem.		

Bibliografie/ Bibliography**:**

1. P. Blackburn, M. de Rijke, Y. Venema, Modal Logic, Cambridge University Press, 2001.
2. R. Goldblatt, Logics of Time and Computation, CSLI, 1992.
3. D. Harel, D. Kozen, J. Tiuryn, Dynamic Logic, MIT Press, 2000.
4. A. Platzer, Logical Foundations of Cyber-Physical Systems. Springer, 2018.
5. H.P. van Ditmarsch, W. van der Hoek, B. Kooi, Dynamic epistemic logic, Springer, 2007.
6. R. Fagin, J. Halpern, Y. Moses, M. Vardi, Reasoning about knowledge, MIT Press, 1995.
7. P. Hinman, Fundamentals of mathematical logic, Springer, 2005.
8. J. D. Monk, Mathematical logic, Springer, 1977.
9. T. Franzen, Gödel's theorem: an incomplete guide to its use and abuse, AK Peters/CRC Press, 2005.
10. **Articole ştiinţifice actuale.** /Actual research papers.

8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Studenții rezolvă probleme legate de materia predată la curs. **Studenții vor prezenta articole articole de cercetare in domeniul cursului.** Students solve problems related to the material taught in the course lectures. Students will present research articles whose topics are relevant for the course.	**Conversația euristică.** **Exercițiu.** **Demonstrație.** **Teme individuale și/sau de grup.** Heuristic conversation. Exercise. Proof. Group and/or individual homeworks.	
Bibliografie/ Bibliography**:** **Bibliografia cursului si articole de cercetare in domeniu./** The course bibliography and research papers in the field.		

8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		
8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

9. SCURTĂ DESCRIERE*

BRIEF DESCRIPTION*

*** COROBORAREA CONŢINUTURILOR DISCIPLINEI CU AŞTEPTĂRILE REPREZENTANŢILOR COMUNITĂŢII EPISTEMICE, ASOCIAŢIILOR PROFESIONALE ŞI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

Noțiunile introduse în acest curs vor dezvolta capacitatea de analiză a studenților și vor duce la o mai bună și profundă înțelegere a aplicațiilor logicii în informatică. Oferind acces la dezvoltări actuale, cursul își propune să dezvolte aptitudini de cercetare și inovare, pregătind candidați care pot urma programe doctorale și care pot deveni membri ai departamentelor de cercetare ale firmelor din domeniu.

The notions introduced in this course will develop the students' ability to analyze and lead to a better and deeper understanding of the applications of logic in computer sciences. By providing access to actual research and developments, the course aims to develop research and innovation skills, preparing candidates who can pursue doctoral programs and who will be able to work as members of research departments of companies in the field.

10. EVALUARE

EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs Course	**Evaluare finală și pe parcurs.** Final and ongoing evaluation.	**Examen scris si/sau prezentarea unui referat.** Written exam and / or presentation of a report.	**70%**
10.5.1. Seminar Seminar	**Abilitatea de a înțelege conceptele introduse la curs.** **Abilitatea de a citi și analiza un articol de cercetare.** **Abilitatea de a realiza o prezentare.** The ability to understand the concepts introduced in the lectures. The ability to read and analyze a research article. The ability to make a presentation.	**Activitatea la seminarii.** **Prezentarea unui referat.** **Bonus – participarea la seminariile seminariile științifice organizate de grupul de Logică și Securitate.** The activity during the seminars. Presentation of a report. Participation to the scientific seminaries organized by the Logic and Security Group.	**30%**
10.5.2. Laborator Laboratory			
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in			

planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Nota finala 5 (cinci) Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI

COURSE SYLLABUS

OPERATING SYSTEMS DESIGN AND SECURITY

1. DATE DESPRE PROGRAM

PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ

COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	**SISTEME DE OPERARE: PROIECTARE ŞI SECURITATE** OPERATING SYSTEMS DESIGN AND SECURITY							
2.2. Titularul activităţilor de curs Course instructor				**Traian Florin Șerbănuță**				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				**Traian Florin Șerbănuță**				
2.4. Anul de studiu Year	**I**	**2.5. Semestrul** Semester	**II**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2] Content	**DF**
							Obligativitate [3] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE

ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**3**	**din care** of which	**3.2 Curs** Course	**2**	**3.3 Seminar** Seminar	**1**	
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**42**	**din care** of which	**3.5 Curs** Course	**28**	**3.6 Seminar** Seminar	**14**	
3.7 Total ore studiu individual Student workload for individual study	66	**3.8 Total ore pe semestru** Total student workload / semester	108	**3.9 Număr de credite** ECTS	**7.5**		
DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF INDIVIDUAL STUDY WORKLOAD	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes						**20**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)						**14**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)						**28**
	Tutoriat (opţional) Individual consultations (optional)						
	Examinări Evaluations / exams						**4**
	Alte activităţi Other activities						

4. PRECONDIŢII

PRECONDITIONS

4.1 De curriculum Curriculum-related	**SISTEME DE OPERARE (NIVEL DE LICENŢĂ)** OPERATING SYSTEMS (UNDERGRAD LEVEL)
4.2 De competenţe Skills-related	**PROGRAMARE C/C++** C/C++ PROGRAMMING

5. CONDIŢII

CONDITIONS

5.1 De desfăşurare a cursului For running the course	**CURSUL SE VA DESFĂŞURA ÎNTR-O SALĂ DOTATĂ CU VIDEOPROIECTOR** THE COURSE WILL USE A CLASS WITH A VIDEO PROJECTOR
5.2 De desfăşurare a seminarului For running the seminar	• **STUDENŢII TREBUIE SĂ SE IMPLICE ACTIV ÎN CADRUL SEMINARULUI / LABORATORULUI / PROIECTULUI.** • **ÎN CAZUL ÎN CARE STUDENŢII ÎNTARZIE CU PREDAREA TEMELOR DE SEMINAR / LABORATOR / A PROIECTELOR, SE VOR APLICA DEPUNCTĂRI SAU ÎN FUNCŢIE DE CAZ, ACTIVITATEA SE VA CONSIDERA NEREALIZATĂ.** • STUDENTS MUST ACTIVELY TAKE PART TO THE SEMINAR / LABORATORY / PROJECTOR • IF STUDENTS ARE LATE IN TURNING OVER AN ASSIGNMENT, THEY MIGHT RECEIVE LESS CREDIT, OR NO CREDIT AT ALL FOR THAT ASSIGNMENT.

6. COMPETENŢE SPECIFICE ACUMULATE

ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	• **CUNOASTEREA CONCEPTELOR DE BAZA SI A PRINCIPIILOR SECURITATII IN SISTEME DE OPERARE** • **UTILIZAREA CORECTA A TEHNICILOR SI METODELOR PREZENTATE** • **ANALIZAREA SECURITATII UNOR SISTEME IN DIFERITE SCENARII** • KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF SECURITY IN OPERATING SYSTEMS • LEARNING TO CORRECTLY USE THE PRESENTED TECHNIQUES AND METHODS • ABILITY TO ANALYZE VARIOUS SCENARIOS OF SYSTEM SECURITY
6.2 Competenţe transversale Cross-cutting skills	• **PREOCUPAREA PENTRU SECURIZAREA SISTEMELOR DE OPERARE** • **DEZVOLTAREA GANDIRII CRITICE PRIN ANTRENAREA CAPACITATILOR DE EVIDENTIERE A PUNCTELOR VULNERABILE** • **APLICAREA REGULILOR DE MUNCĂ RIGUROASĂ ŞI EFICIENTĂ, MANIFESTAREA UNOR ATITUDINI RESPONSABILE FAŢĂ DE DOMENIUL ŞTIINŢIFIC ŞI DIDACTIC, PENTRU VALORIFICAREA OPTIMĂ ŞI CREATIVĂ A PROPRIULUI POTENŢIAL ÎN SITUAŢII SPECIFICE, CU RESPECTAREA PRINCIPIILOR ŞI A NORMELOR DE ETICĂ PROFESIONALĂ.** • **UTILIZAREA EFICIENTĂ A SURSELOR INFORMAŢIONALE ŞI A RESURSELOR DE COMUNICARE ŞI FORMARE PROFESIONALĂ ASISTATĂ, ATÂT ÎN LIMBA ROMÂNĂ, CÂT ŞI ÎNTR-O LIMBĂ DE CIRCULAŢIE INTERNAŢIONALĂ.**

	• A GENERAL CONCERN TOWARD OPERATING SYSTEM SECURITY • DEVELOPING CRITICAL THINKING BY TRAINING THE CAPACITY TO FIND VULNERABLE SPOTS. • APPLYING THE RULES FOR PERFORMING RIGOROUS AND EFFICIENT WORK AND MANIFESTING A RESPONSIBLE ATTITUDE TOWARD RESEARCH AND TEACHING, FOR AN OPTIMAL AND CREATIVE HARNESSING OF ONE'S OWN POTENTIAL IN SIMILAR SITUATIONS, WHILE FOLLOWING THE PRINCIPLES AND POLICIES OF PROFESSIONAL ETHICS. • EFFICIENTLY USING INFORMATION SOURCES AND COMMUNICATION RESOURCES, AS WELL AS ASSISTED PROFESSIONAL DEVELOPMENT.

7. OBIECTIVELE DISCIPLINEI

COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei Course goal	• **DEPRINDEREA ȘI APROFUNDAREA FUNCȚIONALITĂȚILOR PRINCIPALE ALE UNUI SISTEM DE OPERARE** • **STUDENTII ISI VOR DEZVOLTA CAPACITATEA DE A INTELEGE SI ANALIZA DIFERITE PROBLEME ÎN SECURIZAREA SISTEMELOR DE OPERARE ŞI A TEHNICILOR DE A LE ADRESA.** • DEVELOPING A DEEPER UNDERSTANDING OF THE MAIN FUNCTIONALITY OF AN OPERATING SYSTEM • DEVELOPING THE CAPACITY TO UNDERSTAND AND ANALYZE VARIOUS ASPECTS REGARDING OPERATING SYSTEMS SECURITY, AS WELL AS TECHNIQUES TO ADDRESS SUCH PROBLEMS
7.2 Obiective specifice Course objectives	• **INTELEGEREA EVOLUTIEI SISTEMELOR DE OPERARE SI A SECURITATII ACESTORA.** • **DEZVOLTAREA ABILITĂŢII DE ANALIZĂ A IMPLEMENTĂRII UNUI SISTEM DE OPERARE** • UNDERSTANDING THE EVOLUTION OF OPERATING SYSTEMS AND THEIR SECURITY • DEVELOPING THE ABILITY TO ANALYZE AND IMPLEMENT AN OPERATING SYSTEM

8. CONŢINUTURI

CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
1. History and basic concepts		**RESURSE FOLOSITE** **- VIDEOPROIECTOR** **- CALCULATOR** **- TABLĂ** RESOURCES: - VIDEO PROJECTOR - COMPUTER - BLACK/WHITE BOARD
2. Processes and threads. System calls. Process virtualization. Interrupts. Execution planning.		
3. Synchronization. Blocking and priority inversion. Embedded systems and		
4. Advanced planning. Energy. Multicore systems.		
5. Virtual memory		
6. Virtualization. Emulation vs. binary translation.		
7. File systems		
8. Advanced topics in operating systems security.		

Bibliografie/ Bibliography**:**

- Operating Systems: Internals and Design Principles (8th Edition), William Stallings, 2014

<table>
<tr><td colspan="3">

Modern Operating Systems (4rd Edition), Andrew S. Tanenbaum, Prentice Hall, 2014
Operating System Concepts (9th edition), Abraham Silberschatz, Peter B. Galvin and Greg Gagne, 2012
Virtual Machines, James E. Smith and Ravi Nair, Elsevier / Morgan Kaufmann, 2005
Linux Kernel Development (3rd Edition), Robert Love, 2010

</td></tr>
<tr><td>8.2. Seminar [temele dezbătute în cadrul seminariilor]</td><td>Metode de predare-învăţare
Teaching and learning methods</td><td>Observaţii
Remarks</td></tr>
<tr><td></td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td></td></tr>
<tr><td>Bibliografie/ Bibliography:</td></tr>
<tr><td>8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei]
Laboratory [laboratory themes, projects, etc., according to the discipline calendar]</td><td>Metode de predare-învăţare
Teaching and learning methods</td><td>Observaţii
Remarks</td></tr>
<tr><td>APLICAŢII PRACTICE ALE TEMELOR PREZENTATE ÎN CADRUL CURSULUI
PRACTICAL APPLICATIONS OF THE THEMES PRESENTED DURING THE CLASS</td><td>IMPLEMENTAREA FUNCTIONALITĂŢILOR DESCRISE LA CURS PRINTR-O SERIE DE TEME CARE NECESITĂ MODIFICAREA CODULUI UNUI SISTEM DE OPERARE
IMPLEMENTING THE FUNCTIONALITIES DESCRIBED DURING THE THE COURSE THROUGH A SERIES OF ASSIGNMENTS REQUIRING REWRITING PARTS OF AN OPERATING SYSTEM</td><td></td></tr>
<tr><td>Bibliografie/ Bibliography:

ACEEAŞI CA LA CURS.
SAME AS FOR THE COURSE.</td><td></td><td></td></tr>
<tr><td>8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant]
Project [only for disciplines that have a project in the curriculum]</td><td>Metode de predare-învăţare
Teaching and learning methods</td><td>Observaţii
Remarks</td></tr>
<tr><td colspan="3">Bibliografie/ Bibliography:</td></tr>
</table>

9. SCURTĂ DESCRIERE*

BRIEF DESCRIPTION*

*** COROBORAREA CONŢINUTURILOR DISCIPLINEI CU AŞTEPTĂRILE REPREZENTANŢILOR COMUNITĂŢII EPISTEMICE, ASOCIAŢIILOR PROFESIONALE ŞI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

NOTIUNILE INTRODUSE IN ACEST CURS VOR DEZVOLTA CAPACITATEA DE ANALIZA A STUDENTILOR SI VOR DUCE LA O MAI BUNA SI PROFUNDA INTELEGERE A PROBLEMELOR LEGATE DE SECURITATE A RETELELOR DE COMUNICATII. CURSUL OFERA INFORMATII ACTUALE IN DOMENIUL RETELELOR DE COMUNICATII (RETELE DE CALCULATOARE, RETELE DE COMUNICATII MOBILE), PREGATIND CURSANTII ATAT PENTRU O BUNA INTEGRARE PE PIATA MUNCII, CAT SI PENTRU O CONTINUARE A STUDIILOR APROFUNDATE SAU CERCETARE.

THE AIM OF THIS COURSE IS TO DEVELOP THE STUDENTS' ABILITY TO ANALYZE AND GET A BETTER AND DEEPER UNDERSTANDING OF THE OPERATING SYSTEMS SECURITY PROBLEMS. THE COURSE GIVES ACTUAL INFORMATION IN THE OPERATING SYSTEMS AREA, PREPARING STUDENTS FOR A BETTER INTEGRATION IN THE WORK FORCE, AS WELL AS FOR ADVANCED STUDIES AND RESEARCH,

10. EVALUARE
EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs Course	**CUNOASTEREA TERMINOLOGIEI SI A CONCEPTELOR DE BAZA.** **CUNOASTEREA CONCEPTELOR DE SISTEME DE OPERARE ŞI A TEHNICILOR DE SECURITATE PREZENTATE PE PARCURSUL CURSULUI** **ABILITATEA DE A APLICA CUNOSTINTELE DOBANDITE ÎN CAZURI PARTICULARE** **ABILITATEA DE A ANALIZA SECURITATEA UNUI SISTEM ÎN DIFERITE SCENARII** **CAPACITATEA DE A ALEGE O TEMA NETRATATĂ DIRECT IN CURS, ABILITATEA DE INTELEGERE ŞI PREZENTARE A ACESTEIA.** BASIC CONCEPTS AND TERMINOLOGY KNOWLEDGE. KNOWLEDGE OF THE SPECIFIC OPERATING SYSTEMS AND SECURITY CONCEPTS PRESENTED DURING THE CLASS. ABILITY TO APPLY THE GAINED KNOWLEDGE TO NEW SITUATIONS. ABILITY TO ANALYZE THE SECURITY OF A SYSTEMS IN VARIOUS SCENARIOS. GIVEN A RELATED CONCEPT, THE ABILITY TO UNDERSTAND IT AND PRESENT IT.	**EXAMEN SCRIS** WRITTEN EXAM	**50%**
10.5.1. Seminar Seminar			
10.5.2. Laborator Laboratory	**CAPACITATEA DE A CREA PROGRAME SOFTWARE SAU DE UTILIZA PROGRAME SOFTWARE DEJA EXISTENTE PENTRU ÎNDEPLINIREA CERINŢELOR.** ABILITY TO CREATE NEW SOFTWARE, OR TO USE EXISTING SOFTWARE, FOR SATISFYING THE REQUIREMENTS OF THE ASSIGNMENTS.	**PARTICIPAREA ŞI ACTIVITATEA ÎN CADRUL LABORATORULUI** **TEME INDIVIDUALE ŞI / SAU DE GRUP** **REDACTAREA ŞI PREZENTAREA (ÎN FAŢA COLEGILOR ŞI A PROFESORULUI) UNUI PROIECT / ESEU TEHNIC** ACTIVE INVOLVEMENT DURING THE LAB. HOURS. INDIVIDUAL AND GROUP	**50%**

		ASSIGNMENTS. WRITING AND PRESENTING (TO THE CLASS AND TEACHER) OF A TECHNICAL PROJECT / ESSAY.	
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Nota finala 5 (cinci) Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI

COURSE SYLLABUS

Network Security

1. DATE DESPRE PROGRAM

PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ

COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	**Securitatea reţelelor** Network Security							
2.2. Titularul activităţilor de curs Course instructor				**Lector dr. Ruxandra-Florentina Olimid**				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				**Lector dr. Ruxandra-Florentina Olimid**				
2.4. Anul de studio Year	**I**	**2.5. Semestrul** Semester	**II**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2)] Content	**DS**
							Obligativitate [3)] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE

ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**3**	**din care** of which	**3.2 Curs** Course	**2**	**3.3 Seminar** Seminar	**1**	
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**42**	**din care** of which	**3.5 Curs** Course	**28**	**3.6 Seminar** Seminar	**14**	
3.7 Total ore studiu individual Student workload for individual study	134	**3.8 Total ore pe semestru** Total student workload / semester	180	**3.9 Număr de credite** ECTS		**6**	
DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF INDIVIDUAL STUDY WORKLOAD	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes						**56**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)						**20**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)						**58**
	Tutoriat (opţional) Individual consultations (optional)						
	Examinări Evaluations / exams						**4**
	Alte activităţi Other activities						

4. PRECONDIŢII
PRECONDITIONS

4.1 De curriculum Curriculum-related	• **Criptografie** Cryptography • **Noţiuni de de bază în reţelistică** Basic networking concepts
4.2 De competenţe Skills-related	

5. CONDIŢII
CONDITIONS

5.1 De desfăşurare a cursului For running the course	• **Cursul se va desfăşura într-o sală dotată cu videoproiector** The lectures will be given in a room equipped with projector
5.2 De desfăşurare a seminarului For running the seminar	• **Studenţii trebuie să se implice activ în cadrul seminarului / laboratorului / proiectului** Students must be active during the seminar / laboratory / project work • **În cazul în care studenţii întarzie cu predarea temelor de seminar / laborator / a proiectelor, se vor aplica depunctări sau în funcţie de caz, activitatea se va considera nesatisfăcută** If the students fail to deliver the assignments on time, they will receive penalties, or, depending on the case, the assignment might be considered failed

6. COMPETENŢE SPECIFICE ACUMULATE
ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	• **Cunoaşterea conceptelor de bază şi a principiilor securităţii reţelelor** Knowledge of main network security concepts and principles • **Utilizarea corectă a tehnicilor şi metodelor prezentate** Correct usage of the presented techniques and methods • **Analizarea securităţii unor sisteme în diferite scenarii** Analyzing the security of some systems in different scenarios • **Studiul unor tehnici şi protocoale de securitate actuale** The study of current security techniques and protocols
6.2 Competenţe transversale Cross-cutting skills	• **Preocuparea pentru perfecţionarea sistemelor de comunicaţie (în particular a reţelor)** Improvement of communication systems (in particular communication networks) • **Dezvoltarea gândirii critice (în cazul reţelelor) prin antrenarea capacităţilor de evidentiere a punctelor vulnerabile** Develop analytical thinking (in the case of networks) though training capabilities to highlight vulnerabilities • **Aplicarea regulilor de muncă riguroasă şi eficientă, manifestarea unor atitudini responsabile faţă de domeniul ştiinţific şi didactic, pentru valorificarea optimă şi creativă a propriului potenţial în situaţii specifice, cu respectarea principiilor şi a normelor de etică profesională** Apply rigorous and efficient working rules, responsible attitudes towards the scientific and didactic fields for optimal and creative improvement of the student's potential in specific situations, under the principles and norms of professional ethics • **Utilizarea eficientă a surselor informaţionale şi a resurselor de comunicare şi formare profesională asistată** Effective use of information sources and communication and assisted training resources

7. OBIECTIVELE DISCIPLINEI
COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei Course goal	• **Familiarizarea cu standardele şi protocoalele criptografice utilizate în cadrul sistemelor de comunicaţie, în particular a reţelelor cu sau fară fir** Learn about cryptographic standards and protocols used in communication systems, in particular wired and wireless networks

	• **Studenţii îsi vor dezvolta capacitatea de a întelege şi analiza diferite protocoale şi tehnici de securitate** The students will develop their ability to understand and analyze different protocols and security techniques
7.2 Obiective specifice Course objectives	• **Întelegerea evolutiei sistemelor de comunicaţie (a reţelelor) şi a securităţii acestora** Understanding of the evolution of communications systems (networks) and their security • **Dezvoltarea abilităţilor de analiză a securităţii** Developing security analysis skills • **Dezvoltarea abilităţilor de înţelegere, analiză, structurare şi prezentare a unor teme aflate în legătură cu programa cursului** Developing the skills to understand, analyze, structure and present topics related to the course curriculum

8. CONŢINUTURI

CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
8. Aspecte generale de securitate a reţelelor. General network security aspects.	**Prelegeri** Lectures **Studii de caz** Case studies	**Resurse folosite:** Used resources: - **Videoproiector** Projector - **Calculator** Computer - **Tablă** Blackboard / whiteboard
9. **Atacuri şi vulnerabilităţi.** Attacks and vulnerabilities.		
10. Controlul accesului, autorizare şi autentificare. Access control, authorization and authentication.		
11. Standarde şi protocoale de securitate a reţelelor cu fir. Standards and protocols for wired network security.		
12. **Standarde şi protocoale de securitate a reţelelor fără fir. Securitatea reţelelor mobile.** Standards and protocols for wireless network security. Mobile networks security.		
13. Topici speciale de securitate a reţelelor. Special topics in network security.		

Bibliografie/ Bibliography**:**

1. **Standarde**/Standards: **IETF** https://tools.ietf.org, **3GPPP** http://www.3gpp.org/specifications, **ETSI** http://www.etsi.org/standards
2. **W.Stallings, Cryptography and Network Security - Principles and Practices, Prentice Hall, 2005.** http://www.inf.ufsc.br/~bosco.sobral/ensino/ine5680/material-cripto-seg/2014-1/Stallings/Stallings_Cryptography_and_Network_Security.pdf
3. **J.Edney, W.A. Arbaugh Real 802.11 security : Wi-Fi protected access and 802.11i, Addison-Wesley 2004.**
4. **D.Forsberg, G.Horn, W.D.Moeller, V.Niemi, LTE Security, John Wiley & Sons, 2012.**
5. **V.Niemi,K.Nyberg, UMTS Security, John Wiley & Sons, 2003.**
6. **R.Oppliger, SSL and TLS, Theory and Practice, Artech House, 2009.**
7. **J.M.Kizza, Computer Network Security, Springer, 2005.**
8. **Articole ştiinţifice.** / Research papers.

8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Aplicaţii practice ale temelor prezentate în cadrul cursului Practical applications of the themes presented during the course	**Rezolvarea unor probleme practice** Solving practical problems	**Resurse folosite:** Used resources: - **Videoproiector** Projector

	Studii de caz Case studies **Utilizarea unor programe software specifice** Use of specific software tools **Atacuri şi implementări sigure în practică** Attacks and secure implementations in practice	- **Calculator** Computer - **Tablă** Blackboard / whiteboard
Bibliografie/ Bibliography**:** **Aceeaşi ca la curs** Same as for the course		
8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

9. SCURTĂ DESCRIERE*

BRIEF DESCRIPTION*

*** COROBORAREA CONŢINUTURILOR DISCIPLINEI CU AŞTEPTĂRILE REPREZENTANŢILOR COMUNITĂŢII EPISTEMICE, ASOCIAŢIILOR PROFESIONALE ŞI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

Noţiunile introduse în acest curs vor dezvolta capacitatea de analiză a studenţilor şi vor duce la o mai bună şi profundă înţelegere a problemelor legate de securitate a reţelelor de comunicaţii. Cursul oferă informaţii actuale în domeniul reţelelor de comunicaţii (reţele de calculatoare, reţele de comunicaţii mobile), pregătind cursanţii atât pentru o bună integrare pe piaţa muncii, cât şi pentru o continuare a studiilor aprofundate sau cercetare.

The concepts introduced in this course will develop the students' analytical capability and will lead to a better and deeper understanding of the network security issues. The course provides actual information in the field of communications networks (computer networks, mobile communications networks), preparing students for an easy integration into the labor market as well as for further advanced studies or research.

10. EVALUARE

EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs Course	**Cunoaşterea terminologiei si a conceptelor de bază.** Knowledge of the terminology and the basic concepts. **Cunoaşterea protocoalelor şi a tehnicilor de securitate prezentate pe parcursul cursului.** Knowledge of the security protocols and techniques introduced during the course.	**Examen** Exam	**50%**

	Abilitatea de a aplica cunoştinţele dobândite în cazuri particulare. Ability to apply the acquired knowledge in particular cases. **Abilitatea de a analiza securitatea unui sistem de comunicaţii în diferite scenarii.** Ability to analyze the security of a communication system in different scenarios.		
10.5.1. Seminar Seminar			
10.5.2. Laborator Laboratory	**Capacitatea de a crea programe software sau de utiliza programe software deja existente pentru îndeplinirea cerinţelor.** Ability to create software or use existing software tools to meet the requirements. **Capacitatea de a alege o temă netratată direct în curs, abilitatea de inţelegere şi prezentare a acesteia.** Ability to select topic not covered by the lecture material, understand and present it.	**Participarea şi activitatea în cadrul laboratorului.** Participation and activity during the laboratory. **Teme si proiecte individuale şi / sau de grup.** Individual and /or group assignments and projects. **Redactarea şi prezentarea (în faţa colegilor şi a profesorului) unui proiect / eseu tehnic.** Write and present (to the fellow students and the teacher) a technical project / essay.	**50%**
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Nota finala 5 (cinci) Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI

COURSE SYLLABUS

Program verification

1. DATE DESPRE PROGRAM

PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ

COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	**VERIFICAREA PROGRAMELOR** **Program verification**							
2.2. Titularul activităţilor de curs Course instructor				**Conf. dr. Denisa Diaconescu** **Associate professor PhD Denisa Diaconescu**				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				**Conf. dr. Denisa Diaconescu** **Associate professor PhD Denisa Diaconescu**				
2.4. Anul de studiu Year	**I**	**2.5. Semestrul** Semester	**II**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2] Content	**DS**
							Obligativitate [3] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE

ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**3**	**din care** of which	**3.2 Curs** Course	**2**	**3.3 Seminar** Seminar	**1**	
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**42**	**din care** of which	**3.5 Curs** Course	**28**	**3.6 Seminar** Seminar	**14**	
3.7 Total ore studiu individual Student workload for individual study	179	**3.8 Total ore pe semestru** Total student workload / semester	225	**3.9 Număr de credite** ECTS		**6**	
DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF INDIVIDUAL STUDY WORKLOAD	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes						**49**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)						**50**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)						**80**
	Tutoriat (opţional) Individual consultations (optional)						
	Examinări Evaluations / exams						**4**
	Alte activităţi Other activities						

4. PRECONDIŢII
PRECONDITIONS

4.1 De curriculum Curriculum-related	**Logică avansată pentru informatică** Logic for computer science
4.2 De competenţe Skills-related	**Capacitate de analiză și sinteză** Analytical and problem-solving skills

5. CONDIŢII
CONDITIONS

5.1 De desfăşurare a cursului For running the course	**Sala dotată cu videoproiector** Seminar room with projector
5.2 De desfăşurare a seminarului For running the seminar	**Laborator de informatică cu videoproiector** Computer room with projector

6. COMPETENŢE SPECIFICE ACUMULATE
ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	• **Înţelegerea diferenţei dintre testarea şi verificarea programelor.** • **Stabilirea deosebirilor dintre o proiectare bună şi verificare formală.** • **Clasificarea şi aprofundarea diferitelor forme de verificare formală.** • Understanding the difference between testing and formal verification. • Identifying the differences between a safe development and formal verification. • Studying different methods of formal verification.
6.2 Competenţe transversale Cross-cutting skills	• **Aplicarea regulilor de muncă riguroasă şi eficientă, manifestarea unor atitudini responsabile faţă de domeniul ştiinţific şi didactic, pentru valorificarea optimă şi creativă a propriului potenţial în situaţii specifice, cu respectarea principiilor şi a normelor de etică profesională.** • **Utilizarea eficientă a surselor informaţionale şi a resurselor de comunicare şi formare profesională asistată, atât în limba română, cât şi într-o limbă de circulaţie internaţională.** • Application of rigorous and efficient working rules, manifestation of responsible attitudes towards the scientific and academic field, optimal and creative assesment of their own potential in specific situations, observing the principles and norms of professional ethics. • Effective use of information resources and communication resources and assisted training, both in Romanian and in an international language.

7. OBIECTIVELE DISCIPLINEI
COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei Course goal	• **În cadrul acestui curs studenții învață ce înseamnă o aplicație software corectă și cum pot dezvolta astfel de aplicații.** • In this course students learn what a correct software application means and how to develop such applications.
7.2 Obiective specifice Course objectives	• **La acest curs studenții învață o serie de tehnici avansate de validare şi verificare a programelor, tehnici ce depăşesc testarea ad-hoc. Accentul este pus pe tehnici care pot fi automatizate, sau parţial automatizate. Cursul prezintă mai multe metode uzuale de definire a semanticii unui program care permit definirea şi demonstrarea corectitudinii programelor.** • At this course students learn a number of advanced validation and verification techniques, techniques that go beyond ad-hoc testing. The focus is on techniques that can be automated or partially automated. The course presents several common methods for defining the semantics of a program that allow for the definition and demonstration of program correctness.

8. CONŢINUTURI
CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
Limbaje de programare. Sintaxă, semantică. Problema corectitudinii programelor.	**Explicaţia** Explanation	**Resurse necesare:** Necessary equipment:

Programming languages. Syntax; semantics. The adequacy problem. **Semantică axiomatică. Logica Hoare. Corectitudine parțială și totală.** Axiomatic semantics. Hoare Logic. Partial and total correctness. **Verificarea programelor cu pointeri. Logica separării.** Verification of programs with pointers. Separation logic. **Verificarea programelor concurente. Logica separării concurentă. Condiții Owicki-Gries.** Verification of concurrent programs. Concurrent separation logic. Owicki-Gries conditions. **Problema satisfiabilității formulelor din logica propozițională. SAT-solvere.** The propositional satisfiability problem. SAT-solvers. **Satisfiabilitate modulo teorii. SMT-solvere. Execuție simbolică și de tip "concolic".** Satisfiability modulo theories. SMT-solvers. Symbolic and concolic execution. **Logici temporale (LTL și CTL). Verificare de tip "model checking".** Temporal logics (LTL and CTL). Model checking. **Abstractizare. Verificare de tip "model checking" marginită. CEGAR.** Abstract interpretation. Bounded model checking. CEGAR.	**Descrierea şi exemplificarea** Description and exemplification **Demonstraţia** Proof	- **Videoproiector** - Projector - **Calculator** - Computer - **Tablă** - Blackboard
Bibliografie/ Bibliography**:** *Logic in Computer Science: Modeling and Reasoning about Systems, 2nd edition,* Michael Huth,Mark Ryan, Cambridge University Press, 2004. *Verification of Sequential and Concurrent Programs, 3rd edition,* Krzysztof R. Apt, Frank S. de Boer, Ernst-Rüdiger Olderog, Springer. *Systems and Software Verification: Model-Checking Techniques and Tools*, Berard, B., Bidoit, M., Finkel, A., Laroussinie, F., Petit, A., Petrucci, L., Schnoebelen, P., Springer, 2001. *Practical Foundations for Programming Languages, 2nd edition,* Robert Harper, Cambridge University Press, 2016. *Model Checking*, Edmund M. Clarke, O. Grumberg, Doron A. Peled, MIT Press, 2000.		
8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		
8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Aplicaţii practice ale temelor prezentate în cadrul cursului. Practical applications of the methods presented during courses.	**Studiul de caz** Case study **Exerciţiul** Exercise	**Resurse necesare:** Necessary equipment: - **Videoproiector** - Projector - **Calculator** - Computer - **Tablă** Blackboard
Bibliografie/ Bibliography**:** **Aceeaşi ca la curs.** The same as for the course.		
8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

9. SCURTĂ DESCRIERE*

BRIEF DESCRIPTION*

*** COROBORAREA CONŢINUTURILOR DISCIPLINEI CU AŞTEPTĂRILE REPREZENTANŢILOR COMUNITĂŢII EPISTEMICE, ASOCIAŢIILOR PROFESIONALE ŞI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

Noţiunile introduse în acest curs vor contribui la abilităţile studenţiilor de a dezvolta produse software de calitate, pregătindu-i mai bine pentru piaţa muncii. Mai mult, cursul oferă şi acces la dezvoltări actuale în domeniul verificării, pregătind astfel studenţii pentru programe doctorale sau pentru a deveni membrii ai departamentelor de cercetare în firme.

The notions introduced in this course will contribute to the students' skills to develop quality software products, preparing them better for the labor market. Moreover, the course also provides access to ongoing developments in the field of verification, thus preparing students for doctoral programs or becoming members of research departments in companies.

10. EVALUARE

EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs Course	**Evaluare finală.** Final evaluation.	**Lucrare scrisă.** Written exam.	**60%**
10.5.1. Seminar Seminar			
10.5.2. Laborator Laboratory	**Evaluarea temelor de laborator.** Project evaluation.	**Prezentarea temelor de laborator.** Project presentation.	**40%**
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Nota finala 5 (cinci) Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI
COURSE SYLLABUS
Modern Technologies for Securing Information

1. DATE DESPRE PROGRAM
PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ
COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	*Modern Technologies for Securing Information*							
2.2. Titularul activităţilor de curs Course instructor					Asist.Dr. Mihăiță Drăgan			
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant					Asist.Dr. Mihăiță Drăgan			
2.4. Anul de studiu Year	**II**	**2.5. Semestrul** Semester	**I**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2] Content	**DF**
							Obligativitate [3] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE
ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**3**	**din care** of which	**3.2 Curs** Course	**1**	**3.3 Seminar** Seminar	**2**
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**42**	**din care** of which	**3.5 Curs** Course	**14**	**3.6 Seminar** Seminar	**28**

3.7 Total ore studiu individual Student workload for individual study	138	**3.8 Total ore pe semestru** Total student workload / semester	180	**3.9 Număr de credite** ECTS	**6**

DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes	**40**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)	**34**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)	**60**
	Tutoriat (opţional) Individual consultations (optional)	**-**
	Examinări Evaluations / exams	**4**
	Alte activităţi/Other activities	**-**

4. PRECONDIŢII/PRECONDITIONS

4.1 De curriculum/Curriculum-related	Basic knowledge of hardware and software
4.2 De competenţe/Skills-related	Optimal work with the computer

5. CONDIŢII/CONDITIONS

5.1 De desfăşurare a cursului/For running the course	The course takes place in a hall with a projector
5.2 De desfăşurare a seminarului For running the seminar	The lab is hosted in a hall with a projector and dedicated networking equipment. Promotion of on-line platform test assignments.

6. COMPETENŢE SPECIFICE ACUMULATE
ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	The aim of the course is to develop the necessary knowledge for: - understand core security concepts - develop skills in implementing security policies to mitigate risks - differentiating skills in the security market through expertise in order to achieve success in the specialty
6.2 Competenţe transversale Cross-cutting skills	They will acquire the ability to design and manage systems to prevent, combat and monitor security attacks. Developing specialized career-oriented security skills, widening security skills horizons, adding specialized technology expertise

7. OBIECTIVELE DISCIPLINEI
COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei / Course goal	Understand basic security concepts and how to develop and implement security policies to mitigate risks. To acquire the necessary skills to configure, monitor and troubleshoot network security processes.
7.2 Obiective specifice Course objectives	Describe security threats facing modern network infrastructures •Secure Cisco routers and switches •Describe AAA functionalities and implement AAA on Cisco routers using local router database and server-based ACS or ISE •Mitigate threats to networks using ACLs and stateful firewalls •Implement IPS and IDS to secure networks against evolving attacks •Mitigate threats to email, web based and endpoints attacks and common Layer 2 attacks •Secure communications to ensure integrity, authenticity and confidentiality. •Describe the purpose of VPNs, and implement Remote Access and Site-to-Site VPNS. •Secure networks using ASA

8. CONŢINUTURI/CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
1. Introductory - Identity Service Engine (ISE), BYOD and MDM, Network Topologies, Cloud Web Security, Network Security for a virtual environment.	Using the video projector. On board.	Focus on router and switch CLI-based configurations. Updated and expanded content : IPS (next-generation IPS), Firewall (next-generation FW), VPNs, End-point Security, Web Security.
2. Modern Network Security Threats	Using the video projector. On board.	Explain security threats in modern network infrastructures and how to mitigate them.
3. Securing Network Devices	Using the video projector. On board.	Secure routers, firewalls, servers, host.
4. 3 A : ”Authentication, Authorization and Accounting”	Using the video projector. On board.	Implement AAA on routers and servers using local router database and server-based ACS or Identity Service Engine (ISE).
5. Implementing Firewall Technologies	Using the video projector. On board.	Implement firewall technologies to secure network perimeter.
6. Implementing Intrusion Prevention	Using the video projector. On board.	Implement IPS to mitigate attacks on networks.
7. Securing the Local Area Network	Using the video projector. On board.	Secure endpoints and mitigate common Layer 2 attacks.
8. Cryptographic Systems	Using the video projector. On board.	Secure communications to ensure integrity, authenticity and confidentiality.

9. Implementing Virtual Private Networks	Using the video projector. On board.	Implement secure Virtual Private Networks.
10. Implementing the Adaptive Security Appliance (ASA)	Using the video projector. On board.	Implement an ASA firewall configuration using the CLI.
11. Advanced Adaptive Security Appliance (AASA)	Using the video projector. On board.	Implement an ASA firewall configuration and VPNs using ASDM.
12. Managing a Secure Network	Using the video projector. On board.	Test network security and create a technical security policy.

Bibliografie/ Bibliography**:**

"Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation" Bruce Dang; 2014
"Threat Modeling: Designing for Security" Adam Shostack; 2014
"Android Hacker's Handbook" Joshua J. Drake; 2014
"The Art of Computer Virus Research and Defense" Peter Szor; 2005
"Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" Michael Sikorski; 2012

8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
1. Introductory - Identity Service Engine (ISE), BYOD and MDM, Network Topologies, Cloud Web Security, Network Security for a virtual environment.	On Table- Examples, Solutions	
2. Modern Network Security Threats	On Table- Examples, Solutions	
3. Securing Network Devices	On Table- Examples, Solutions	
4. 3 A : "Authentication, Authorization and Accounting"	On Table- Examples, Solutions	
5. Implementing Firewall Technologies	On Table- Examples, Solutions	
6. Implementing Intrusion Prevention	On Table- Examples, Solutions	
7. Securing the Local Area Network	On Table- Examples, Solutions	
8. Cryptographic Systems	On Table- Examples, Solutions	
9. Implementing Virtual Private Networks	On Table- Examples, Solutions	
10. Implementing the Adaptive Security Appliance (ASA)	On Table- Examples, Solutions	
11. Advanced Adaptive Security Appliance (AASA)	On Table- Examples, Solutions	
12. Managing a Secure Network	On Table- Examples, Solutions	

Bibliografie/ Bibliography**:**

"Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation" *Bruce Dang; 2014*
"Threat Modeling: Designing for Security" Adam Shostack; 2014
"Android Hacker's Handbook" Joshua J. Drake; 2014
"The Art of Computer Virus Research and Defense" Peter Szor; 2005
"Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" Michael Sikorski; 2012

8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
1. Introductory - Identity Service Engine (ISE), BYOD and MDM, Network Topologies, Cloud Web Security, Network Security for a virtual environment.	Platform online. Working on the equipment. Use specialized programs.	Describe the current network security landscape. Explain how all types of networks need to be protected.
2. Modern Network Security Threats	Platform online. Working on the equipment. Use specialized programs.	Common network security terms: - Threat - Vulnerability - Mitigation

		- Risk
3. Securing Network Devices	Platform online. Working on the equipment. Use specialized programs.	Upon completion of this section, the student should be able to: Explain how to secure a network perimeter. Configure secure administrative access to routers. Configure enhanced security for virtual logins. Configure an SSH daemon for secure remote management.
4. 3 A : ”Authentication, Authorization and Accounting”	Platform online. Working on the equipment. Use specialized programs.	Explain why AAA is critical to network security. Describe the characteristics of AAA.
5. Implementing Firewall Technologies	Platform online. Working on the equipment. Use specialized programs.	Configure standard and extended IPv4 ACLs using CLI. Use ACLs to mitigate common network attacks. Configure IPv6 ACLs using CLI.
6. Implementing Intrusion Prevention	Platform online. Working on the equipment. Use specialized programs.	Upon completion of this section, the student should be able to: Explain zero-day attacks. Understand how to monitor, detect and stop attacks. Describe the advantages and disadvantages of IDS and IPS.
7. Securing the Local Area Network	Platform online. Working on the equipment. Use specialized programs.	Describe endpoint security and the enabling technologies. Explain how AMP is used to ensure endpoint security. Explain how NAC authenticates and enforces the network security policy.
8. Cryptographic Systems	Platform online. Working on the equipment. Use specialized programs.	Explain the requirements of secure communications including integrity, authentication, and confidentiality. Explain cryptography. Describe cryptoanalysis.
9. Implementing Virtual Private Networks	Platform online. Working on the equipment. Use specialized programs.	Describe VPNs and their benefits. Compare site-to-site and remote-access VPNs.
10. Implementing the Adaptive Security Appliance (ASA)	Platform online. Working on the equipment. Use specialized programs.	Upon completion of this section: Compare ASA solutions to other routing firewall technologies. Explain ASA 5505 operation with the default configuration.
11. Advanced Adaptive Security Appliance (AASA)	Platform online. Working on the equipment. Use specialized programs.	Configure an ASA to provide basic firewall services using ASDM. Configure an ASA to provide additional firewall services using ASDM wizards. Configure management settings and services in an ASA using ASDM.

		Configure object groups on an ASA.
12. Managing a Secure Network	Platform online. Working on the equipment. Use specialized programs.	Upon completion of this section: Describe the techniques used in network security testing. Describe the tools used in network security testing.
Bibliografie/ Bibliography**:"Reversing: Secrets of Reverse Engineering",** Eldad Eilam; 2005 **"The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities"** Mark Dowd; 2006. **"The IDA Pro Book: The Unofficial Guide to the World's Most Popular Disassembler"** Chris Eagle; 2011**.** **"The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory"** Michael Hale Ligh; 2014.		
8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

9. SCURTĂ DESCRIERE*

BRIEF DESCRIPTION*

*** COROBORAREA CONŢINUTURILOR DISCIPLINEI CU AŞTEPTĂRILE REPREZENTANŢILOR COMUNITĂŢII EPISTEMICE, ASOCIAŢIILOR PROFESIONALE ŞI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

The knowledge needed to manage a network that uses multiple routers.

10. EVALUARE/EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs / Course	Understanding the notions presented Active participation in the presentation of the materials Examining tests at the end of the course	Computer Written	
10.5.1. Seminar / Seminar	Active participation by presenting examples and news in the field (worms, trojan horses, viruses, attacks, solutions).	Colloquy	
10.5.2. Laborator Laboratory	Work done during the lab Scores from platform tests	Computer Practical work Written	
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI

COURSE SYLLABUS

Database Security

1. DATE DESPRE PROGRAM

PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ

COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	**Securitatea bazelor de date** Database Security							
2.2. Titularul activităţilor de curs Course instructor				**Lect. Dr. Letiția Marin**				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				**Lect. Dr. Letiția Marin**				
2.4. Anul de studio Year	**II**	**2.5. Semestrul** Semester	**I**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2] Content	**DS**
							Obligativitate [3] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE

ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**3**	**din care** of which	**3.2 Curs** Course	**2**	**3.3 Seminar** Seminar	**1**	
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**42**	**din care** of which	**3.5 Curs** Course	**28**	**3.6 Seminar** Seminar	**14**	
3.7 Total ore studiu individual Student workload for individual study	179	**3.8 Total ore pe semestru** Total student workload / semester	225	**3.9 Număr de credite** ECTS		**6**	
DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF INDIVIDUAL STUDY WORKLOAD	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes						**49**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)						**50**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)						**72**
	Tutoriat (opţional) Individual consultations (optional)						**8**
	Examinări Evaluations / exams						**4**
	Alte activităţi Other activities						

4. PRECONDIŢII
PRECONDITIONS

4.1 De curriculum Curriculum-related	**Sisteme de operare: proiectare și securitate** Operating systems: design and security
4.2 De competenţe Skills-related	**Cunoștințe de baze de date; cunoștințe de sisteme de gestiune a bazelor de date, cunoștințe de programare** Databases, databases management systems, operating systems and programming knowledge

5. CONDIŢII
CONDITIONS

5.1 De desfăşurare a cursului For running the course	**Cursul se va desfășura într-o sală prevăzută cu tablă și video-proiector** The course will take place in a room having a whiteboard and a video-projector.
5.2 De desfăşurare a seminarului For running the seminar	**Seminarul (laboratorul) se va desfășura într-o sală cu stații de lucru, tablă și video-proiector** The seminar will be take place in a laboratory having working stations for each student, a white board and a video-projector.

6. COMPETENŢE SPECIFICE ACUMULATE
ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	• **Capacitatea de a analiza și formula cerințe de securitate pentru bazele de date și aplicațiile care le utilizează.** • **Cunoașterea metodelor avansate de autentificare și identificarea corectă a aspectelor legate de controlul accesului.** • **Cunoașterea vulnerabilităților din aplicații și a metodelor de prevenire a acestora.** • **Asigurarea securității bazelor de date din perspectiva adminstrării acestora** • The ability to analyze and formulate security requirements for databases and applications which use them. • The knowledge of the advanced methods of authentication and the correct identification of the aspects related to the access control. • The knowledge of the vulnerabilities in applications and the methods of preventing them. • The approach of the database security from the point of view of the database administration.
6.2 Competenţe transversale Cross-cutting skills	• **Documentarea riguroasă și judicioasă în scopul rezolvării unor teme și probleme concrete.** • **Organizarea activităţilor în proiectele realizate în echipă.** • **Capacitatea de a identifica, înțelege, dezvolta și aplica materiale corespunzătoare bibliografiei cursului, referatelor și proiectelor.** • **Capacitatea de a redacta si prezenta referate și proiecte.** • Documenting in a rigorous and judicious manner in order to solve concrete problems. • Organizing the activities as part of the projects carried out in teams. • Identifying, understanding, developing and applying materials from the bibliography of the course, essays and projects. • Writing, developing and presenting essays and projects.

7. OBIECTIVELE DISCIPLINEI
COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei Course goal	• **Familiarizarea studenților cu direcții actuale care presupun dezvoltări teoretice cu aplicații în securitate.** • **Studenții își vor dezvolta capacitatea de a modela și analiza probleme de securitate, de a citi și prezenta articole științifice, de a lucra în echipă și vor fi stimulați să aducă contribuții originale.** • Familiarization of the students with current research directions which involve theoretical developments with applications in security. • Students will develop their ability to model and analyze security problems, to read

	and present scientific articles, to work in teams and will be stimulated to bring original contributions.
7.2 Obiective specifice Course objectives	**Cursul conține trei module, având următoarele obiective:** • **(1) fundamente teoretice ale securității bazelor de date;** • **(2) securitate în sistemele de gestiune a bazelor de date (autentificare, autorizare, criptare de date, profiluri, audit) cu referire preponderentă la sistemul Oracle;** • **(3) vulnerabilități ale aplicațiilor ce utilizează baze de date, detectarea și prevenirea acestora.** The course contains three modules, having the following objectives: • (1) theoretical foundations of database security; • (2) security in database management systems (authentication, authorization, data encryption, profiles, auditing) with predominant reference to the Oracle system; • (3) vulnerabilities of the applications that are using databases; detecting and preventing these vulnerabilities.

8. CONŢINUTURI

CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
1. Introducere în securitatea bazelor de date; evoluția domeniului de cercetare.	**Pentru predare se vor folosi slide-uri și exemple de cod executate pentru a ilustra conceptele și metodele din curs. Cursul va avea loc într-o sală cu tablă astfel încât unele dintre conceptele prezentate pe slide-uri vor putea fi explicate și detaliate la tablă.**	**Studenții vor fi încurajați să propună teme ce vor fi prezentate în cadrul laboratorului. De asemenea, studenților li se va propune să găsească materiale noi în direcțiile teoretice prezentate la curs; acest demers se va putea concretiza în elaborarea de referate ce vor fi prezentate în unele dintre laboratoare.**
2. Aspecte obligatorii și opționale ale securității sistemelor de gestiune a bazelor de date securizate pe niveluri multiple.		
3. Problema inferenței în bazele de date. Arhitecturi ale modulelor de proiectare a schemei și de procesare a interogărilor și actualizărilor.		
4. Constrângeri de securitate și rețele semantice multinivel.		
5. Metode de autentificare în bazele de date. Privilegii obiect și sistem, role-uri, acordarea și revocarea acestora. Aplicarea vizualizărilor în asigurarea securității datelor.		
6. Definirea profilurilor de resurse.		
7. Metode de audit al bazelor de date.		
8. Vulnerabilități ale bazelor de date (SQL Injection, PL/SQL Injection), cauze, detectare și soluționare; practici corecte în dezvoltarea codului sursă al aplicațiilor din pespectiva securității acestora.		
1. Introduction in database security; the evolution of this research field.	In teaching, presentation slides and source code examples, executed in order to illustrate the concepts and methods from the course, will be used. The course will take place in a room with a whiteboard, so that some of the concepts presented on the slides can be explained in better detail.	Students will be encouraged to propose new subjects that will be presented during the laboratories. Also, the students will be advised to find new papers, concerning the theoretical topics and research directions presented in the course; this work could be expressed through the writing of essays and reports, which are supposed to be presented in some of the laboratories.
2. Mandatory and discretionary aspects of the multi-level secured database systems.		
3. The inference problem in databases. Architectures of the design module for schemas and of the processing modules for queries and updates.		
4. Security constraints and multi-level semantic networks.		
5. Methods of authentication in databases. Object and system privileges, roles, granting and revoking them. Usage of views in data security.		
6. Defining resource profiles.		
7. Auditing methods in databases.		
8. Database vulnerabilities (SQL Injection, PL/SQL Injection), causes, detection and solution; good practices in the development of the source code of applications, from their security point of view.		

Bibliografie/ Bibliography**:**

1. B. Thuraisingham, Database and Applications Security: Integrating Information Security and Data Management, Auerbach Publications, 2005.

2. A. Basta, M. Zgola, Database Security, Cengage Learning, 2011.
3. H. Afyouni Database Security and Auditing: Protecting Data Integrity and Accessibility, Cengage Learning, 2006.
4. K. Kenan, Cryptography in the Database: The Last Line of Defense, Addison Wesley Publishing Company, 2005.
5. D. Knox, W. Maroulis, S. Gaetjen, Oracle Database 12c Security, Oracle Press, 2015.
6. A. Neagu, Oracle 11g Anti-Hacker's Cookbook, Packt Publishing, 2012.
7. R. Natan, Implementing Database Security and Auditing, Elsevier, 2005.

8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		
8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Pentru anumite tematici studenții vor rezolva teme, vor elabora referate sau vor efectua proiecte de laborator. Vor fi alternate laboratoare de predare cu prezentări ale temelor și proiectelor studenților. For some topics, the students will have to do practical work in the laboratory, elaborate essays or develop projects. The teaching laboratories will alternate with those dedicated to the presentation of the essays and projects completed by the students.	**Teme de laborator, referate și proiecte individuale și/sau de grup.** Laboratory practical work, essays and individual or group projects.	**Această activitate va dezvolta capacitatea de analiză și implementare a măsurilor de securitate pe care le impune un proiect informatic care utilizează baze de date. În privința referatelor, acestea vor pune accent pe probleme de cercetare din domeniu.** These activities will develop the ability of the students to analyze and implement the security measures imposed by a project which involves databases. Concerning the essays, these will focus on research problems in the field.
Bibliografie/ Bibliography**:** **Bibliografia cursului și articole din domeniu.** The course's bibliography and articles in the field.		
8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

9. SCURTĂ DESCRIERE*

BRIEF DESCRIPTION*

*** COROBORAREA CONŢINUTURILOR DISCIPLINEI CU AŞTEPTĂRILE REPREZENTANŢILOR COMUNITĂŢII EPISTEMICE, ASOCIAŢIILOR PROFESIONALE ŞI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

Noțiunile prezentate în acest curs vor dezvolta capacitatea de analiză a studenților în privința asigurării securității datelor și vor conduce la o perspectivă mai completă a problemelor legate de securitatea aplicațiilor care utilizează baze de date. Cursul își propune să completeze aptitudinile de analiză și dezvoltare ale studenților, atrăgând totodată atenția asupra unor probleme de cercetare deschise. Prin urmare, cursul pregătește atât candidați care se pot încadra pe poziții cu un grad ridicat de responsabilitate în cadrul firmelor din domeniu, cât și candidați care pot urma programe doctorale care să includă probleme din securitatea bazelor de date.

The concepts presented in this course will develop the students' ability of analysis, concerning the data security, and will lead towards a more complete perspective on the problems related to the security of the database-driven applications. The course aims to complete the analysis and development skills of the students, also bringing into attention some open research problems.

Therefore, the course prepares both candidates that would be able to occupy positions requiring a high level of responsibility in the companies, and candidates that would be able to attend doctoral programs which also involve database security problems.

10. EVALUARE
EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs Course	**Evaluare finală și pe parcurs** Final and along the way evaluation.	**Lucrare scrisă** Written exam	**50%**
10.5.1. Seminar Seminar			
10.5.2. Laborator Laboratory	**Abilitatea de a realiza un proiect informatic care să reflecte aplicarea diferitelor aspecte ale securității bazelor de date.** The ability to develop a project which would reflect the usage of different aspects of the database security.	**Proiect** Project	**50%**
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Nota finala 5 (cinci) Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI

COURSE SYLLABUS

Special topics in Logic and Security

1. DATE DESPRE PROGRAM

PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ

COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	**Special topics in Logic and Security**							
2.2. Titularul activităţilor de curs Course instructor				**Prof. Ioana Leustean**				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				**Prof. Ioana Leustean**				
2.4. Anul de studiu Year	**II**	**2.5. Semestrul** Semester	**I**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2)] Content	**DS**
							Obligativitate [3)] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE

ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**3**	**din care** of which	**3.2 Curs** Course	**2**	**3.3 Seminar** Seminar	**1**	
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**42**	**din care** of which	**3.5 Curs** Course	**28**	**3.6 Seminar** Seminar	**14**	
3.7 Total ore studiu individual Student workload for individual study	138	**3.8 Total ore pe semestru** Total student workload / semester	180	**3.9 Număr de credite** ECTS		**6**	
DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF INDIVIDUAL STUDY WORKLOAD	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes						**50**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)						**34**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)						**50**
	Tutoriat (opţional) Individual consultations (optional)						
	Examinări Evaluations / exams						**4**
	Alte activităţi Other activities						

4. PRECONDIŢII
PRECONDITIONS

4.1 De curriculum Curriculum-related	**Logica avansata pentru informatica, Criptografie avansata, Securitatea spatiului cybernetic** Advanced Logic for computer science, Advanced Cryptography, Cybersecurity
4.2 De competenţe Skills-related	**Cunostinte de programare, capacitate de analiza si sinteza** General programming knowledge, analytical and problem-solving skills

5. CONDIŢII
CONDITIONS

5.1 De desfăşurare a cursului For running the course	**Sala dotată cu videoproiector** Seminar room with projector
5.2 De desfăşurare a seminarului For running the seminar	**Laborator de informatică cu videoproiector** Computer room with projector

6. COMPETENŢE SPECIFICE ACUMULATE
ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	• **Capacitatea de a analiza comportamentul sistemelor folosind metode formale.** • **Aplicarea tehnicilor de invatarea automata in probleme de securitate.** • The ability to analyze system behavior using formal methods. • The ability to use automated learning techniques in computer security.
6.2 Competenţe transversale Cross-cutting skills	• **Utilizarea eficientă a surselor informaţionale şi a resurselor de comunicare şi formare profesională.** • **Capacitatea de a citi si prelucra materiale profesionale atat in limba romana cat si in limba engleza.** • **Capacitate de a redacta si prezenta proiecte.** • **Desfăşurarea eficientă și eficace a activităţilor organizate în echipă.** • Effective use of information resources; proper use of communication and training resources. • The ability to read and process professional materials both in Romanian and English. • The ability to write and present projects. • Efficient and effective organization of team activities.

7. OBIECTIVELE DISCIPLINEI
COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei Course goal	**Familiarizarea studentilor cu directii actuale care presupun aptitudini practice dar si dezvoltari teoretice cu aplicatii in securitate. Studentii isi vor dezvolta capacitatea de a modela si analiza probleme de securitate, de a citi si prezenta articole stiintifice, de a lucra in echipa si vor fi stimulati sa aduca contributii originale.** Familiarizing students with current directions involving practical skills, as well as theoretical developments with applications in security. The students will develop their ability to model and analyze security issues, to read and present scientific articles, to work in a team, to make original contributions.
7.2 Obiective specifice Course objectives	**Cursul contine doua parti, una practica si una teoretica. Din punct de vedere practice studentii vor fi introdusi in domeniul invatarii automate cu aplicatii in securitate. Din punct de vedere theoretic vor fi studiate metode formale de analiza a problemelor de securitate. Cursul este flexibil, adaptandu-se nevoilor si dezvoltarii domeniului.** The course contains two parts, one practical and one theoretical. From a practical point of view, students will be introduced to automated learning with security applications. From a theoretical point of view, formal methods of analysis of security issues will be studied. The course is flexible, adapting to the needs and development of the field.

8. CONŢINUTURI

CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
Metode formale in securitate: **-logici ale protocoalelor; logica BAN;** **-logici epistemice si aplicatii;** **-logici fuzzy; aplicatii in securitate si invatare automata.** Formal security methods: -logics for protocols; BAN logic; -epistemic logics and applications; -fuzzy logic; applications in security and machine learning.	**Pentru predare se vor folosi slideuri.** We shall use slides for teaching	**Studentii vor fi incurajati sa gasesca materiale noi in directiile propuse de curs. Topicile vor fi actualizate conform evolutiei domeniului.** The students will be encouraged to find new relevant materials. The topics will be updated according to the evolution of the field.
Invatare automata: **-concept generale** **-invatare supervizata, invatare nesupervizata, optimizari ale metodelor de invatare;** **-aplicatii in securitate: detectie de anomalii, clasificare de continut (filtre spam), metode de detectie hibridă, analiza traficului de retea, confidentialitatea datelor.** Machine learning - general concepts - supervised learning, unsupervised learning, optimization methods; -applications to security: anomaly detection, content classification (spam filters), hybrid detection methods, network traffic analysis, data privacy.		
Bibliografie/ Bibliography**:**		
8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
In cadrul seminarului studentii vor prezenta articole de cercetare in directiile cursului; pentru partea de invatare automata vor fi efectuate lucrari de laborator. The students will present research articles whose topics are relevant for the course; laboratory work will be carried out for the machine learning part.	**Teme individuale și/sau de grup.** Group and/or individual homeworks.	**Aceasta activitate va dezvolta creativitatea si capacitatea de analiza a studentilor.** This activity will develop students creativity and analytical ability.
Bibliografie/ Bibliography**:**		
8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		
8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks

Bibliografie/ Bibliography**:**

1. S. Dua, X. DuData Mining and Machine Learning in Cybersecurity, Auerbach Publications Boston, 2011.

2. R. Fagin, J. Y. Halpern, Y. Moses, and M. Y. Vardi, Reasoning about Knowledge. Cambridge, Mass.: MIT Press, 1995

3. J. Y. Halpern , K. R. O'Neill, Anonymity and information hiding in multiagent systems, J. of Computer Security 13 (2005): 483-514

6. A. Maloof (Ed), Machine Learning and Data Mining for Computer Security, Springer, 2006.

7. P.Y.A. Ryan, S.A. Schneider,. M.H. Goldsmith, G. Lowe and A.W. Roscoe, The Modelling and Analysis of Security Protocols: The CSP approach, Addison-Wesley Professional, 2000

9. SCURTĂ DESCRIERE/ BRIEF DESCRIPTION*

Notiunile introduse in acest curs vor dezvolta capacitatea de analiza a studentilor si vor duce la o mai buna si profunda intelegere a problemelor legate de securitate. Oferind acces la dezvoltari actuale – teoretice, dar cu aplicabilitate practica – cursul isi propune devolte aptitudini de cercetare si inovare, pregatind candidati care pot urma programe doctorale si care pot deveni membrii ai departamentelor de cercetare ale firmelor din domeniu.
The notions introduced in this course will develop the students' ability to analyze and lead to a better and deeper understanding of security issues. By providing access to current theoretical and practical applications, the course aims to develop research and innovation skills, preparing candidates who can pursue doctoral programs and who can become members of research departments of companies in the field.

10. EVALUARE / EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs Course	**Evaluare finală și pe parcurs.** Final and ongoing evaluation.	**Examen scris si/sau prezentarea unui referat.** Written exam and / or presentation of a report.	**70%**
10.5.1. Seminar Seminar	**Abilitatea de a citi si analiza un articol de cercetare. Ablititatatea de a realiza o prezentare .** The ability to read and analyze a research article. The ability to make a presentation.	**Prezentarea unui proiect.** Project presentation.	**30%**
10.5.2. Laborator Laboratory			
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Nota finala 5 (cinci) Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI

COURSE SYLLABUS

LOGIC AND CODE THEORY

1. DATE DESPRE PROGRAM

PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ

COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	**LOGICA SI TEORIA CODURILOR / LOGIC AND CODE THEORY**							
2.2. Titularul activităţilor de curs Course instructor				**Conf. Dr. Mihai Prunescu**				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				**Conf. Dr. Mihai Prunescu**				
2.4. Anul de studiu Year	**II**	**2.5. Semestrul** Semester	**II**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2] Content	**DS**
							Obligativitate [3] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE

ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week	**3**	**din care** of which	**3.2 Curs** Course	**2**	**3.3 Seminar** Seminar	**1**	
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program	**30**	**din care** of which	**3.5 Curs** Course	**20**	**3.6 Seminar** Seminar	**10**	
3.7 Total ore studiu individual Student workload for individual study	19	**3.8 Total ore pe semestru** Total student workload / semester	22	**3.9 Număr de credite** ECTS		**7,5**	
DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF INDIVIDUAL STUDY WORKLOAD	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes						**60**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)						**51**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)						**80**
	Tutoriat (opţional) Individual consultations (optional)						
	Examinări Evaluations / exams						**4**
	Alte activităţi Other activities						

4. PRECONDIŢII
PRECONDITIONS

4.1 De curriculum Curriculum-related	
4.2 De competenţe Skills-related	

5. CONDIŢII
CONDITIONS

5.1 De desfăşurare a cursului For running the course	
5.2 De desfăşurare a seminarului For running the seminar	

6. COMPETENŢE SPECIFICE ACUMULATE
ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	**CS1 Operarea cu noţiuni si metode teoretice** **CS1 Skills in using theoretic notions and methods** **CS2 Demonstrarea rezultatelor matematice folosind diferite concepte şi raționamente matematice** **CS2 Proof of mathemtical results using mathematical concepts and reasoning** **CS3 Cresterea bazei teoretice pentru idei de implementare, algoritmi, logistica** CS3 To increse the theoretical basis for new ideas in implementation, algorithms, logistic CS4 Conectarea la domenii actuale in cercetare CS4 Connection to main-stream research CS5 Cresterea capacitatii de asimilare din surse stiintifice contemporane CS5 Increase familiarity with modern scientific / research sources (books, articles) CS6 Posibilitatea de a efectua munca de cercetare in domenii actuale si de a obtine rezultate noi CS6 The students get the opportunity to make research in modern research areas and to obtain new research results
6.2 Competenţe transversale Cross-cutting skills	**CT1 Aplicarea regulilor de muncă riguroasă şi eficientă, manifestarea unor atitudini responsabile faţă de domeniul ştiinţific şi didactic, pentru valorificarea optimă şi creativă a propriului potenţial în situaţii specifice, cu respectarea principiilor şi a normelor de etică profesională.** CT1 Exact proficient work, responsibility towards science and academia, optimal evaluation of the own potential, respecting professional deontology and ethics. **CT2 Desfăşurarea eficientă şi eficace a activităţilor organizate în echipă.** CT2 Team work abilities. **CT3 Utilizarea eficientă a surselor informaţionale şi a resurselor de comunicare şi formare profesională asistată, atât în limba engleza, cât şi în romana.** CT3 Efficient use of informational sources, as of communication skills, both in English and Romanian.

7. OBIECTIVELE DISCIPLINEI
COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei Course goal	**Familiarizarea studentilor cu directii actuale care presupun dezvoltari teoretice cu aplicatii in securitate. Studentii isi vor dezvolta capacitatea de a citi si prezenta articole stiintifice, de a lucra in echipa si vor fi stimulati sa aduca contributii originale.** Increse familiarity with actual directions of development with applications in IT security.

	The students develop their skills to read and understand scientific papers, to work in a team and to make original achievements.
7.2 Obiective specifice Course objectives	**Cursul se doreste a fi unul flexibil, adaptandu-se nevoilor si dezvoltarii domeniului. Pentru inceput propune doua directii care se afla la confluenta dintre logica si securitate: aplicatii ale teoriei complexitatii in securitate, si aplicatii ale calculului cuantic (quantum computing) in teoria complexitatii si in securitate.** The lecture will be flexible, ready to adapt to the development in the area. For the beginning we focus in two directions in logic and security: to apply complexity theory in security, and to apply code theory in complexity theory and in security.

8. CONŢINUTURI

CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
1. Teoria complexitatii in criptografie si securitate / Complexity theory in cryptography and security	Explicația. / Explanations. Demonstrația. / Proofs. Descrierea și exemplificarea. / Descriptions and examples. Conversația euristică. / Heuristic communication and persuasion.	Resurse: Pe lângă materialele bibliografice indicate, studenții sînt încurajați să folosească resursele online disponibile pe Internet. Students are encouraged to use also online resources.
2. Functii one-way / One-way functions		
3. Generatori pseudo-random / Pseudo-random generators		
4. Teorema PCP / The PCP-theorem		
5. Teoria codurilor / Code theory		
6. Coduri Golay, Reed – Muller, Goppa / Golay, Reed-Muller, Goppa Codes		

Bibliografie/ Bibliography**:**

1. Sanjeev Arora and Boaz Barak, Computational Complexity (a modern approach), Cambridge University Press, 2009

2. Mika Hirvensalo, Quantum Computing, Springer Verlag (Natural Computing Series) 2004

3. Wolfgang Willems, Codierungstheorie, de Gruyter Lehrbuch

4. Wolfgang Ebeling, Lattices and Codes, based on Lectures by F. Hirzebruch, Advanced Lectures in Mathematics.

5. Articole științifice din ultima perioadă. /actual research papers.

8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
1. Teoria complexitatii in criptografie si Securitate. / Complexity theory in cryptography and security.	**Munca individuala sau in grup / Individual or group work**	
2. Teoria codurilor. / Code theory.		
Bibliografie/ Bibliography**: Aceeasi ca la curs. / The course bibliography.**		

8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**: Aceeasi ca la curs. / The course**		

bibliography.		
8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

9. SCURTĂ DESCRIERE*

BRIEF DESCRIPTION*

*** COROBORAREA CONŢINUTURILOR DISCIPLINEI CU AŞTEPTĂRILE REPREZENTANŢILOR COMUNITĂŢII EPISTEMICE, ASOCIAŢIILOR PROFESIONALE ŞI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

Notiunile introduse in acest curs vor dezvolta capacitatea de analiza a studentilor si vor duce la o mai buna si profunda intelegere a problemelor legate de securitate. Oferind acces la dezvoltari actuale – teoretice, dar cu aplicabilitate practica – cursul isi propune devolte aptitudini de cercetare si inovare, pregatind candidati care pot urma programe doctorale si care pot deveni membrii ai departamentelor de cercetare ale firmelor din domeniu.

Notions introduced by this course will develop the students' analysis and understanding skills in IT security issues. The course gives students acces to actual research and developments. This will contribute to their ability of research and inovation, so they will be able to work in doctoral programs or in the research and development departments of the private companies.

10. EVALUARE

EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs Course	**Evaluare finala si pe parcurs. / final and partial evaluation,**	**Lucrare scrisa. / Class work.**	**50 %.**
10.5.1. Seminar Seminar	Abilitatea de a citi si analiza un articol de cercetare. Ablititatatea de a realiza o prezentare / **Reading and understanding a research paper. The ability to present it in the class.**	Participarea la seminarii. Referat prezentat în fața colegilor și a profesorului. Bonus – participarea la seminariile organizate de grupul de Logica si Securitate. /Participation to seminaries, presentation, participation to other seminaries organized by the Logic and Security Group.	**50%**
10.5.2. Laborator Laboratory			
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in			

planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Nota finala 5 (cinci) Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			

FIŞA DISCIPLINEI

COURSE SYLLABUS

Reverse Engineering and Exploitation

1. DATE DESPRE PROGRAM

PROGRAM IDENTIFICATION DETAILS

1.1 **Instituţia de învăţământ superior** Higher education institution	**UNIVERSITATEA DIN BUCUREŞTI** UNIVERSITY OF BUCHAREST
1.2 **Facultatea** Faculty	**FACULTATEA DE MATEMATICĂ ŞI INFORMATICĂ** FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
1.3 **Departamentul** Department	**DEPARTAMENTUL DE INFORMATICĂ** DEPARTMENT OF COMPUTER SCIENCE
1.4 **Domeniul de studii** Field of studies	**INFORMATICĂ** COMPUTER SCIENCE
1.5 **Ciclul de studii** Cycle of studies (degree)	**MASTER** **MASTER**
1.6 **Programul de studii / calificarea** Degree program / qualification	**SECURITATE ŞI LOGICĂ APLICATĂ** SECURITY AND APPLIED LOGIC
1.7 **Forma de învăţământ** Mode of study	**ZI** FULL-TIME
1.8 **Limba de predare** Language of teaching	**ENGLEZĂ** ENGLISH

2. DATE DESPRE DISCIPLINĂ

COURSE IDENTIFICATION DETAILS

2.1. Denumirea disciplinei Course title	**Inginerie inversă şi explotarea vulnerabilitatilor** Reverse Engineering and Exploitation							
2.2. Titularul activităţilor de curs Course instructor				**Lector dr. Ruxandra-Florentina Olimid**				
2.3. Titularul activităţilor de seminar / laborator / proiect Seminar instructor/Teaching assistant				**Lector dr. Ruxandra-Florentina Olimid**				
2.4. Anul de studio Year	**II**	**2.5. Semestrul** Semester	**II**	**2.6. Tipul de evaluare** Type of evaluation	**E**	**2.7. Regimul disciplinei** Course type	**Conţinut** [2] Content	**DS**
							Obligativitate [3] Compulsoriness	**DI**

3. TIMPUL TOTAL ESTIMAT (ORE PE SEMESTRU) AL ACTIVITĂŢILOR DIDACTICE

ESTIMATED WORKLOAD (HOURS/SEMESTER)

3.1 Număr de ore pe săptămână Number of teaching hours/week		**3**	**din care** of which	**3.2 Curs** Course	**1**	**3.3 Seminar** Seminar	**2**
3.4 Total ore din planul de învăţământ Total number of teaching hours within the program		**30**	**din care** of which	**3.5 Curs** Course	**10**	**3.6 Seminar** Seminar	**20**
3.7 Total ore studiu individual Student workload for individual study	146	**3.8 Total ore pe semestru** Total student workload / semester	180	**3.9 Număr de credite** ECTS			**6**
DISTRIBUŢIA FONDULUI DE TIMP DISTRIBUTION OF INDIVIDUAL STUDY WORKLOAD	**Studiu după manual, suport de curs, bibliografie şi notiţe** Individual study of texbooks, handbooks/reader, bibliography and notes						**56**
	Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren Additional research (library, electronic resources, potential fieldwork)						**20**
	Pregătire seminarii, teme, referate, portofolii şi eseuri Homework (preparing seminar presentations, portfolios, critical essays, research papers etc.)						**70**
	Tutoriat (opţional) Individual consultations (optional)						
	Examinări Evaluations / exams						**4**
	Alte activităţi Other activities						

4. PRECONDIŢII
PRECONDITIONS

4.1 De curriculum Curriculum-related	• **Arhitectura calculatorului** Computer architecture • **Noţiuni de programare** Programming
4.2 De competenţe Skills-related	

5. CONDIŢII
CONDITIONS

5.1 De desfăşurare a cursului For running the course	• **Cursul se va desfăşura într-o sală dotată cu videoproiector** The lectures will be given in a room equipped with projector
5.2 De desfăşurare a seminarului For running the seminar	• **Studenţii trebuie să se implice activ în cadrul seminarului / laboratorului / proiectului** Students must be active during the seminar / laboratory / project work • **În cazul în care studenţii întarzie cu predarea temelor de seminar / laborator / a proiectelor, se vor aplica depunctări sau în funcţie de caz, activitatea se va considera nesatisfăcută** If the students fail to deliver the assignments on time, they will receive penalties, or, depending on the case, the assignment might be considered failed

6. COMPETENŢE SPECIFICE ACUMULATE
ACQUIRED SKILLS

6.1 Competenţe profesionale Professional skills	• **Familiarizarea cu tehnicile de inginerie inversa şi analiză a fişierelor executabile** Learn about reverse engineering techniques and analysis of executable files • **Utilizarea corectă a tehnicilor şi metodelor prezentate pentru mitigare şi securizare a codului** Correct usage of the presented techniques and methods for securing the code
6.2 Competenţe transversale Cross-cutting skills	• **Preocuparea pentru perfecţionarea sistemelor informatice** Improvement of computer systems • **Dezvoltarea gândirii critice prin antrenarea capacităţilor de evidentiere a punctelor vulnerabile** Develop analytical thinking though training capabilities to highlight vulnerabilities • **Aplicarea regulilor de muncă riguroasă şi eficientă, manifestarea unor atitudini responsabile faţă de domeniul ştiinţific şi didactic, pentru valorificarea optimă şi creativă a propriului potenţial în situaţii specifice, cu respectarea principiilor şi a normelor de etică profesională** Apply rigorous and efficient working rules, responsible attitudes towards the scientific and didactic fields for optimal and creative improvement of the student's potential in specific situations, under the principles and norms of professional ethics • **Utilizarea eficientă a surselor informaţionale şi a resurselor de comunicare şi formare profesională asistată** Effective use of information sources and communication and assisted training resources

7. OBIECTIVELE DISCIPLINEI
COURSE GOAL & OBJECTIVES

7.1 Obiectivul general al disciplinei Course goal	• **Familiarizarea cu procesul de inginerie inversă şi analiză a codului, precum şi cu tehnici de securizare a codului** Learn about reverse engineering techniques, analysis of executable files and secure coding techniques
7.2 Obiective specifice Course objectives	• **Însuşirea unor competenţe de bază pentru a analiza fişiere în format executabil fară a avea cod sursă** Acquire basic skills to analyze executable files without access to the source code • **Familiarizarea cu o varietate de constructe emise de compilator prin analiză statică, analiza dinamică a unor parţi şi a întregului**

	Familiarization with a variety of constructs issued by the compiler by static analysis, dynamic analysis of parts and the whole • **Reconstruirea unui pseudocod echivalent cu funcţionalitatea originală care poate fi analizat la un nivel mai înalt** Build pseudocode equivalent to the original functionality that can be analyzed at a higher level • **Identificarea şi analiza prin exploatare a unor clase majore de vulnerabilităţi** Identify and analyze major classes of vulnerabilities by exploitation • **Însuşirea unor metode de mitigare** Gain knowledge about mitigation methods

8. CONŢINUTURI

CONTENT

8.1. Curs Course	**Metode de predare** Teaching methods	**Observaţii** Remarks
14. Contextualizarea procesului de inginerie inversă. Contextualizing the reverse engineering process.	**Prelegeri** Lectures **Studii de caz** Case studies	**Resurse folosite:** Used resources: - **Videoproiector** Projector - **Calculator** Computer - **Tablă** Blackboard / whiteboard
15. Utilitare de bază şi elemente de formatul ELF. Basic tools and binary file format ELF.		
16. Analiza dinamică folosind debuggere. Dynamic analysis using debuggers.		
17. Analiza statică folosind programe specializate. Static analysis using specialized programs.		
18. Clase de vulnerabilităţi şi metode de identificare. Vulnerability classes and identification methods.		
19. Analiza şi sinteza de shellcode. Shellcode analysis and synthesis.		
20. Metode moderne de mitigare: ASLR, NX, PIE, RELRO. Modern mitigation methods: ASLR, NX, PIE, RELRO.		
21. Metode actuale de bypass: scurgeri de informaţie, ROP, atacuri orientate spre date. Current bypass methods: information leakage, ROP, data-oriented attacks.		
Bibliografie/ Bibliography**:** **9. IDA Pro Book, 2nd Edition, Chris Eagle** **10. Gray Hat Hacking The Ethical Hacker's Handbook, Fourth Edition, Daniel Regalado** **11. Hacking: The Art of Exploitation, 2nd Edition, Jon Erickson** **12. Pwntools documentation,** http://pwntools.readthedocs.io		
8.2. Seminar [temele dezbătute în cadrul seminariilor]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		
8.3. Laborator [temele de laborator, proiecte etc, conform calendarului disciplinei] Laboratory [laboratory themes, projects, etc., according to the discipline calendar]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Aplicaţii practice ale temelor prezentate în cadrul cursului Practical applications of the themes presented during the course	**Rezolvarea unor probleme practice** Solving practical problems **Studii de caz** Case studies **Exercitii** Exercises	**Resurse folosite:** Used resources: - **Videoproiector** Projector - **Calculator** Computer - **Tablă** Blackboard / whiteboard
Bibliografie/ Bibliography**:** **Aceeaşi ca la curs**		

Same as for the course		
8.4. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]	**Metode de predare-învăţare** Teaching and learning methods	**Observaţii** Remarks
Bibliografie/ Bibliography**:**		

9. SCURTĂ DESCRIERE*

BRIEF DESCRIPTION*

*** COROBORAREA CONŢINUTURILOR DISCIPLINEI CU AŞTEPTĂRILE REPREZENTANŢILOR COMUNITĂŢII EPISTEMICE, ASOCIAŢIILOR PROFESIONALE ŞI ANGAJATORI REPREZENTATIVI DIN DOMENIUL AFERENT PROGRAMULUI /** CORRELATION BETWEEN THE CONTENT OF THE COURSE AND THE NEEDS/EXPECTATIONS OF THE EPISTEMIC COMMUNITY, PROFESSIONAL ASSOCIATION S AND/OR SIGNIFICANT EMPLOYERS RELEVANT FOR THE PROGRAM

Noţiunile introduse în acest curs vor dezvolta capacitatea de analiză a codului şi vor duce la o mai bună şi profundă înţelegere a problemelor legate de securitate a programelor. Cursul oferă informaţii actuale în domeniul ingineriei inverse şi a tehnicilor de securizare a codului, pregătind cursanţii pentru o bună integrare pe piaţa muncii.

The concepts introduced in this course will develop code analysis capabilities and lead to a better and deeper understanding of program security issues. The course provides current insights into reverse engineering and securing code techniques, training the students for an easy integration into the labor market.

10. EVALUARE

EVALUATION

Tip activitate Actitity	**10.1 Criterii de evaluare** Evaluation criteria	**10.2 Metode de evaluare** Evaluation methods	**10.3 Pondere din nota finală** Per cent of final grade
10.4. Curs Course	**Cunoaşterea terminologiei si a conceptelor de bază.** Knowledge of the terminology and the basic concepts. **Cunoaşterea tehnicilor introduse pe parcursul cursului.** Knowledge of the techniques introduced during the course. **Abilitatea de a aplica cunoştinţele dobândite în cazuri particulare.** Ability to apply the acquired knowledge in particular cases.	**Examen** Exam	**50%**
10.5.1. Seminar Seminar			
10.5.2. Laborator Laboratory	**Capacitatea de a rezolva problem practice referitoare la analiza fişierelor în format executabil, reconstrucţia pseudocodului, identificarea şi analiza unor vulnerabilităţi, aplicarea unor tehnici de mitigare în cazuri practice particulare.** The ability to solve practical problems related to file analysis in executable format, pseudocode reconstruction,	**Participarea şi activitatea în cadrul laboratorului** Participation and activity during the laboratory **Teme şi proiecte** Assignments and projects	**50%**

	identification and analysis of vulnerabilities, apply mitigation techniques in practical cases.		
10.5.3. Proiect [doar pentru disciplinele la care exista proiect semestrial normat in planul de invatamant] Project [only for disciplines that have a project in the curriculum]			
10.6. 10.4 Standard minim de performanţă: Nota finala 5 (cinci) Threshold for the acquisition of the ECTS credits: Final grade 5 (five)			