

# MINISTRY OF EDUCATION AND RESEARCH



## "OVIDIUS" UNIVERSITY OF CONSTANTA FACULTY OF MATHEMATICS AND COMPUTER SCIENCE CURRICULUM

(contains *16* pages)

|                          |                                                                                                 |
|--------------------------|-------------------------------------------------------------------------------------------------|
| Domeniul<br>fundamental: | <b>Mathematics and natural sciences</b>                                                         |
| Domeniul de masterat:    | <b>Computer Science</b>                                                                         |
| Ciclul de studii:        | <b>II</b>                                                                                       |
| Programul de studii:     | <b>Securitate cibernetică și învățare automată / Cyber Security and Machine Learning (CSML)</b> |
| Durata studiilor:        | <b>4 semesters</b>                                                                              |
| Forma de învățământ:     | <b>Full time (IF)</b>                                                                           |
| Tip masterat:            | <b>Professional</b>                                                                             |

Valid starting with the 2025 – 2026 ACADEMIC YEAR



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**FACULTY OF MATHEMATICS AND COMPUTER SCIENCE**

Fundamental domain: Mathematics and Natural Sciences

Masterss Domain: COMPUTER SCIENCE

Study program: CYBER SECURITY AND MACHINE LEARNING

(CSML) / SECURITATE CIBERNETICA ȘI ÎNVĂȚARE AUTOMATĂ

Form of education: full-time (IF)

Duration of studies: 2 years

Valid starting with the study cycle:2025-2027

## 1. MISSION OF THE STUDY PROGRAM

The Master's program in Cybersecurity and Machine Learning (in English) within the field of Informatics aims to train specialists in two important areas of informatics: that of computer/cyber security and that of machine learning.

The program aims to create highly trained specialists in ensuring the protection of computer systems and information systems, data protection, computer network administration, development of specific software and development of artificial intelligence systems for the most diverse application areas, using the latest technologies in the field of machine learning.

## 2. PROFESSIONAL QUALIFICATION, RELATIONSHIP WITH THE CLASSIFICATION OF OCCUPATIONS IN ROMANIA (COR) - UPDATED FORM (OCCUPATIONS, POSSIBILITIES OF INTEGRATION ON THE LABOR MARKET)

**The occupations, as described by COR, are the following:**

Specialist in computer systems security procedures and tools (251402)

**The ESCO competencies are the following:**

C1. Ability to implement ICT risk management: Develop and implement procedures to identify, assess, treat and mitigate ICT risks, Analyze and manage security risks and incidents, Recommend measures to improve the digital security strategy.

C2. Ability to develop information security strategies in order to maximize information integrity, availability and confidentiality of data.

C3. Ability to conduct data recovery following disasters in the operation or security of ICT systems, such as in terms of data recovery, identity and information protection and measures to be taken to prevent further problems.

C4. Ability to perform ICT security tests, such as network penetration tests, wireless testing, code evaluations, wireless and/or firewall assessments, in accordance with industry-accepted methods and protocols to identify and analyze potential vulnerabilities.

C5. Ability to manage disaster recovery plans that may cause data loss from the information system.

C6. Ability to manage ICT systems security: Apply detection techniques for security. Understands cyber attack techniques and implements effective countermeasures.



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C7. Ability to perform data analysis, collect data and statistics for testing and evaluation to generate statements and pattern predictions, in order to discover useful information in the decision-making process.

C8. Ability to ensure and maintain database security.

C9. Ability to create data models, using specific techniques and methodologies.

C10. Ability to design cloud architectures and develop cloud computing services.

**Transversal competencies:**

CT1. Applying work organization rules, understanding responsibilities and respecting professional ethics rules, as well as data security and confidentiality rules

CT2. Identifying the role of an interdisciplinary team and assuming responsibilities corresponding to the professional and personal profile

CT3. Effective use of information and communication sources and professional training

CT4. Analytical thinking, problem-solving ability

CT5. Ability to interpret, synthesize and critically analyze results

**3. ADMISSION**

Admission to master's degree studies is based on the Regulation regarding the organization and conduct of the Admission Competition to master's degree studies of Ovidius University of Constanța and on the basis of its own Methodology on the organization and conduct of the Admission Competition to Bachelor's and Master's degree studies, within the Faculty of Mathematics and Informatics.

**4. STUDIES CERTIFICATION**

The certification of studies is done with a master's degree in Computer Science (Level 7 – CNC). The diploma is accompanied by the diploma supplement containing the results of the assessments during schooling.



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## PLAN DE ÎNVĂȚĂMÂNT ANUL I

| No.                  | Discipline code | *C1 | **C2 | Disciplines                                       | 1st Semester (14 Weeks) |   |   |   |   |    |    |    | 1st Semester (14 Weeks) |   |   |   |    |    |       |        | Hours per discipline |  |  |
|----------------------|-----------------|-----|------|---------------------------------------------------|-------------------------|---|---|---|---|----|----|----|-------------------------|---|---|---|----|----|-------|--------|----------------------|--|--|
|                      |                 |     |      |                                                   | SI                      | C | S | L | P | FV | CR | SI | C                       | S | L | P | FV | CR | Total | Course | Appl<br>icati<br>ons |  |  |
|                      |                 |     |      | Discipline                                        |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |        |                      |  |  |
| 1.                   | CSML.1.1<br>.01 | DF  | DOB  | Security of databases                             | 69                      | 2 |   | 2 |   | E  | 5  |    |                         |   |   |   |    |    | 56    | 28     | 28                   |  |  |
| 2.                   | CSML.1.1<br>.02 | DS  | DOB  | Machine Learning                                  | 69                      | 2 |   | 2 |   | E  | 5  |    |                         |   |   |   |    |    | 56    | 28     | 28                   |  |  |
| 3.                   | CSML.1.1<br>.03 | DF  | DOB  | Advanced Programming Elements                     | 83                      | 1 |   | 2 |   | E  | 5  |    |                         |   |   |   |    |    | 42    | 14     | 28                   |  |  |
| 4.                   | CSML.1.2<br>.04 | DF  | DOB  | Distributed Networks Systems                      |                         |   |   |   |   |    |    | 83 | 1                       |   | 2 |   | E  | 5  | 42    | 14     | 28                   |  |  |
| 5.                   | CSML.1.2<br>.05 | DS  | DOB  | Data Mining                                       |                         |   |   |   |   |    |    | 83 | 1                       |   | 2 |   | E  | 5  | 42    | 14     | 28                   |  |  |
| 6.                   | CSML.1.2<br>.06 | DF  | DOB  | Advanced Database Systems                         |                         |   |   |   |   |    |    | 83 | 1                       |   | 2 |   | E  | 5  | 42    | 14     | 28                   |  |  |
| 7.                   | CSML.1.2<br>.07 | DC  | DOB  | Ethics and Academic Integrity                     |                         |   |   |   |   |    |    | 36 |                         | 1 |   |   | C  | 2  | 14    | 14     | 0                    |  |  |
| Optional Disciplines |                 |     |      |                                                   |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |        |                      |  |  |
| OPTIONAL I           |                 |     |      |                                                   |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |        |                      |  |  |
| 8.                   | CSML.1.1<br>.08 | DS  | DOP  | Malware Analysis                                  | 97                      | 1 |   | 1 |   | C  | 5  |    |                         |   |   |   |    |    | 28    | 14     | 14                   |  |  |
| 9.                   | CSML.1.1<br>.09 |     |      | Pen Testing                                       |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |        |                      |  |  |
| OPTIONAL II          |                 |     |      |                                                   |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |        |                      |  |  |
| 10.                  | CSML.1.1<br>.10 | DS  | DOP  | Statistics for Data Science                       | 97                      | 1 |   | 1 |   | C  | 5  |    |                         |   |   |   |    |    | 28    | 14     | 14                   |  |  |
| 11.                  | CSML.1.1<br>.11 |     |      | Cyber Security Simulation and Visualization Tools |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |        |                      |  |  |
| OPTIONAL III         |                 |     |      |                                                   |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |        |                      |  |  |

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**PLAN DE ÎNVĂȚĂMÂNT  
ANUL II**

| No.                  | Discipline Code | *C1 | **C2 | Disciplines                                                               | 1st Semester (14 weeks) |   |   |   |   |    |    |    | 1st Semester (14 weeks) |   |   |   |    |    |       |            | Hours per discipline |    |  |
|----------------------|-----------------|-----|------|---------------------------------------------------------------------------|-------------------------|---|---|---|---|----|----|----|-------------------------|---|---|---|----|----|-------|------------|----------------------|----|--|
|                      |                 |     |      |                                                                           | SI                      | C | S | L | P | FV | CR | SI | C                       | S | L | P | FV | CR | Total | Cours<br>e | App<br>lications     |    |  |
|                      |                 |     |      | Disciplines                                                               |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |            |                      |    |  |
| 1.                   | CSML.2.1<br>.01 | DF  | DOB  | Applied Criptography                                                      | 83                      | 1 |   | 2 |   | E  | 5  |    |                         |   |   |   |    |    | 42    | 14         | 28                   |    |  |
| 2.                   | CSML.2.1<br>.02 | DS  | DOB  | Semantic Web and Ontologies                                               | 69                      | 2 |   | 2 |   | E  | 5  |    |                         |   |   |   |    |    | 56    | 28         | 28                   |    |  |
| 3.                   | CSML.2.2<br>.03 | DF  | DOB  | Generative Artificial Intelligence                                        | 69                      | 2 |   | 2 |   | E  | 5  |    |                         |   |   |   |    |    | 56    | 28         | 28                   |    |  |
| 4.                   | CSML.2.2<br>.04 | DS  | DOB  | Security of Web Applications                                              |                         |   |   |   |   |    |    |    | 83                      | 2 |   | 1 |    | E  | 5     | 42         | 28                   | 14 |  |
| 5.                   | CSML.2.2<br>.05 | DF  | DOB  | Cloud Architectures                                                       |                         |   |   |   |   |    |    |    | 83                      | 2 |   | 1 |    | E  | 5     | 42         | 28                   | 14 |  |
| 6.                   | CSML.2.2<br>.06 | DS  | DOB  | Research and documentation for the preparation of the Dissertation Thesis |                         |   |   |   |   |    |    |    | 97                      |   | 2 |   |    | C  | 5     | 28         | 0                    | 28 |  |
| 7.                   | CSML.2.2<br>.07 | DC  | DOB  | Elaboration of the Dissertation Thesis                                    |                         |   |   |   |   |    |    |    | 69                      |   | 4 |   |    | C  | 5     | 56         | 0                    | 56 |  |
| Discipline optionale |                 |     |      |                                                                           |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |            |                      |    |  |
| Pachet OPTIONAL V    |                 |     |      |                                                                           |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |            |                      |    |  |
| 8.                   | CSML.2.1<br>.08 | DS  | DOP  | Form Recognition and Data Search in the Web                               | 97                      | 1 |   | 1 |   | C  | 5  |    |                         |   |   |   |    |    |       | 28         | 14                   | 14 |  |
| 9.                   | CSML.2.1<br>.09 |     |      | Cyber Security Entrepreneurship                                           |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |            |                      |    |  |
| Pachet OPTIONAL VI   |                 |     |      |                                                                           |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |            |                      |    |  |
| 10.                  | CSML.2.1<br>.10 | DS  | DOP  | Information Technology and Communications Forensics                       | 97                      | 1 |   | 1 |   | C  | 5  |    |                         |   |   |   |    |    |       | 28         | 14                   | 14 |  |
| 11.                  | CSML.2.1<br>.11 |     |      | Data Mining in Relational Databases                                       |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |            |                      |    |  |
| 12.                  | CSML.2.1        |     |      | Quantum Computing                                                         |                         |   |   |   |   |    |    |    |                         |   |   |   |    |    |       |            |                      |    |  |

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|                                                                           |                 |    |     |                                                                                   |     |    |   |   |   |              |    |     |   |   |   |   |              |    |     |     |     |
|---------------------------------------------------------------------------|-----------------|----|-----|-----------------------------------------------------------------------------------|-----|----|---|---|---|--------------|----|-----|---|---|---|---|--------------|----|-----|-----|-----|
|                                                                           | .12             |    |     |                                                                                   |     |    |   |   |   |              |    |     |   |   |   |   |              |    |     |     |     |
| Pachet OPTIONAL VII                                                       |                 |    |     |                                                                                   |     |    |   |   |   |              |    |     |   |   |   |   |              |    |     |     |     |
| 13.                                                                       | CSML.2.2<br>.13 | DS | DOP | Autonomous AI Agents: Design, Development, and Security in Cyber-Physical Systems |     |    |   |   |   |              |    |     |   |   |   |   |              |    |     |     |     |
| 14.                                                                       | CSML.2.2<br>.14 |    |     | Online Threats to Modern Organizations                                            |     |    |   |   |   |              |    |     |   |   |   |   |              |    |     |     |     |
| 15.                                                                       | CSML.2.2<br>.15 |    |     | Software security                                                                 |     |    |   |   |   |              |    |     |   |   |   |   |              |    |     |     |     |
| Total physical hours per week /Total number of verification forms/credits |                 |    |     |                                                                                   | 415 | 7  | 0 | 8 | 0 | 3E+2C<br>+0V | 25 | 429 | 5 | 6 | 3 | 0 | 3E+2C<br>+0V | 25 | 406 | 168 | 238 |
| Hours per week                                                            |                 |    |     |                                                                                   |     | 15 |   |   |   |              |    | 14  |   |   |   |   |              |    |     |     |     |

| STAGII DE PRACTICĂ                                                        |                 |                                                                           |     |                             |     |      |   |    |              |       |    |     |      |   |   |               |       |    |                  |     |     |
|---------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------|-----|-----------------------------|-----|------|---|----|--------------|-------|----|-----|------|---|---|---------------|-------|----|------------------|-----|-----|
| 16.                                                                       | CSML.2.1.<br>16 | DC                                                                        | DOB | Specialization Practice III | 97  |      |   | 2  |              | C     | 5  |     |      |   |   |               |       | 28 | 0                | 28  |     |
| 17.                                                                       | CSML.2.2.<br>17 | DC                                                                        | DOB | Specialization Practice IV  |     |      |   |    |              |       |    | 97  |      |   | 2 |               | C     | 5  | 28               | 0   | 28  |
| Total physical hours per week /Total number of verification forms/credits |                 |                                                                           |     |                             | 512 | 7    | 0 | 10 | 0            | 3+2+1 | 30 | 526 | 5    | 6 | 5 | 0             | 3+3+0 | 30 | 462              | 168 | 294 |
| Grand Total                                                               |                 | Total physical hours per week /Total number of verification forms/credits |     |                             | 512 | 15+2 |   |    | 3E+3C+<br>0V |       | 30 | 526 | 14+2 |   |   | 3Ex+3C<br>+0V |       | 30 | Ratio A/C = 1.42 |     |     |

**LEGEND:** \*C1 = content criterion: DF – fundamental subjects, DS – specialization subjects, DC – complementary subjects.

\*\*C2 = obligation criterion: DOB – obligatory subjects, DOP – optional subjects;.

SI - Individual Study, C – course, S – seminar, L – Laboratory, P – Project, CR – Credits, FV – form of verification, Ex - Exam, C – Colloquium, V-Verification

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**5. GENERAL SUMMARY**

according to the criterion of the **content** of the subjects in the curriculum

| No.          | Disciplines         | Number of hours   |                   | Total              |             |
|--------------|---------------------|-------------------|-------------------|--------------------|-------------|
|              |                     | Ist Year          | IInd Year         | Hours              | %*          |
| 1            | fundamental (DF)    | 182               | 140               | 322                | 39.66%      |
| 2            | specialization (DS) | 210               | 210               | 420                | 51.72%      |
| 4            | complementary (DC)  | 14                | 56                | 70                 | 8.62%       |
| <b>TOTAL</b> |                     | <b>406 (+56)*</b> | <b>406 (+56*)</b> | <b>812 (+112)*</b> | <b>100%</b> |

\*Stagii de practică

**6. GENERAL SUMMARY**

according to the criterion of **compulsory** subjects in the curriculum

| No.          | Disciplines      | Number of hours   |                   | Total             |                |
|--------------|------------------|-------------------|-------------------|-------------------|----------------|
|              |                  | Ist Year          | IInd Year         | ore               | %*             |
| 1            | obligatory (DOB) | 294               | 322               | 616               | 75.86%         |
| 2            | optional (DOP)   | 112               | 84                | 196               | 24.14%         |
| <b>TOTAL</b> |                  | <b>406 (+56)*</b> | <b>406 (+56)*</b> | <b>812(+112)*</b> | <b>100.00%</b> |

\*Stagii de practică

**GENERAL RATIO Applications/Course (according to ARACIS specific Quality Standards) = 1.32**





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## 7. EXPLANATORY NOTES ON PRACTICE

| YEAR | CONTENT OF THE ACTIVITIES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I    | <p>The Specialization Practice is organized in the form of weekly activities and aims to carry out projects on an established topic.</p> <p><i>Specialization Practice I</i><br/>Analysis, design and implementation of a software project using a relational database: requirements analysis, software design, relational database design, project implementation.</p> <p><i>Specialization Practice II</i><br/>Development of a software system with implementation of cybersecurity measures: software analysis and design, database design and implementation respecting security requirements, system testing, documentation writing.</p>                        |
| II   | <p>The Specialization Practice is organized in the form of weekly activities and aims to carry out projects on an established topic.</p> <p><i>Specialization Practice III</i><br/>Development and querying of RDF data sources, as part of a robust and secure software system: querying SPARQL data sources, creating and validating RDF documents.</p> <p><i>Specialization Practice IV</i><br/>Development of a software system based on ontology: analysis of software requirements, design of the database associated with an ontology respecting security constraints, design and implementation of system classes, system testing, writing documentation.</p> |



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## 8. WEEKLY STRUCTURE OF THE UNIVERSITY YEAR

| YEAR | Teaching Activities |                |               |                | Examn Sessions |        |       | Practică | Vacanțe |            |        |
|------|---------------------|----------------|---------------|----------------|----------------|--------|-------|----------|---------|------------|--------|
|      | Ist Semester        |                | IInd Semester |                | Winter         | Summer | Debts |          | Winter  | Spring     | Summer |
|      | weeks               | hours/<br>week | weeks         | hours/<br>week | Weeks          | Weeks  | Weeks |          | Weeks   | Weeks      | weeks  |
| I    | 14                  | 15             | 14            | 14             | 3              | 3      | 2     | 56=28+28 | 2       | 1+1(Paști) | 10     |
| II   | 14                  | 15             | 14            | 14             | 3              | 3      | 2     | 56=28+28 | 2       | 1+1(Paști) | -      |

## 9. SPECIFIC CONDITIONS FOR ACCESS/ADMISSION, PROMOTION/EQUIVALENCE OF THE YEAR OF STUDY/SOME DISCIPLINES, TRANSFER ETC.

The professional activity of students is quantitatively assessed by awarding the number of credits allocated to each subject in the curriculum and by awarding a grade between 1 and 10 to the corresponding exams, seminars, assignments, projects and laboratory reports. The minimum grade required to pass an exam/colloquium is 5. The results/grades obtained by students during their academic training are recorded in catalogues and program registers. After the final exam and the defense of the bachelor's thesis, students graduate and receive a Master's Degree and a Master's Degree Supplement. The promotion of the study year is achieved with a minimum of 30 credits.

## 10. CHOICE OF OPTIONAL SUBJECTS BY STUDENTS

The choice of optional subjects is made in the last weeks of the 2nd semester, for the following academic year, with the exception of students in the 1st year of study, who choose at the time of enrollment in the Admissions Competition. Students complete a standard application containing the list of subjects on offer for the optional subjects in both semesters of the following academic year and submit, through the head of year, to the faculty secretariat, the completed applications. The optional subject that meets the maximum number of applications from students will be supported. In the event that there are two or more subjects with the maximum number of applications, the faculty council will decide which subject will run.



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## 11. STRUCTURE OF THE FINAL EXAM

The dissertation exam consists of a single test, namely Oral test: dissertation presentation. The exam ends with the award of a grade. The passing grade for the exam is at least 6.00. 10 credits are awarded for passing the dissertation exam.

## 12. LEARNING OUTCOMES

| No. | LEARNING OUTCOMES                                                                                                            |                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                        | Disciplines                                                                                                       |
|-----|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
|     | Knowledge                                                                                                                    | Skills                                                                                                                                                                                                | Responsibility and autonomy                                                                                                                                                                                                                                                                                                            |                                                                                                                   |
| 1.  | The student/graduate identifies and argues fundamental concepts of data and relational database security.                    | The student designs, develops and demonstrates software solutions using various security techniques and policies specific to relational databases.                                                    | The student/graduate performs actions to develop software systems that use databases and manages the actions necessary to ensure maximum security of relational databases.                                                                                                                                                             | Security of Databases,<br>Advanced Database Systems,<br>Software Security<br>Specialization Practice I            |
| 2.  | The student/graduate identifies and implements strategies for managing security risks in software systems and organizations. | The student/graduate implements procedures to identify, evaluate and treat security risks to information systems, such as unauthorized access or data leaks, analyzes and manages security incidents. | The student/graduate implements procedures to identify, evaluate and treat security risks to information systems, such as unauthorized access or data leaks, analyzes and manages security incidents. The student/graduate ethically and responsibly builds security strategies for information systems and manages security incidents | Malware Analysis,<br>Pen Testing,<br>Software Security<br>Specialization Practice I<br>Specialization Practice IV |



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|----|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                                                                             |                                                                                                                                              | appropriately.                                                                                                                                                   |                                                                                                                                                                            |
| 3. | The student/graduate explains modern cyber threats, including malware, network attacks, and vulnerabilities in web and mobile environments. | The student/graduate analyzes malicious software, conducts penetration tests, and uses simulation tools to model and mitigate cyber attacks. | The student/graduate proactively identifies potential security threats and applies defensive techniques in an ethical and responsible manner.                    | Malware Analysis<br>Pen Testing<br>Cyber Security Simulation and Visualization Tools<br>Wireless and Mobile Devices Security<br>Specialization Practice II                 |
| 4. | The student/graduate understands secure coding principles, common vulnerabilities, and best practices in software security.                 | The student/graduate develops software applications with integrated security mechanisms and audits existing code for vulnerabilities         | The student/graduate ensures software reliability and security throughout the development lifecycle and demonstrates accountability for secure coding practices. | Software Security<br>Advanced Programming Elements<br>Programming applications in the Linux operating system<br>Security of Web Applications<br>Specialization Practice II |
| 5. | The student/graduate understands theoretical and practical aspects of classical and modern cryptographic systems.                           | The student/graduate implements encryption, hashing, and secure communication protocols in real-world applications.                          | The student/graduate applies cryptographic techniques responsibly to ensure data confidentiality, integrity, and authenticity.                                   | Advanced Cryptographic Techniques<br>Applied Cryptography<br>Wireless and Mobile                                                                                           |



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|----|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                                                                      |                                                                                                                                                     |                                                                                                                                                       | Devices Security                                                                                                       |
| 6. | The student/graduate understands core principles of machine learning and data mining and their application to cybersecurity problems | The student/graduate applies machine learning models to detect anomalies, classify threats, and support decision-making in cybersecurity contexts.  | The student/graduate responsibly applies AI techniques in security applications and evaluates the ethical implications of automated decision systems. | Machine Learning<br>Statistics for Data Science<br>Data Mining<br>Data Mining in Relational Databases<br>Generative AI |
| 7. | The student/graduate explains protocols and architectures for secure network and cloud environments.                                 | The student/graduate configures and secures distributed systems and cloud services, applying principles of network segmentation and virtualization. | The student/graduate ensures confidentiality and availability of networked and cloud-based services in compliance with best practices.                | Distributed Networks Systems<br>Cloud Architectures<br>Wireless and Mobile Devices Security                            |
| 8. | The student/graduate understands security models and protocols for securing e-commerce platforms and digital transactions.           | The student/graduate evaluates and implements secure payment systems, authentication mechanisms, and transaction auditing.                          | he student/graduate builds and maintains secure digital services that protect user data and support business continuity.                              | E-Commerce Security<br>Advanced Cryptographic Techniques<br>Security of Web Applications                               |
| 9. | The student/graduate understands semantic web principles, ontologies, and knowledge representation.                                  | The student/graduate models, organizes, and searches information using semantic structures and                                                      | The student/graduate autonomously applies semantic reasoning tools for organizing and retrieving data in                                              | Semantic Web and Ontologies<br>Form Recognition and Data                                                               |



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|     |                                                                                                                                                  | intelligent algorithms.                                                                                                         | complex systems.                                                                                                  | Search in the Web<br>Generative AI<br>Specialization Practice III<br>Specialization Practice IV                                                                                                                                                     |
| 10. | The student/graduate identifies key concepts in digital forensics and understands legal and ethical requirements related to evidence collection. | The student/graduate performs forensic investigations, extracts digital evidence, and documents findings for legal proceedings. | The student/graduate acts with integrity and adherence to legal standards when conducting digital investigations. | Information Technology and Communications Forensics<br>Ethics and Academic Integrity<br>Online Threats to Modern Organizations                                                                                                                      |
| 11. | The student/graduate understands the cybersecurity market, startup development, and the innovation process in technological entrepreneurship.    | The student/graduate designs and evaluates cybersecurity products or services with business viability and innovation potential. | The student/graduate independently initiates and manages innovation projects in the field of cybersecurity.       | Cybersecurity Entrepreneurship<br>Cybersecurity Simulation and Visualization Tools<br>Generative Artificial Intelligence<br>Autonomous AI Agents: Design, Development, and Security in Cyber-Physical Systems<br>Research and documentation for the |



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|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                | preparation of the<br>Dissertation Thesis<br>Elaboration of the<br>Dissertation Thesis                                                                                                                           |
| 12. | The student/graduate understands the principles of quantum computing and generative artificial intelligence, as well as their implications for security.                                                        | The student/graduate applies emerging technologies to model security threats and improve protective measures.                                                                                                                                                                                                                      | The student/graduate stays up to date with technology trends and integrates innovative tools into cybersecurity workflows responsibly.                                                                                                                                                                                         | Quantum Computing<br>Statistics for Data Science<br>Generative AI<br>Applied cryptography<br>Research and documentation for the preparation of the Dissertation Thesis<br>Elaboration of the Dissertation Thesis |
| 13. | The student/graduate understands and explains the fundamental concepts of autonomous agents, agent architectures and their role in cyber-physical systems, as well as the challenges related to their security. | The student designs, develops, and deploys autonomous AI agents capable of operating intelligently in cyber-physical environments, using modern planning, reasoning, and integration techniques with machine learning models. He also identifies and applies security measures to protect the agent's behavior and communications. | The student/graduate is able to critically evaluate the behavior of autonomous agents, anticipate security risks in cyber-physical systems, and propose ethical, secure, and robust solutions for their autonomous operation. Takes responsibility for the agent's decisions and their effects in the operational environment. | Autonomous AI Agents:<br>Design, Development, and Security in Cyber-Physical Systems<br><br>Software security<br><br>Generative AI                                                                               |





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|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 14. | The student/graduate explains the fundamental principles of autonomous AI agents and generative models (Generative AI), understands the architectures used for content generation and their integration into autonomous agent systems for complex applications in cyber-physical environments. | The student/graduate designs and develops autonomous agents that use generative models for decision-making, plan generation or context-adapted content. Uses modern frameworks for training and integrating LLM (Large Language Models) or multimodal generative models in security, simulation and intelligent interaction applications. | The student/graduate assesses the impact and risks associated with the use of generative AI in autonomous agents, applies ethical and security principles in the development and implementation process. Is able to make autonomous decisions to guarantee the transparency, robustness and security of the proposed solutions. | Machine Learning<br>Autonomous AI Agents: Design, Development, and Security in Cyber-Physical Systems<br><br>Generative Artificial Intelligence |
| 15. | The student/graduate knows the norms of professional and academic ethics, as well as the legislative and institutional framework of academic integrity.                                                                                                                                        | The student/graduate recognizes ethical dilemmas and makes responsible decisions in teaching and research activities.                                                                                                                                                                                                                     | The student/graduate acts with integrity and responsibility in compliance with ethical principles and deontological norms. Ethics and academic integrity.                                                                                                                                                                       | Ethics and Academic Integrity                                                                                                                   |

**13. OPPORTUNITIES TO CONTINUE STUDIES OR ACCESS OTHER FORMS OF PERSONAL AND PROFESSIONAL DEVELOPMENT**

Graduates of this master's program can enroll in a doctorate or pursue other postgraduate programs for professional and personal development in the same field.