UNIVERSITA' DEGLI STUDI DI MILANO
PROGRAMME DESCRIPTION - ACADEMIC YEAR 2023/24
MASTER DEGREE
Informatics Security (Classe LM-66)
Enrolled from 18/19 academic year

HEADING

Degree classification - Denomination and code:	LM-66 Computer systems safety
Degree title:	Dottore Magistrale
Curricula currently available:	Methods for information technology security / Safe systems
Length of course:	2 years
Credits required for admission:	180
Total number of credits required to complete programme:	120
Years of course currently available:	1st , 2nd
Access procedures:	Open, subject to entry requirements
Course code:	F2Y

PERSONS/ROLES

Head of Study Programme
Prof. ssa Sabrina Gaito

Degree Course Coordinator
Prof. ssa Sabrina de Capitani di Vimercati

Tutors - Faculty
TUTOR PER L'ORIENTAMENTO:
Valentina Ciriani
Fabio Scotti

Degree Course website
https://sicurezzainformatica.cdl.unimi.it/

Career Guidance Board

via Celoria 18, Milano   http://www.di.unimi.it/ecm/home/organizzazione/organi-di-governo/altre-commissioni   Email: orientamento.uscita@di.unimi.it

Course management

via Celoria 18, Milano   Phone 02503 16250/252   Sportello in presenza: mercoledì dalle 14.00 alle 16.00 / Sportello telefonico: giovedì dalle 9.30 alle 12.30   http://www.di.unimi.it/ecm/home/organizzazione/strutture-e-servizi/segreteria-didattica
https://informastudenti.unimi.it/saw/ess?AUTH=SAML

Erasmus and International Student Board

via Celoria 18, Milano   http://www.di.unimi.it/ecm/home/organizzazione/organi-di-governo/altre-commissioni   Email: erasmus@di.unimi.it

international.students@unimi.it

Via Celoria 18 - 20133 Milano   Phone 0250325032   https://www.unimi.it/it/node/360/   https://www.unimi.it/it/node/359/

Internship and Master's Degree Thesis Board

via Celoria 18, Milano   http://www.di.unimi.it/ecm/home/organizzazione/organi-di-governo/altre-commissioni   Email: tesi.magistrali@di.unimi.it

Master's Degree Admission Board

via Celoria 18, Milano   http://www.di.unimi.it/ecm/home/organizzazione/organi-di-governo/altre-commissioni   Email: ammissioni.magistrali@di.unimi.it

Programme Transfer Board

via Celoria 18, Milano   http://www.di.unimi.it/ecm/home/organizzazione/organi-di-governo/altre-commissioni   Email: trasferimenti@di.unimi.it

Student Orientation Board

via Celoria 18, Milano   http://www.di.unimi.it/ecm/home/organizzazione/organi-di-governo/altre-commissioni   Email: orientamento@di.unimi.it

Student representatives

Study Plan Board

via Celoria 18, Milano   http://www.di.unimi.it/ecm/home/organizzazione/organi-di-governo/altre-commissioni

CHARACTERISTICS OF DEGREE PROGRAMME

General and specific learning objectives

The master degree in Informatics Security aims to train professionals with high-level scientific and technological skills, methodological and operational skills, and with an open and critical vision of the problems connected with the adoption and use of Information Technologies (ITs). The master degree in Informatics Security ensures its graduates an advanced and complete training in relation to the foundations, methodologies, scientific and technological solutions related to information security. The degree has been designed to be proficiently followed both by people already acquainted with IT security issues (to whom it will provide deeper insight into ICT sciences and technologies useful for security critical application), and by people coming from scientific degrees where computer security has never been specifically addressed (to whom it will supply the required competencies starting from basic aspects of ICT security). In both cases, however, training is structured around a large common basis, aimed at providing graduates with training related to the various scientific and technological problems, methodologies, and solutions in the information security area, preserving the uniqueness of the overall degree and guaranteeing homogeneity and cultural coherence of the graduated people.

Expected learning outcomes

KNOWLEDGE AND UNDERSTANDING

Graduates in Information Security master?s degree will have advanced knowledge and skills in:
- cryptography
- network security
- security of service-oriented architectures
- data protection
- system modeling and analysis
- biometric systems
- risk analysis and management
- business organization
- processing of personal and sensitive data
- management of IT incidents

Expected learning outcomes:

1. Knowledge of methods, principles and conceptual systems, for the study and design of complex secure computer systems
2. Knowledge of methods and tools for analysis and formal synthesis of systems, with particular reference to their safety
3. Knowledge of the problems related to sensitive data processing, its legislation and organizational aspects
4. Knowledge of methods and principles for the implementation of secure service-oriented architectures
5. Knowledge and understanding of organizational problems and solutions relating to IT security
6. Knowledge of the main research results and research lines of the most important theoretical developments in one or more disciplinary sub-domains and research fields related to information security

APPLYING KNOWLEDGE AND UNDERSTANDING

Graduates of the course must be able to apply the knowledge and skills acquired to the analysis, design, implementation and evaluation of secure and protected IT systems operating in various areas: commercial, industrial, public administration, insurance, banking, hospital, environmental, energy, research.
They must also be able to use their cognitive tools to analyze and evaluate from a professional point of view - within companies, public and private research centers, governmental bodies, as well as regulatory authorities. control and guarantee - the correctness and conformity of design choices as well as the effects of decisions on the correct functioning of IT systems and the necessary data protection guarantees.

Expected learning outcomes:

1. Knowledge of a broad spectrum of application areas and related solutions
2. Ability to analyze a specific problem whose solution requires the use of IT tools and to choose the most appropriate methods for its solution
3. Ability to analyze and model a complex system and synthesize its behavior
4. Ability to collect, evaluate and analyze empirical evidence relating to the behavior of a computer system.
5. Ability to compile systematic bibliographies and to provide bibliographic references consistent with the conventions accepted by the scientific communities of reference

MAKING JUDGEMENTS

Graduates of the course must be able to formulate fully autonomous and conscious judgments regarding the decisions and design choices of the companies, organizations in which they will operate. They will also have to fully assimilate the principles of professional ethics that guide interpersonal relationships in the reference occupational contexts in which they may encounter in the professional life following the achievement of the master's degree.

Expected learning outcomes:

1. Ability in critical thinking about design and implementation choices
2. Ability to develop autonomous and independent reasoning and reflections
3. Awareness of the existence of various alternative methodological approaches for the design and analysis of systems, understanding the relevance of this plurality
4. Ability to critically evaluate the relevance and merits of alternative projects
5. Ability to critically evaluate and interpret evidence

COMMUNICATION SKILLS

Graduates of the course must be able to argue their positions and communicate the results of their analysis and assessments in a clear and effective way, using the most common working language in international working contexts (English) and making use, with full technical mastery of the most up-to-date IT tools, as well as the most advanced tools (IT, mathematical, statistical, econometric) for the analysis, processing and presentation of data.

Expected learning outcomes:

1. Written communication skills, based on the use of appropriate technical terminology and languages
2. Ability to present and critically evaluate in writing in a clear, coherent and concise manner, technical and methodological ideas and arguments
3. Ability to formulate and express orally, even in public contexts, complex arguments in the technical and methodological field
4. Ability to develop an original research dissertation on a complex topic in a complete and coherent manner, also using appropriate technological supports

LEARNING SKILLS

The master's degree course aims to gradually lead its students to the research fields; this is why the course intends to favor the development of further learning abilities by its students as a priority, as well as the acquisition of methodological and theoretical skills and competences that allow their master's graduates to independently undertake the field of scientific research according to international standards, and also in order to foster doctoral programs in the IT field and other related fields.

Expected learning outcomes:

1. Ability to organize ideas in a critical and systematic way
2. Ability to identify, select and collect information through the appropriate use of relevant sources
3. Ability to use libraries, databases, archives, paper and electronic repertories to access relevant scientific and documentary information
4. Ability to organize and implement an independent study plan
5. Ability to reflect on one's own learning experience and to adapt it in response to suggestions and stimuli from teachers or colleagues
6. Ability to recognize the need for further study and to appreciate the role of innovative learning modalities and additional research activities
7. Ability to design and develop independent research work, albeit guided by a supervisor

Professional profile and employment opportunities

Competencies acquired by people who obtained the masterly degree in Informatics Security are for job positions of high responsibility that are needed in all projects requiring consultancy, analysis, design, management, and marketing of medium-large information systems. The graduate in Informatics Security will be able to operate in various application areas for the design and management of computer and telematic systems and for the study of new systems and applications. These job positions will be available in all kinds of private and public companies using IT technologies and requiring particular attention to security and privacy issues. The main market segments involved are: banks, insurance companies, logistics and

transport, healthcare, public administrations, telecommunications and media, service companies, industry. More precisely, referring to the ISTAT 2008 Professional Classification scheme, the masterly degree in Informatics Security will prepare for the following professional profiles.

Management consultants for the design of secure information systems, for risk management and the application of rules and standards

Role in a professional context: Professional figures in this category operate in the vast sector of consultancy aimed at the management of information systems and business management. They combine knowledge of information technology with knowledge of project and business process management, an in-depth knowledge of information security issues, relevant regulatory and legal aspects, and the main development trends both in technology and in related disciplines such as privacy and risk analysis.

Skills associated with this professional profile: Professional figures in this category have specific skills in the field of technologies and methods for IT security and interdisciplinary and management knowledge, which are both needed for mastering not only the more technical aspects but also the needs deriving from the management of information systems, from the positioning of market, and from commercial needs and business strategy in the context of the IT sector.

Employment opportunities: Professional figures in this category carry out highly specialized professional activities in the field of business consultancy aimed at companies and the public administration, where they support company management and information systems management by dedicating themselves to project management or by participating to strategic projects that require not only specialized technical skills but also managerial and interdisciplinary level knowledge.

Project leader in Business Information Systems

Role in a professional context: Professional figures in this category deal with the management of IT security-oriented projects within business information systems. The typical functions are those of a technology expert who must be able to structure a project, organize it into phases, coordinate activities and technical personnel, manage a dedicated budget, select resources and tools, manage relationships with suppliers and consultants, and operate in compliance with the planned deadlines.

Skills associated with this professional profile: Professional figures in this category have interdisciplinary, technical, and managerial skills, to be able to direct and organize a complex activity both in terms of technological and management aspects. Starting from a technical-scientific training, these professional figures have additional skills such as project management skills, economic and legal skills, and risk management skills associated with the life cycle of a project.

Employment opportunities: The structured management of projects within information systems is needed in all companies, which often are forced to use external figures due to the lack of internal figures. To this purpose, many companies frequently request young professionals to be included in their workforce who have both technical and management skills able to cover roles of a higher level than that of technical specialist.

Specialists in the design of IT systems, application software, web and multimedia services with advanced IT security requirements and secure data management

Role in a professional context: Professional figures in this category are experts in advanced IT security issues related to both to the critical systems and resources of a company (data centers, highly reliable systems, intellectual property, sensitive data) and to the most innovative technological solutions. These professional figures deal with technological aspects for which an extremely in-depth knowledge of technologies and evolutionary trends on a global level is required. They are therefore fundamental in cases where the ability to analyze highly complex and specific technological scenarios is required.

Skills associated with this professional profile: Professional figures in this category are high-level specialists with knowledge on all specific aspects of the major innovative technologies. Advanced skills of this type may be required in all areas of computer security, ranging from secure programming with the application of advanced methodologies of static and dynamic analysis, analysis of malicious code available on Internet, advanced encryption techniques, to advanced data protection techniques, and innovative methodologies for the monitoring and testing of applications.

Employment opportunities: The IT sector is characterized by the presence, in many big and small companies as well as in the consultancy sector, of technological excellences which aim at researching and applying the most innovative solutions. This happens in the management of datacenters, in the design of interactive applications, in sectors with a high use of technology such as precision mechanics, pharmaceutical or biomedical, in web services and in the development of applications for mobile devices. In all these cases, the management of business information systems requires highly specialized professionals who deal with complex scenarios, where there is the need of using recent or specific technologies, or complex scenarios presenting highly difficult problems.

Information and Communication Technologies (ICTs) specialists

Role in a professional context: Professional figures in this category are experts in the use of ICTs in various operational contexts, on which the master degree in Informatics Security is largely based. These professional figures integrate the ability to develop sophisticated IT applications with knowledge of operational problems in various application contexts (industrial automation, information systems, digital communication, decision support, and so on) dealing with the design, management, and maintenance of complex IT applications.

Skills associated with this professional profile: Professional figures in this category have an excellent basic skills, a broad knowledge in various sectors of the ICT, are familiar with the scientific method of investigation, have high modeling skills, know how to use mathematical tools that can be used in the support of their computer skills, manage group activities, operate independently, and are able to easily integrate into work environments.

Employment opportunities: The level of knowledge and skills achieved will allow graduates in Informatics Security to carry out functions of high responsibility in the context of projects involving consultancy, analysis, design, management, maintenance and marketing of medium-large information systems. Graduates will be able to operate in the context of various application fields for designing and managing information systems and for studying new systems and applications. This activity can take place in all areas of the public and private sectors that use information technology. The main market segments involved are: banks, insurance companies, logistics and transport, healthcare, public administrations, telecommunications and media, service companies, and industry.

Initial knowledge required

Candidates must have earned at least the following credits in their previous studies:
- 48 credits in the INF/01 academic field
- 12 credits in the MAT/01-09 academic fields.

For the purposes of admission to the programme, the Academic Board reserves the right to carefully assess the student's career if not perfectly in line with the above requirements.

In all cases, admission requirements will be assessed based on the following qualifications: degree certificate with marks, list of exams passed with marks and number of credits, course syllabus where not available on the website of the Università degli Studi di Milano. The candidate's educational background will be assessed based on the exam grades achieved in the academic fields (SSD) listed under the admission requirements. If necessary, the candidate will be required to pass an individual interview. Any curricular additions, in terms of university credits (CFU), must be achieved before the above assessment, by attending the following courses, and taking the relevant exams, within the degree programme in Computer Systems and Networks Security: Continuum Mathematics (MAT/01-09), Discrete Mathematics (MAT/01-09), Computer Architecture (INF/01), Computer Programming (INF/01), Cybersecurity Management, Operating Systems I (INF/01), Operating Systems II (ING-INF/05), Algorithms and Data Structures (INF/01), Computer Networks (INF/01), Databases (INF/01), Cryptography (INF/01), Web and Mobile Systems Security (INF/01), Secure Software Design (INF/01), System and Network Security (INF/01), Web and Mobile Programming (INF/01), Statistics and Data Analysis (INF/01), Computer Forensics (ING-INF/05), Biometric Systems, Model-Driven Software Design (INF/01).

Compulsory attendance

Attendance is strongly recommended for both courses and laboratories.

Degree programme final exams

The final exam consists of the presentation and discussion of an original Master's degree thesis (in English or Italian), proving the candidate's research, reworking and synthesis skills. The student will write their thesis under the guidance of a supervisor.

For students to be admitted to the final exam, they must have earned 81 CFU as required hereunder.

Campus

IT course venues: via Celoria 18 - Milan.

Other course venues: Teaching sector, via Celoria; Teaching sector, via Golgi 19; Teaching sector, via Venezian 15.

Laboratories

Computer laboratory (Silab) at the Department of Computer Science, via Celoria 18, Milan.

Notes

In order to obtain their degree, students must be proficient in English at a B2 level. This proficiency level may be certified as follows:

- By submitting a language certificate attesting B2 or higher level in English and issued no more than three years before the date of submission. You will find the list of language certificates recognized by the University at: https://www.unimi.it/en/node/297/). The certificate must be uploaded during the enrolment procedure, or subsequently to the portal http://studente.unimi.it/uploadCertificazioniLingue;

- B2 or higher level achieved during a University of Milan degree programme and certified by the University Language Centre (SLAM) no more than four years before the date of admission application. In this case the process is automatic, the applicant does not have to attach any certificates to the application

- Through a placement test administrated by the SLAM between October and January of year 1. Applicants who fail the test

will be required to take a SLAM course.

The placement test is mandatory for all those who do not hold a valid certificate.

Those who do not take the placement test by January or do not pass the end-of-course exam after six attempts must obtain the necessary certification privately before graduating.

EXPERIENCE OF STUDY ABROAD AS PART OF THE TRAINING PROGRAM

The University of Milan supports international mobility by providing its students with the opportunity to spend study and internship periods abroad. It is a unique chance to enrich your educational path in a new exciting environment.

The agreements entered into by the University with over 300 universities from the 27 EU member countries under the European Erasmus+ programme allow regularly enrolled students to carry out part of their studies at one of the partner universities or to undertake internships at companies, training and research centres and other organizations.

Similar international mobility opportunities are provided outside Europe, through agreements with a number of prestigious institutions.

Study and internships abroad

The education program can be enriched by educational activities abroad both to deepen some topics and as socialization experience in international environments. Within the Erasmus+ program study periods can be taken in over 50 universities in Belgium, Czech Republic, Finland, France, Germany, Greece, Hungary, Lithuania, Norway, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Switzerland, Turkey. Courses will be recognized in the personalized study plan. These periods abroad are typically 5-month long and include courses for about 30 CFU, in the area of information and communication technology and related applications. Recognition of these educational activities will be based on the Learning Agreement, to be defined in advance by the student and the Erasmus coordinator at the Computer Science Department before starting the period abroad: course in the learning agreement with passed exams will replace the educational activities of the study plan ("manifesto"), either by covering the same topics or complementing the acquired basic competences. The Erasmus Committee at the Computer Science Department will perform the recognition of CFU obtained abroad and the definition of the personalized study plan. Similarly, stages to prepare the final dissertation are allowed in the same foreign universities. Recognition will be performed by the Department Erasmus Committee.

Erasmus: the coordinator for the Department of Informatics is Prof. Fabio Scotti

International Programs: the coordinator for the Department of Informatics is Prof. Vincenzo Piuri.

More information are available at the following link: http://www.di.unimi.it/ecm/home/didattica/international-studies

How to participate in Erasmus mobility programs

The students of the University of Milan can participate in mobility programmes, through a public selection procedure.

Ad hoc commissions will evaluate:

Academic career

the candidate's proposed study programme abroad

his/her foreign language proficiency

the reasons behind his/her application

Call for applications and informative meetings

The public selection for Erasmus+ mobility for study generally begins around February each year with the publication of a call for applications specifying destinations and requirements. Regarding the Erasmus+ Mobility for Traineeship, the University of Milan usually publishes two calls a year enabling students to choose a destination defined by an inter-institutional agreement or to find a traineeship position on their own.

The University organizes informative meetings to illustrate mobility opportunities and rules for participation.

Erasmus+ scholarship

The European Union grants the winners of the Erasmus+ programme selection a scholarship to contribute to their mobility costs, which may be supplemented by the University funding for disadvantaged students.

Language courses

Students who pass the selections for mobility programmes can benefit from intensive foreign language courses offered each year by the University Language Centre (SLAM).

https://www.unimi.it/en/node/8/

Learn more at https://www.unimi.it/en/node/274/

For assistance, please contact:

International Mobility Office

Via Santa Sofia 9 (second floor)

Tel. 02 503 13501-12589-13495-13502

Contacts: InformaStudenti; mobility.out@unimi.it

Student Desk booking through InformaStudenti

1st COURSE YEAR Core/compulsory courses/activities common to all curricula	Ects	Sector
Learning activity	Ects	Sector
COMPLEMENTS OF SECURITY AND PRIVACY	6	INF/01

Learning activity	Ects	Sector
English proficiency B2 (3 ECTS)	3	NN
PRIVACY AND DATA PROTECTION	6	INF/01
RISK ANALYSIS AND MANAGEMENT	6	INF/01
SERVICE-ORIENTED ARCHITECTURE SECURITY	6	INF/01
SYSTEM MODELING AND ANALYSIS	6	INF/01
	Total compulsory credits	33	

2nd COURSE YEAR Core/compulsory courses/activities common to all curricula

Learning activity	Ects	Sector
ORGANIZATION	6	SECS-P/10
PROCESSING OF SENSITIVE DATA	6	IUS/01
	Total compulsory credits	12	

Further elective courses common to all curricula

Free choice courses.
Students will have to achieve 12 free cfu as follows:
- among courses activated by the Department for the current academic year
- among all the courses activated by the university.
Starting from the a.y. 2020-21, the Academic Board has activated the course of Network Security II, which can be included in the free choice credits.

Students can request the recognition of credits for training activities at external institutions, presenting a certification. Each certification can give rise to a maximum of 3 credits, and up to 2 certifications can be recognized. The students who intend to request the recognition of the certifications must complete the "application" form available on the page https://www.unimi.it/en/study/student-services/welcome-desk-infostudenti/general-forms and send ver to the secretary of his / her degree together with a copy of the certifications achieved.
The evaluation will be carried out by a special commission based on the following parameters:
- Validity: the certification must have been obtained for a maximum of 5 years.
- Specificity: the object of the certification must be those referable to those required by the degree course in which the student is regularly enrolled.
- Specialization: the certification must concern specialized and / or professional skills.
- Level: the certification must attest to skills of a medium or advanced level. Basic and entry level certifications are excluded.

The above requests can only be submitted by students who have not already obtained these awards during the three-year course.

NETWORK SECURITY II	6	INF/01

End of course requirements common to all curricula

	Ects	Sector
FINAL EXAM	39	NN
	Total compulsory credits	39	

ACTIVE CURRICULA LIST

Methods for information technology security Course years currently available: 1st , 2nd
Safe systems Course years currently available: 1st , 2nd

CURRICULUM: [F2Y-A] Methods for information technology security

Qualifying Training Objectives

The specific objective of this curriculum is to provide knowledge in fundamental and useful information sciences and technologies for the management of security problems to students who come from a degree in the computer science class and who have already acquired knowledge in the main security technologies. Please note that this curriculum must be chosen by three-year graduates in computer systems and network security and cannot be chosen by graduates in other three-year degree courses of the IT class of the University of Milan.

1st COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Methods for information technology security

Learning activity	Ects	Sector
ADVANCED BIOMETRICS	6	INF/01
INFORMATION SYSTEM SECURITY MANAGEMENT	6	ING-IND/35
LOGIC	6	INF/01
	Total compulsory credits	18	

Further elective courses Curriculum-specific features Methods for information technology security

Students must choose 6 credits from the following courses:

ARTIFICIAL INTELLIGENCE		6	INF/01
DEPENDABILITY		6	ING-INF/07
INFORMATION MANAGEMENT *Not available in 2024/25*		6	INF/01

CURRICULUM: [F2Y-B] Safe systems

Qualifying Training Objectives

The specific objective of this curriculum is to provide knowledge in cyber security issues starting from the basics to students who come from a scientific degree but who have limited previous knowledge on security issues. Please note that this curriculum cannot be chosen by three-year graduates in computer systems and networks security.

1st COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Safe systems			
Learning activity		**Ects**	**Sector**
BIOMETRIC SYSTEMS		6	INF/01
COMPUTER FORENSICS		6	ING-INF/05
CRYPTOGRAPHY		6	INF/01
NETWORK SECURITY		6	INF/01
	Total compulsory credits	24	