



**UNIVERSITA' DEGLI STUDI DI MILANO**  
**PROGRAMME DESCRIPTION - ACADEMIC YEAR 2022/23**  
**MASTER DEGREE**  
**DATA SCIENCE FOR ECONOMICS (Classe LM-data)**  
**Enrolled from 2022/23 academic year**

### **HEADING**

<b>Degree classification - Denomination and code:</b>	LM Data
<b>Degree title:</b>	Dottore Magistrale
<b>Length of course:</b>	2 years
<b>Credits required for admission:</b>	180
<b>Total number of credits required to complete programme:</b>	120
<b>Years of course currently available:</b>	1st
<b>Access procedures:</b>	Open, subject to entry requirements
<b>Course code:</b>	B79

### **PERSONS/ROLES**

#### **Head of Study Programme**

prof.ssa Silvia Salini Vice-Presidente Collegio Didattico Prof. Stefano Montanelli

#### **Tutors - Faculty**

Prof. Alfio Ferrara (Academic guidance tutor)  
Prof. Luca Rossini (Academic guidance tutor)  
Prof. Domenico Massaro (Erasmus and international mobility tutor)  
Prof. Giancarlo Manzi (Internship tutor)

<https://www.linkedin.com/company/74033091/admin/>

#### **Facebook**

<http://www.facebook.com/dseunimi>

#### **Instagram**

[https://www.instagram.com/dse\\_unimi/](https://www.instagram.com/dse_unimi/)

#### **Twitter**

<https://twitter.com/DseUnimi>

#### **Web Site**

<https://mls.cdl.unimi.it/en>

#### **Welcome desk**

Via Santa Sofia 9 Phone +39 02 5032 5032 <https://www.unimi.it/en/study/student-services/welcome-desk-informastudenti>

### **CHARACTERISTICS OF DEGREE PROGRAMME**

#### **General and specific learning objectives**

The graduates of the DSE MSc program will receive advanced education on methodologies and tools in computer science, quantitative and methodological notions to interpret and analyze economic phenomena using approaches that integrate business, market, and social media data. Among these, the MSc program focuses on the analysis of the effects of economic policies as well as the evaluation of actions and any other activity related to the sectors of economy, marketing, and business.

The DSE course enforces the construction of solid methodological bases by addressing topics of the economic theory, decision theory under uncertainty conditions, micro-econometric techniques, and time-series analysis. It also enforces the study of emerging data management technologies and scalability of analysis systems in cloud environments, as well as machine learning techniques for the extraction and classification of information.

In addition to these compulsory activities, the DSE course allows a student to autonomously customize/specialize the study plan according to her/his own inclination by choosing elective courses for a total of 18 ECTS within two different educational paths, namely the "Data Science" path and the "Economic Data Analysis" path. A first kind of specialization

focus is about the aspects of methodological and technological innovation, advanced statistical methods, techniques of social media analysis, and textual analysis as well as their impact on the data-driven business. A further kind of specialization offers useful tools for economic applications in the area of policy or investment assessment, the study of production processes, and the evolution of social phenomena.

These specialization activities are geared, together with the external training activities, to the preparation of the dissertation and to the final exam. Therefore, the dissertation is considered as the fulfillment of the course of study and the apprenticeship that started with the choice of the educational path.

The courses of DSE, both compulsory and elective, include lectures and laboratory classes as well as autonomous project activities and individual activities to guarantee an adequate preparation also from a practical point of view, in close contact with case studies and real data.

The in-depth studies in mathematics, statistics, computer science, and economics highly qualify the educational project of Data Science for Economics and they prepare the students also for selective procedures of PhD and research programs in the areas of Data Science, Computer Science, and Economics.

### **Expected learning outcomes**

The master's degree course intends to train specialists able to use mathematical statistical-computer techniques in the economic field by pursuing the following educational objectives: understand the mathematical tools relevant to tackle data science problems; understand the theory and the methodological-operational aspects of statistics and probability; understand the theory and the methodological aspects and the tools of the computer science discipline; understand the methodological-operational aspects of the economic theory (at the micro and macro-economic level) and of the statistical-econometric methods; understand the aspects related to business, management and company organization; understand the essential elements of data protection legislation and the privacy risks deriving from the release of public and semi-public data.

Knowledge and comprehension skills will be acquired mainly through lectures, accompanied by seminars, exercises and discussion groups, as well as guided and autonomous individual study. The verification of the achievement of learning outcomes takes place through oral and/or written exams, as well as through the evaluation by the teacher of individual and group written reports.

The master's degree course aims to provide the application capabilities useful for recognize, analyze and characterize the problems inherent to the data and their analysis; deal with and solve problems related to the management and storage of data, even from sources that are heterogeneous by type and structure; process data with the use of complex software tools; autonomously define algorithms and programs for data processing; interpret the results of the analysis of economic data with competence and the ability to understand the implications.

The exercises, which integrate all the teachings, will play an important role in achieving and verifying the ability to apply knowledge and understanding. Students are also expected to extend and deepen the knowledge thus acquired through participation in laboratories and workshops, many of which offered by companies and organizations, in seminars conducted by external experts, through the carrying out of the internship or curricular internship, with the consultation of bibliographic materials and with the thesis work.

### **Making judgements**

The graduates should acquire the ability to formulate independent and informed judgments by developing critical skills, with special focus on the effects and effectiveness of the decisions of the companies and institutions in which they operate, also with reference to the ethical implications of such actions and decisions, above all in relation to the security and confidentiality of the analyzed data, the consequences and effectiveness of economic policies. The graduates will also have i) to fully assimilate the principles of professional deontology that guide interpersonal relations in the occupational context, and ii) to acquire the fundamental principles of the scientific approach to the solution of the economic-business problems that they will face in their professional activity. The multidisciplinary approach of the degree program fosters the development of autonomous judgment and critical thinking, by offering students the opportunity to compare methodological approaches belonging to different disciplines. The relevant presence of economic, statistical, and computer science courses, which provide methodological and technical skills of formal analysis, fosters the acquisition of the scientific approach to problem solving. The acquisition of critical skills and autonomy of judgment will be verified in the discussion of project work assigned to students, both individual and team-based, and company seminars through the presentation of business cases. These skills will also be verified by providing open questions in the examinations and, by requiring the students to present/discuss short essays and scientific papers.

### **Communication skills**

The graduates will be able i) to present and effectively communicate the results of their work (e.g., projects, reporting, document analysis) within the company or institutions in which they are involved, ii) to clearly and effectively express and communicate their positions/opinions in written and oral forms by providing evidences supported by data, iii) to set up cooperative and collaborative relationships within working groups, iv) to present proposals and solutions to the problems considered in a working context using mathematical-quantitative tools, v) to access a specialized audience, for example, by publishing the results of a research work. The ability to effectively communicate in working contexts is primarily acquired through the presentation and discussion of business cases. The application of quantitative methods of analysis and computer science techniques in economic teachings will allow to develop the ability of students to use information and empirical evidence to support the solutions they propose in working contexts. The preparation of reports and short essays expected by some teachings, as well as the preparation of the dissertation allow to enhance the written communication skills. The

participation to the exercise classes, the development of any internship within a company and, alternatively, the participation to internal laboratories will allow students to develop communication and relational skills. The ability to communicate is assessed in the examination tests as an element that contributes to the overall judgment, especially in those courses where such an ability is explicitly expected in the objectives. The drafting and discussion of the dissertation provide further evaluation elements.

#### Learning skills

The graduates will have the ability to develop and deepen their skills by exploiting specialized scientific publications, databases, and further useful information on the web; as well as by analyzing information and data through mathematical, statistical, and econometric tools. The DSE course also provides methodological skills that foster the ability i) to undertake a professional experience with managerial functions or high responsibility in industry and in the financial sector where the position of the data scientist is more and more prominent, and ii) to develop the autonomy of research, which is functional to undertake professional activities in research institutions or to continue their studies in second level master's degrees or in doctoral programs.

The students can also attend, as elective educational activities, laboratories for learning methods of economic research. Further learning opportunities are given by teachings that provide methodological and technical skills of formal analysis. Finally, the preparation of the dissertation provides an additional opportunity to develop learning skills through the autonomous elaboration of an advanced research work.

### Professional profile and employment opportunities

The MSc program in Data Science for Economics aims to train the following professional figures.

#### Profile: Data Scientist

Functions: its main functions are i) to analyze and elaborate forecasts on large data flows, ii) to identify and apply the most suitable software tools and statistical techniques for their processing, iii) to create complex models for predictive data-based analysis. The Data Scientist knows the different contexts in which data emerge and she/he knows how to interact with experts from various disciplines.

Skills: statistical analysis, programming, knowledge of software tools.

Outlets: large companies, small and medium-sized enterprises, startups, and Public Administration. They can work in manufacturing, telco and media, services, banking-insurance, utilities sectors.

#### Profile: Data Analyst

Functions: its main functions are the identification and supervision of operational decision-making processes in direct coordination with the company executive management. They can work in marketing, business, management innovation, and finance.

Skills: baggage of theoretical knowledge about economics, statistics, and computer science to support both organizational and development decisions of economic institutions and companies.

Outlets: large companies, small and medium-sized enterprises and consulting firms operating in various sectors such as manufacturing, telco and media, services, banking-insurance, utilities.

#### Profile: Data Driven Economist

Functions: its main functions are to frame problems of economic analysis in the context of data science by identifying data and technologies capable of providing new keys to interpret or to evaluate economic and social phenomena.

Skills: economic theory, statistical, econometric, and computer science techniques.

Outlets: large companies, Public Administration, and international organizations.

#### Profile: Data-Driven Decision Maker

Functions: the professions included in this category perform managerial functions of high responsibility in private and public companies with an international vocation and a strong technological component, using data analysis to guide strategic and operational decisions.

Skills: wealth of theoretical knowledge about economics, statistics, and computer science to support organizational and development decisions of economic institutions and companies.

Outlets: small and medium enterprises, large companies, Public Administration.

#### Profile: Analyst of development projects or economic policies

Functions: the professions included in this category contribute to the formulation, monitoring, and analysis of development projects or economic policies.

Skills: baggage of theoretical and operational notions in the field of economics, business management strategy, and the economic policies that govern them.

Outlets: they work in private or public companies in industry, commerce, business services, personal services, and companies

of similar kind as well as international and/or governmental institutions.

### Initial knowledge required

Candidates for admission to the master's degree course may come from various bachelor's, but must have earned at least 30 ECTS in computer science and mathematics (scientific disciplinary sectors: from MAT-01 to MAT-09, INF-01, ING-INF/05) and/or in the area of economic sciences and statistics (scientific disciplinary sectors: SECS-S/01, SECS-S/02, SECS-S/03, SECS-S/06, SECS-P/05, SECS-P/01, SECS-P/02, SECS-P/03, SECS-P/07, SECS-P/08, SECS-P/10).

The ownership of linguistic skills at least at B2 level in the English language is a requirement for access.

Proficiency in English at a B2 level or higher, under the Common European Framework of Reference for Languages (CEFR), is required for admission.

The B2-level requirement will be ascertained by the University Language Centre (SLAM) upon admission as follows:

- Language certificate at or above B2, obtained no more than three years earlier. For the list of language certificates recognized by the University please review: <https://www.unimi.it/en/node/39267/>). The certificate must be uploaded when submitting the online application;
- English level achieved during a Bachelor's degree programme through SLAM courses and tests. The test must have been passed within the last four years. It will be assessed administratively, without the applicant having to attach any certificates;
- Placement Test delivered by the University Language Centre (SLAM), which will take place according to the schedule posted to the website: <https://www.unimi.it/en/node/39267/>

All those who fail to submit a valid certificate or do not meet the required proficiency level will be invited to take the test through the admission procedure.

Candidates who do not sit or pass the placement test will have until 30 June 2022 (Extra EU) or by 31 July 2022 (EU) to obtain and submit a recognized certificate to SLAM.

Students who do not meet the requirement by 30 June 2022 (Extra EU) or by 31 July 2022 (EU) will not be admitted to the Master's degree programme and may not sit further tests

Minimum curricular requirements cannot be considered as a verification of personal competencies and skills, which is mandatory. Admission is conditional and it depends on the assessment of the personal competencies and skills of the student provided by the Admission Board, whose members are appointed by the Faculty Board-Collegio Didattico.

Assessment of personal competencies and skills is based on the academic curriculum (quality of the previous degree as well as the average grade obtained in the bachelor program. Grades obtained in mathematics, statistics, computer science and economics courses are also part of the evaluation) and choice coherence (coherence between the academic curriculum and/or the activities previously carried out by the student and the learning objectives of the MSc in Data Science for Economics).

The Admission Board reserves the possibility to request the applicant an oral interview or written text for admission, held in English language and exclusively done via electronic devices (i.e., via Teams, Skype, Zoom or other platforms). The oral interview is aimed at verifying the individual knowledge and skills required by DSE. A complete, detailed list of topics that can be asked during the interview is published on the DSE website.

Students with a foreign qualification are also required to ascertain the basic requirements equivalent to the minimum requirements for students with an Italian qualification.

Students without an Italian degree or diploma must obtain 3 credits in Additional language skills: Italian by proving an Italian language proficiency at level A2 within the Common European Framework of Reference for Languages (CEFR). This level can be assessed by the end of the degree course in the following ways:

- \_ by submitting the language certificate achieved no more than three years prior to the submission, at level A2 or higher, recognised by the University (the list of recognised language certificates can be found at: <https://www.unimi.it/en/node/349/>). The language certificate must be uploaded through the service <https://informastudenti.unimi.it/saw/ess?AUTH=SAML>, by choosing the category SLAM;
- \_ by an entry-level test, organised by SLAM, which can be taken at the beginning of every semester.

Students who fail to reach level A2 will have to attend a 60-hour Italian course organised by SLAM and to pass the final test in order to earn 3 ECTS credits of Additional Language Skills: Italian.

The DSE program also reserves the right to evaluate the possible definition of a planned maximum number of students, determined each year by the competent academic bodies, on the basis of structural, instrumental, and personnel resources available for the functioning of the degree course.

### **Compulsory attendance**

No obligation

### **Degree programme final exams**

The final exam consists in a public discussion in front of a committee of a master's dissertation. The master's dissertation is an original piece of work, written by the candidate under the guidance of a supervisor.

### **Campus**

Department of Economics, Management and Quantitative Methods, Via Conservatorio 7, Milano Department of Computer Science "Giovanni degli Antoni", Via Celoria 18, Milano

## **EXPERIENCE OF STUDY ABROAD AS PART OF THE TRAINING PROGRAM**

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

The agreements defined by the University with over 300 universities from 30 different 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

One of the most effective policies adopted by European Union in the last years has been the internationalization of higher education. The various Erasmus programmes that have been implemented since the nineties have greatly increased the mobility of European students.

Being a brand-new programme with an internationally oriented educational core strategy, DSE promotes a wide internationalization of their students, and therefore strongly encourages them to spend part of their studies abroad in Erasmus+ Programmes.

Erasmus+ provides opportunities to study, train, gain work experience and skills. Students can go abroad from 3 up to 12 months (including a complementary traineeship period, if planned), and may receive additional grants for studying or training. At the end of their foreign stay, students get full recognition of completed activities in terms of credits for their degree. Student mobility is carried out in the framework of prior “inter-institutional agreements” between the sending and receiving institutions.

Students can also join the traineeship programme (Placement), by going abroad from 2 up to 12 months, starting their traineeship from the first year of study. For a traineeship which is an integral part of the curriculum, the sending institution must give full academic recognition for the period spent abroad. For a traineeship that is not part of the curriculum of the student, the sending institution shall at least provide recognition by recording this period in the Diploma Supplement or, in the case of recent graduates, by providing a traineeship certificate. Traineeship may also be established with private and public companies, educational or research centers other than the hosting institution, especially in the field of finance.

## 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](mailto:mobility.out@unimi.it)

Student Desk booking through InformaStudenti

<b>1st COURSE YEAR Core/compulsory courses/activities common</b>		
<b>Learning activity</b>	<b>Ects</b>	<b>Sector</b>
Coding for Data Science and Data Management	12	(6) SECS-S/01, (6) INF/01
Data-Driven Economic Analysis	12	(6) SECS-P/05, (6) SECS-P/02, (6) SECS-P/01
Dynamic Economic Modeling	9	SECS-P/01

Machine Learning and Statistical Learning	12	(6) SECS-S/01, (6) INF/01
Statistical Theory and Mathematics	12	(6) SECS-S/01, (6) MAT/08
Total compulsory credits	57	
<b>2nd COURSE YEAR (available as of academic year 2023/24) Core/compulsory courses/activities common</b>		
<b>Learning activity</b>	<b>Ects</b>	<b>Sector</b>
Cybersecurity and Protection of Personal Data: Legal and Policies Issues	6	IUS/09, IUS/20
Privacy, Data Protection and Massive Data Analysis in Emerging Scenarios	12	INF/01
Total compulsory credits	18	
<b>Elective courses</b>		
<b>3 activities among the selected path</b>		
<b>Total 18 credits/ects</b>		
<b>DATA SCIENCE PATH</b>		
<b>(3 courses chosen from the following, no more than 1 among those indicated with the symbol *)</b>		
Advanced Multivariate Statistics	6	SECS-S/01
Bayesian Analysis	6	SECS-S/01
Functional and Topological Data Analysis	6	MAT/06
Marketing Analytics*	6	SECS-P/08
Network Science	6	INF/01
Project Management and Innovation*	6	SECS-P/10
Reinforcement Learning	6	INF/01
Text Mining and Sentiment Analysis	6	INF/01
Time Series and Forecasting**	6	SECS-P/05
<b>ECONOMIC DATA ANALYSIS PATH</b>		
<b>(3 courses chosen from the following, at least 2 of those indicated with the symbol **)</b>		
Advanced Multivariate Statistics	6	SECS-S/01
Bayesian Analysis	6	SECS-S/01
Causal Inference and Policy Evaluation**	6	SECS-P/01
Experimental Methods and Behavioural Economics**	6	SECS-P/01
Text Mining and Sentiment Analysis	6	INF/01
Time Series and Forecasting**	6	SECS-P/05
<b>Further elective courses</b>		
<b>Students must earn 9 credits for elective activities.</b>		
<b>Students must earn 3 credits by selecting one of the following alternatives: Foreign language: advanced; Transversal Skills, Laboratory</b>		
Additional Language Skills: Italian (3 ECTS)	3	ND
Transversal Skills	3	NA
<b>Students must earn 3 credits by selecting one of the following alternatives: Internship or Stage</b>		
Internship or stage in companies, public or private bodies, professional orders	3	NA
Training and orientation internships	3	NA
<b>End of course requirements</b>		
Final Exam	12	NA
Total compulsory credits	12	

## COURSE PROGRESSION REQUIREMENTS

none