

#### SCIENCES, TECHNOLOGIES AND HEALTH

# Operations Research, Combinatorics and Optimisation (ORCO) 2nd year

Master in Computer science

Target level Baccalaureate +5

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Duration 1 year

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Component UFR IM2AG (informatique, mathématiques et mathématiques appliquées), Grenoble INP - Ensimag (Informatique, mathématiques appliquées et télécommunications), UGA



# Presentation

Semester 9 corresponds to the specialization training, semester 10 consists of a practicum in a company or laboratory of 5 to 7 months, which represents 30 European credit transfer and accumulation system credits.

The scientific objectives are to train students in the foundations and methods of operational research (mathematical programming, graph theory, complexity, stochastic programming, heuristics, approximation algorithms etc) and to prepare students to use and develop these methods to solve complex industrial applications (supply chain, scheduling, transport, revenue management etc) and implement the corresponding software solutions.

Students departing from this course intend to, depending on their preferences :

- Orient themselves towards the research professions (academic or industrial thesis)
- Enter, as a specialist engineer, major research and development services in optimization (SNCF, IBM, Air France, Amadeus etc) or enter consulting firms in optimization (Eurodécision, Artelys etc)

They will also be able to enter less specialized companies by highlighting their ability to methodologically analyse operational problems and thus displaying themselves as potential key elements in the improvement of the company's performance (by linking up with specialized firms or developing in-house methods). In the longer term, students who are oriented towards the industrial world should be able, with their experience in improving company performance and good "business" knowledge, to naturally access decisionmaking positions at high levels of responsibility.

The course is labelled "Core AI" by 🗹 MIAI.

### Skills



Some teaching units of the program, of common core or labelled research, allow students to acquire organizational skills and skills related to research work :

- Formulate a research problem and propose a solution
- Position a research problem in the scientific literature
- Evaluate and validate a solution to a research problem
- Write a scientific publication
- Communicating the results of research work
- Develop and use mathematical and computer tools
- Communicate in English and French

International education : Internationally-oriented programmes

# International dimension

Possibility of doing a 🖸 double degree with the 🗹 University of Swansea

# Organisation

# Admission

# Access conditions

The second year master's is accessible to candidates according to their transcripts (and/or interview) :

- Having validated the first year of a compatible course or by validating studies or acquired experience according to the conditions determined by the university or the training Public continuing education : You are in charge of continuing education :
- if you resume your studies after 2 years of interruption of studies
- or if you followed a formation under the regime formation continues one of the 2 preceding years
- or if you are an employee, job seeker, self-employed

If you do not have the diploma required to integrate the training, **C** you can undertake a validation of personal and professional achievements (VAPP)

# Candidature / Application

Do you want to apply and register? Note that the procedure differs depending on the degree considered, the degree obtained, or the place of residence for foreign students.

C Find out which procedure applies to me and apply

### Prerequisites

Language requirements :

 Students are required to provide evidence of Competence in English.

English scores required for the MSIAM, programs: TOEFL IBT 78, CBT 210, Paper 547 / TOEIC 700 / Cambridge FCE / IELTS 6.0 min.

This is equivalent to CEFR level B2.

If you have successfully completed a degree (or equivalent) course at a University in one of the following countries then you meet the English requirement automatically: Australia, Canada, Guyana, Ireland, New Zealand, South Africa, United Kingdom, United States of America, West Indies.

# And after

# **Further studies**

This program allows students to write a thesis. Its strong industrial basis especially allows students to find industrial theses with very good conditions (CIFRE, contract...)

Sector(s)





- Operational research engineer
- Logistics engineering engineer
- Optimization development engineer
- R&D engineer in operations research
- Teacher/researcher in operational and combinatorial research

# Useful info

# Contacts

#### Program director

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#### Program director

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#### Program administration

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#### Program administration

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# Course location(s) - City

**Grenoble** 

### Campus

Grenoble - University campus





# Program

# Specifics of the program

Program under constrcution - awaiting CFVU vote

### Master 2nd year

#### Semester 9

	Nature	СМ	TD	TP	Crédits
UE Advanced models and methods in operations research	Teaching Unit (UE)	36h			6 credits
UE Combinatorial optimization and graph theory	Teaching Unit (UE)	36h			6 credits
UE Optimization under uncertainty	Teaching Unit (UE)	36h			6 credits
UE Constraint Programming, applications in scheduling	Teaching Unit (UE)				3 credits
UE Graphs and discrete structures	Teaching Unit (UE)	18h			3 credits
UE Advanced heuristic and approximation algorithms	Teaching Unit (UE)	18h			3 credits
UE Advanced mathematical programming methods	Teaching Unit (UE)	18h			3 credits
UE Academic and industrial challenges	Teaching Unit (UE)	18h			3 credits
UE Transport Logistics and Operations Research	Teaching Unit (UE)				6 credits
UE Advanced parallel system	Teaching Unit (UE)	36h			6 credits
UE Multi-agent systems	Teaching Unit (UE)	18h			3 credits
UE Fundamentals of Data Processing and Distributed Knowledge	Teaching Unit (UE)	36h			6 credits
UE Scientific Methodology, Regulatory and ethical data usage	Teaching Unit (UE)	36h			6 credits





UE Large scale Data Management and Distributed Systems	Teaching Unit (UE)	30h		6h	6 credits
UE Cryptographic engineering, protocols and security models, data privacy, coding and applications	Teaching Unit (UE)	36h	18h	24h	6 credits
UE From Basic Machine Learning models to Advanced Kernel Learning	Teaching Unit (UE)	36h			6 credits
UE Mathematical Foundations of Machine Learning	Teaching Unit (UE)	36h			3 credits
UE Learning, Probabilities and Causality	Teaching Unit (UE)	36h		18h	6 credits
UE Statistical learning: from parametric to nonparametric models	Teaching Unit (UE)	36h			6 credits
UE Mathematical optimization	Teaching Unit (UE)	36h			6 credits
UE Safety Critical Systems: from design to verification	Teaching Unit (UE)	36h			6 credits
UE Information visualization	Teaching Unit (UE)	18h			3 credits
UE GPU Computing	Teaching Unit (UE)	18h		18h	6 credits
UE Robotics	Teaching Unit (UE)	36h			6 credits
UE Cloud Computing, from infrastructure to applications	Teaching Unit (UE)	36h			6 credits
UE Advanced Machine Learning: Applications to Vision, Audio and Text	Teaching Unit (UE)	36h			6 credits
UE Natural Language Processing & Information Retrieval	Teaching Unit (UE)	36h			6 credits
UE Information Security	Teaching Unit (UE)	36h			6 credits
UE Human Computer Interaction	Teaching Unit (UE)	36h			6 credits
UE Next Generation Software Development	Teaching Unit (UE)	36h			6 credits
Semester 10					





**UE** Practicum

Teaching Unit (UE) 30 credits

# Master 2nd Graduate School program

#### Semester 9

	Nature	СМ	TD	TP	Crédits
UE GS_MSTIC_Research ethics	Teaching Unit (UE)				6 credits
UE Advanced models and methods in operations research	Teaching Unit (UE)	36h			6 credits
UE Combinatorial optimization and graph theory	Teaching Unit (UE)	36h			6 credits
UE Optimization under uncertainty	Teaching Unit (UE)	36h			6 credits
UE Constraint Programming, applications in scheduling	Teaching Unit (UE)				3 credits
UE Graphs and discrete structures	Teaching Unit (UE)	18h			3 credits
UE Advanced heuristic and approximation algorithms	Teaching Unit (UE)	18h			3 credits
UE Advanced mathematical programming methods	Teaching Unit (UE)	18h			3 credits
UE Academic and industrial challenges	Teaching Unit (UE)	18h			3 credits
UE Transport Logistics and Operations Research	Teaching Unit (UE)				6 credits

### Semester 10

	Nature	СМ	TD	TP	Crédits
UE Practicum	Teaching				30 credits
	Unit (UE)				