SCIENCES, TECHNOLOGIES AND HEALTH

# Cybersecurity

Master in Mathematics and applications

Target level
Baccalaureate +5

ECTS
120 credits

Duration
2 years

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

Language(s) of instruction
English

## Presentation

The global economic impact of losses due to cybercrime amounts to hundreds of billions of euros per year ($445 billion according to the McAfee/CSIS study of 2014) with a strong increase in attacks, especially for identity theft and digital data theft, as well as malicious attacks.

Protection against these vulnerabilities includes :

- Robustness to cyber attacks of sensitive infrastructure (e.g. stuxnet)
- Robustness of security components against software vulnerabilities and data leaks (e.g. heartbleed)
- Protection of privacy and security of cloud infrastructure
- Robust design and evaluation of safety components
- Fault detection in protocols or software and hardware components

The topics covered in the training cover the complementary areas of Cybersecurity, including cryptology, forensics, and privacy, in particular for embedded systems and distributed architecture.

The objective of this program is to train cybersecurity experts (including data privacy aspects) with a bac + 5 degree, able to evolve immediately in an industrial environment and who can also pursue a thesis.

The course is labelled "Core AI" by MIAI.

**International education :** Internationally-oriented programmes

## International dimension

Internationally oriented training

## Organisation

**Abroad intership :** In France or abroad

# Admission

## Access conditions

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

- Proof of a national degree conferring the degree of bachelor in a field compatible with that of the Master's degree- or by validation of studies or acquired experience according to the conditions determined by the university or the training

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 (the course is accessible from the two common trunks General mathematics and Applied mathematics provided that the students have taken the appropriate optional courses)
- Or by validation of 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, 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.

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

Depending on the nature of their practicum, students may wish to pursue research in a doctoral thesis.

## Targeted trades

- Cybersecurity engineer
- Information systems security engineer
- Engineer specialized in auditing security of information systems
- Technical sales engineer in computer security
- R & D engineer specialized in cybersecurity

# Useful info

## Contacts

### Program director

Clement Pernet

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### Program director

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### Administrative contact

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### Administrative contact

Elise Ros

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## Course location(s) - City

Grenoble

## Campus

Grenoble - University campus

## Know more

Cybersecurity Course Site

http://cybersecurity.imag.fr/

# Program

## Specifics of the program

Program under construction - awaiting CFVU vote

### Master applied mathematics 1st year

#### Semester 7

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|
| UE Object-oriented and software design | Teaching Unit (UE) | | | 18h | 3 credits |
| UE Partial differential equations and numerical methods | Teaching Unit (UE) | 16,5h | 16,5h | 16,5h | 6 credits |
| Partial differential equations and numerical methods | OTHER | 16,5h | 16,5h | | |
| Partial differential equations and numerical methods complementary | OTHER | | | 16,5h | |
| UE Signal and image processing | Teaching Unit (UE) | | | 16,5h | 6 credits |
| UE Geometric modelling | Teaching Unit (UE) | | | 16,5h | 6 credits |
| UE English | Teaching Unit (UE) | | 24h | | 3 credits |
| UE Applied probability and statistics | Teaching Unit (UE) | 22,5h | 18h | 9h | 6 credits |
| UE Systèmes dynamiques | Teaching Unit (UE) | 12h | 9h | 3h | 3 credits |
| UE Instability and Turbulences | Teaching Unit (UE) | | | | 3 credits |
| UE Turbulence | Teaching Unit (UE) | 12h | | 18h | 3 credits |

#### Semester 8

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|
| UE Computing science for big data and HPC | Teaching Unit (UE) | | | 15,5h | 6 credits |
| HPC | OTHER | | | 9h | |
| Introduction to database | OTHER | | | 7,5h | 3 credits |

| | | | | | |
|---|---|---|---|---|---|
| UE Project | Teaching Unit (UE) | | | | 3 credits |
| UE Internship | Teaching Unit (UE) | | | | 3 credits |
| UE Numerical optimisation | Teaching Unit (UE) | | | 16,5h | 6 credits |
| UE Operations Research (AM) | Teaching Unit (UE) | | | | 6 credits |
| UE Operations Research | Teaching Unit (UE) | 16,5h | 16,5h | | 3 credits |
| Operations Research Complementary | OTHER | 16,5h | 16,5h | | |
| UE Introduction to cryptology (AM) | Teaching Unit (UE) | | | | 6 credits |
| UE Introduction to cryptology | Teaching Unit (UE) | 16,5h | 13,5h | 3h | 3 credits |
| Introduction to cryptology complementary | OTHER | | 16,5h | | |
| UE 3D Graphics (AM) | Teaching Unit (UE) | | | | 6 credits |
| UE 3D graphics | Teaching Unit (UE) | 16,5h | 16,5h | | 3 credits |
| 3D Graphics Complementary | OTHER | | | 16,5h | |
| UE Turbulences | Teaching Unit (UE) | | | | 6 credits |
| Plasmas Astrophysiques et de Fusion | Teaching Unit (UE) | 24h | 3h | | |
| Experimental techniques in fluid mechanics | Teaching Unit (UE) | 6h | | 24h | |
| UE Statistical analysis and document mining | Teaching Unit (UE) | | | | 6 credits |
| Statistical analysis and document mining | OTHER | 16,5h | | 25,5h | |
| Statistical analysis and document mining Complementary | EPREUVE | | 7,5h | 9h | 3 credits |
| UE Variational methods applied to modelling | Teaching Unit (UE) | 16,5h | 16,5h | 16,5h | 6 credits |
| Variational methods applied to modelling | OTHER | 16,5h | 16,5h | | |
| Variational methods applied to modelling Complementary | OTHER | | | 16,5h | |

## Master applied mathematics 1 st year Graduate School program

### Semester 7

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| UE Object-oriented and software design | Teaching Unit (UE) | | | 18h | 3 credits |
| UE Partial differential equations and numerical methods | Teaching Unit (UE) | 16,5h | 16,5h | 16,5h | 6 credits |
| Partial differential equations and numerical methods | OTHER | 16,5h | 16,5h | | |
| Partial differential equations and numerical methods complementary | OTHER | | | 16,5h | |
| UE Signal and image processing | Teaching Unit (UE) | | | 16,5h | 6 credits |
| UE Geometric modelling | Teaching Unit (UE) | | | 16,5h | 6 credits |
| UE Applied probability and statistics | Teaching Unit (UE) | 22,5h | 18h | 9h | 6 credits |
| UE English | Teaching Unit (UE) | | 24h | | 3 credits |

## Semester 8

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|
| UE Computing science for big data and HPC | Teaching Unit (UE) | | | 15,5h | 6 credits |
| HPC | OTHER | | | 9h | |
| Introduction to database | OTHER | | | 7,5h | 3 credits |
| UE Project | Teaching Unit (UE) | | | | 3 credits |
| UE Internship | Teaching Unit (UE) | | | | 3 credits |
| UE Numerical optimisation | Teaching Unit (UE) | | | 16,5h | 6 credits |
| UE GS_MSTIC_Scientific approach | Teaching Unit (UE) | | | | 6 credits |
| UE Operations Research (AM) | Teaching Unit (UE) | | | | 6 credits |
| UE Operations Research | Teaching Unit (UE) | 16,5h | 16,5h | | 3 credits |
| Operations Research Complementary | OTHER | 16,5h | 16,5h | | |
| UE Introduction to cryptology (AM) | Teaching Unit (UE) | | | | 6 credits |
| UE Introduction to cryptology | Teaching Unit (UE) | 16,5h | 13,5h | 3h | 3 credits |
| Introduction to cryptology complementary | OTHER | | 16,5h | | |

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|---|---|---|---|---|---|
| UE 3D Graphics (AM) | Teaching Unit (UE) | | | | 6 credits |
| UE 3D graphics | Teaching Unit (UE) | 16,5h | 16,5h | | 3 credits |
| 3D Graphics Complementary | OTHER | | | 16,5h | |
| UE Turbulences | Teaching Unit (UE) | | | | 6 credits |
| Plasmas Astrophysiques et de Fusion | Teaching Unit (UE) | 24h | 3h | | |
| Experimental techniques in fluid mechanics | Teaching Unit (UE) | 6h | | 24h | |
| UE Variational methods applied to modelling | Teaching Unit (UE) | 16,5h | 16,5h | 16,5h | 6 credits |
| Variational methods applied to modelling | OTHER | 16,5h | 16,5h | | |
| Variational methods applied to modelling Complementary | OTHER | | | 16,5h | |
| UE Statistical analysis and document mining | Teaching Unit (UE) | | | | 6 credits |
| Statistical analysis and document mining | OTHER | 16,5h | | 25,5h | |
| Statistical analysis and document mining Complementary | EPREUVE | | 7,5h | 9h | 3 credits |

## Master general mathematics 1st year

### Semester 7

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|
| UE Algebra | Teaching Unit (UE) | 33h | 48h | | 9 credits |
| UE Holomorphic functions | Teaching Unit (UE) | 21h | 33h | | 6 credits |
| UE Probabilities | Teaching Unit (UE) | 33h | 48h | | 9 credits |
| UE Analysis | Teaching Unit (UE) | 33h | 48h | | 9 credits |

### Semester 8

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|
| UE Study and research work | Teaching Unit (UE) | | | | 6 credits |
| UE Effective algebra and cryptographie | Teaching Unit (UE) | 21h | 33h | | 6 credits |

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|---|---|---|---|---|---|
| UE Compléments sur les EDP | Teaching Unit (UE) | 21h | 33h | | 6 credits |
| UE Differential geometry | Teaching Unit (UE) | 19,5h | 29h | | 6 credits |
| UE Markov process | Teaching Unit (UE) | 21h | 33h | | 6 credits |
| UE Galois theory | Teaching Unit (UE) | 21h | 33h | | 6 credits |
| UE Operations Research (AM) | Teaching Unit (UE) | | | | 6 credits |
| UE Operations Research | Teaching Unit (UE) | 16,5h | 16,5h | | 3 credits |
| Operations Research Complementary | OTHER | 16,5h | 16,5h | | |
| UE English S8 | Teaching Unit (UE) | | 24h | | 3 credits |
| UE Opening UE (only if C1 level in English reached) | Teaching Unit (UE) | | | | 3 credits |

## Master 2nd year

### Semester 9

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|
| UE Software security, secure programming and computer forensics | Teaching Unit (UE) | 19,5h | | 19,5h | 3 credits |
| UE Security architecture | Teaching Unit (UE) | 48h | | 30h | 6 credits |
| UE Cryptographic engineering, protocols and security models, data privacy, coding and applications | Teaching Unit (UE) | 36h | 18h | 24h | 6 credits |
| UE Threat and risk analysis, IT security audit and norms | Teaching Unit (UE) | 19,5h | | 19,5h | 3 credits |
| UE Physical Security : Embedded, Smart Card, Quantum & Biometrics | Teaching Unit (UE) | 39h | 18h | 21h | 6 credits |
| UE Advanced cryptology | Teaching Unit (UE) | 24h | 12h | 12h | 6 credits |
| UE Advanced security | Teaching Unit (UE) | 24h | 24h | | 6 credits |

## Semester 10

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|
| UE Research practicum (in company or laboratory) | Teaching Unit (UE) | | | | 30 credits |

# Master 2nd Graduate School program

## Semester 9

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|
| UE Software security, secure programming and computer forensics | Teaching Unit (UE) | 19,5h | | 19,5h | 3 credits |
| UE Cryptographic engineering, protocols and security models, data privacy, coding and applications | Teaching Unit (UE) | 36h | 18h | 24h | 6 credits |
| UE Threat and risk analysis, IT security audit and norms | Teaching Unit (UE) | 19,5h | | 19,5h | 3 credits |
| UE Physical Security : Embedded, Smart Card, Quantum & Biometrics | Teaching Unit (UE) | 39h | 18h | 21h | 6 credits |
| UE GS_MSTIC_Research ethics | Teaching Unit (UE) | | | | 6 credits |
| UE Advanced cryptology | Teaching Unit (UE) | 24h | 12h | 12h | 6 credits |
| UE Advanced security | Teaching Unit (UE) | 24h | 24h | | 6 credits |

## Semester 10

| | Nature | CM | TD | TP | Crédits |
|---|---|---|---|---|---|
| UE Research practicum (in company or laboratory) | Teaching Unit (UE) | | | | 30 credits |