Master of Science in Engineering
Diplôme d’Ingénieur IMT Atlantique

In-depth study themes
Thématiques d’approfondissement – TAFs
(courses mostly taught in French)
Master of Science in Engineering - Diplôme d’Ingénieur IMT Atlantique

**MAJORS**

- Healthcare engineering / Ingénierie de la santé
- Energy, Nuclear and Environmental engineering / Ingénierie de l’énergie, de l’environnement et nucléaire
- Industrial engineering / Systèmes industriels, Organisations
- Electrical engineering / Robotique, électronique, Automatique, Télécommunications, Systèmes embarqués
- Computer Science and Network / Informatique, Réseaux
MAJORS

- **Healthcare engineering**: assisted surgery technologies, medical imaging, diagnostic assistance or even tattooing of medical data

- **Energy, nuclear and environmental engineering**: process engineering, energy systems, eco-design, nuclear physics, radiochemistry, neutronics or safety

- **Computer science and networks**: big data, applied mathematics, software engineering, cybersecurity, artificial intelligence or cloud computing

- **Industrial engineering and organizations**: industrial performance, digital business models, production management, logistics optimization and digital transformation management

- **Electrical engineering / robotics, electronics, automation, telecommunication and embedded systems**: human-machine interaction, communication systems, connected objects, space and maritime surveillance, etc.
Master of Science in Engineering - Diplôme d’Ingénieur IMT Atlantique

In-depth study themes (TAFs) offered in 2019

**COMPUTER SCIENCE AND NETWORK**
- IoT, IoT for industry 4.0 (R, taught in English)
- CoOC, Design of communicating objects (B)
- Cyber, Cybersecurity (R)
- DaSci, Data Science (B)
- DCL, Collaborative software development (BN)
- DigIC, Digitalisation, innovation and changes (B)
- IHM, HMI & collaborative systems (B)
- MCE, Mathematical and computational engineering (B)
- PNum, Digital platforms: technologies and markets (R, taught in English)

**ENERGY, NUCLEAR AND ENVIRONMENT**
- DEMIN, Development and management of nuclear facilities (N)
- TEE, Energy and environmental transitions - M1 (N)

**HEALTHCARE ENGINEERING**
- Health, Healthcare Engineering (BN)

**INDUSTRIAL ENGINEERING**
- ASCy, Automation and cyber-physical systems (N)
- COPSI, Design, Optimization and Control of Industrial Systems (N)
- MPR, Risk and return management (N)
- Robin, Robotics and interactions (N)

*Each TAF is taught in only one campus*

**Legend:**
- B : Brest
- N : Nantes
- R : Rennes
- BN : multi-location organisation
Choice of courses

There are 11 slots (rated from A to K) in all the TAFs.

Each course (UE) chosen by the student must be from a different slot.

Students cannot take more than 11 UE per year.

To validate a TAF students must pass at least 8 courses (UE):

- All the core courses (UE coeur) of the TAF, which are mandatory (3 or 4 depending on the TAF).
- 3 or 4 elective courses (UE électives) of the TAF.
- Free courses (UE libres): students can take other UEs from other slots (among all UEs available in all the TAFs) either to get 8 UEs or as extra.
**Acronym and title** (number of *UE cœur* + number of *UE électives* to be passed in order to validate the *TAF*)

*UE Cœur*: core courses

*UE Électives*: specialized courses

*UE Libres*: elective courses to be chosen from a different *TAF*

Schedule of *UEs*:

**A, B, C, D**: September - December

**E**: January

**F, G, H**: February, March

**I, J, K**: April, May
ASCY – AUTOMATION AND CYBER-PHYSICAL SYSTEMS (4+3)

Core
A: Modeling, analysis and simulation of mechatronics systems
B: From perception to action: robust control of dynamic systems
C: Identification and estimation of signals and dynamic systems
F: Implementation of control or diagnostic algorithms

Electives
D: Contemporary managerial issues
   Management of the company’s performance
   Engineering of complex systems
   Environmental energy: issues and strategies
E: Prototyping robotic systems
G: Advanced control methodology
   Embedded systems
H: Smart transports
   Cyber-physical systems optimization
   Real time and distributed information systems
I, J, K: free choice of course

Contact: fabien.claveau@imt-atlantique.fr
COOC – COMMUNICATING OBJECTS DESIGN (3+3)

Core
A: User centered design
B: Rapid prototyping and agile development
C: The object in its environment

Electives
D: Advanced methods of programing and software development
E: Radio software
   Decrypting a market
F: Evaluation, acceptability and digital ressources
   Internet of things, social web and semantic
   New techniques and uses of visualisation and interactive display
G: Web applications Engineering
   AI – optimised implementation
   Connected medical devices
H: Development of mobile devices
   Introduction to AI
I: Sensors and Energy
J: Innovation Ecosystem
   Introduction to AI
K: Electronics integration: from the algorithm to the prototype

Contact: charlotte.langlais@imt-atlantique.fr
COPSI – DESIGN, OPTIMIZATION & CONTROL OF INDUSTRIAL SYSTEMS (4+3)

Core
A: Operation management
B: Modeling languages and technics
C: Operations research
E: Advanced operations research

Electives
D: Contemporary managerial issues
   Management of the company’s performance
   Engineering of complex systems
   Environmental energy: issues and strategies
   Algorithms and machine learning
F: AI and constraint programing
   Logisitic chain design
G: Transport
   Implementation case: Decision, Optimisation and Responsability
H: Planification and sequencing
I, J, K: free choice of course

Contact: gilles.simonin@imt-atlantique.fr
Core
A: Networks basis
B: Networks Cybersecurity
C: Systems Cybersecurity
E: Evaluation, Analysis and Security certification

Electives
D: System security architecture
E: Core course
F: Cyber in specific environment
Web applications and Databases Cybersecurity
G: free choice of course
H: Data protection
I, J, K: free choice of course

Contact: nora.cuppens@imt-atlantique.fr
DCL – COLLABORATIVE SOFTWARE DEVELOPMENT (4+3)

Core
A: Advanced methods for programming and software development
B: Developer’s economic, organizational and legal environment
C: Software development engineering
E: Theoretical foundation of concurrent software development

Electives
D: Contemporary managerial issues (N)
  Management of the company’s performance (N)
  Engineering of complex systems (N)
  Environmental energy: issues and strategies (N)
  Algorithms and machine learning (N)
F: Principles of computer networks through practice (B)
  Aspects of wide scale development (N)
G: Web applications engineering (B)
  Programing robotic systems (B)
  Big data: collect, process and operate large amounts of data (N)
H: Cryptography and its applications (B)
  Apps development on mobile devices (B)
  High performance computing (N)
I: « Userland » operating systems – service-oriented architectures and system programing (B)
  Web applications engineering (N)
J: Languages and logics (B)
  Logical architecture and component based programing (N)
K: Algorithms design and analysis (B)
  Man-machine interaction – user experience (N)
  Certified programing (N)

Contacts:
fabien.dagnat@imt-atlantique.fr
herve.grall@imt-atlantique.fr
DIGIC – DIGITALISATION, INNOVATION AND CHANGES (3+3)

Core
A: Introduction to machine learning
B: Innovative society
C: Digital strategies

Électives
D: free choice of course
E: Decoding a market
   Company architecture and Information systems urbanisation
F: Assessment of user experience
   Digital marketing and Customer Relationship Management (CRM)
   Innovation Ecosystem
G: Company architecture and Information systems urbanisation
   Business Engineer
   Decision-making
H: Business Intelligence
   Change management
I: Graph Theory and social networks analysis
   Change management
J: Storytelling Dataviz
   Steering tools for company management
K: Game theory and agent based modeling
   Digital marketing and CRM

Contact: bernard.gourvennec@imt-atlantique.fr

This TAF is very popular. Unfortunately there are no more places available this year.
**Core**

A: Introduction to machine learning  
B: A journey to data scientist 1  
C: A journey to data scientist 2

**Electives**

D: Statistics and Statistical Analysis Systems (SAS)  
  Advanced C++ programing  
  Deep learning  

E: Big Data & Cloud computing

F: Advanced data mining  
  Data mining cases deployment

G: Decision-making  
  Market finance  
  Language processing and text mining  
  AI algorithms optimisation

H: Business Intelligence  
  Advanced Big Data architecture  
  Introduction to AI

I: Data sciences  
  Graph theory & social network Analysis  
  Advanced C++ programing

J: Learning analytics & learners follow-up  
  Introduction to AI

K: Game theory & agent based modeling  
  Digital marketing

Contact: cecile.bothorel@imt-atlantique.fr

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DEMIN – NUCLEAR ENGINEERING(4+3)

Core
A: Nuclear physics
B: Fuel cycle
C: Nuclear reactors operation
G: Radio protection

Electives
D: Contemporary managerial issues (N)
   Management of the company’s performance (N)
   Engineering of complex systems (N)
   Environmental energy: issues and strategies (N)
   Algorithms and machine learning (N)

E: Economy of energy
   Fusion, GEN IV, Propulsion

F: Monte Carlo modeling in nuclear physics
H: Management of complex projects in the nuclear field

I, J, K: free choice of course

Contact: julie.champion@imt-atlantique.fr
HEALTH – HEALTHCARE ENGINEERING (3+3)

Core
A: Anatomy & physiology for the design of medical devices & sensors
B: The digital patient
C: Health management: Information System organization

Electives
D: free choice of course
E: Computer-aided medical interventions
   Economy and health law
F: Principles of physics, system architecture, training and medical image processing
G: Connected medical devices
   Dosimetry
   Health information system, standards and security
H: Analysis of health data: epidemiology and decision-making
   From the radioisotope to the radiopharmaceutical
I, J, K: free choice of course

Contacts:
chafia.hamitouche@imt-atlantique.fr
vincent.metivier@imt-atlantique.fr
IHM – MAN MACHINE INTERACTION (MMI) 
AND COLLABORATIVE SYSTEMS (4+3)

Core
A: Software engineering for MMIs and collaboration
B: Cognitive ergonomy for interaction
C: Social, legal and ergonomy principles of work within a collaborative network
D: Advanced methods for programing and software development

Electives
E: Augmented reality
F: User experience evaluation
   IoT Intelligence, social web and semantic
G: Collaborative virtual reality
   Web Apps engineering
   Language processing and data mining
H: Mobile Devices Development

I, J, K: free choice of course

Contact: thierry.duval@imt-atlantique.fr
IOT – INTERNET OF THINGS FOR THE INDUSTRY 4.0 (3+3)

Core
A: Developing and deploying applications in the cloud
B: Information transport protocols
C: New economy models and digital law

Electives
D: Security architecture of systems
   Mobile networks
E: Wireless networks for IoT devices
   Industrial networks
F: Distribution radio networks
G: Cyber-security in specified environments
H: Smart cities and transports
I: Computer networks basis
   Mobile networks
J: Standardisation
K: Literature review project

Contact: laurent.toutain@imt-atlantique.fr
ISC – COMMUNICATION SYSTEMS ENGINEERING (3+3)

Core
A: Physical channels of communication
B: Digital communications
C: Transmission systems architecture and engineering

Electives
D: Error correction coding
   Radio technologies
E: Receivers for digital communications: from principles to implementation
   Data and applications security
F: Optical technologies
   Computer networks through practise
G: Mobile networks
   Data compression: from source coding to virtual reality
H: Optical networks
I, J: Fee choice of course
K: Electronic integration: from the algorithm to the prototype

Contact: karine.amis@imt-atlantique.fr
MCE – MATHEMATICAL & COMPUTATIONAL ENGINEERING (3+3)

Core
A: Introduction to machine learning
B: Stochastic modelling and analysis
C: Numerical methods

Electives
D: Advanced C++ programing
   Deep learning
E: Stochastic Dynamic Models
   Big data & cloud computing
F: Statistical learning & sparse representations
   Empirical finance
   Computational Imaging
   Deployment of data mining true cases
G: Markov chains & applications
   Market finance
   Computer vision
H: Portfolio management & trading algorithms
   Projects on recent advances in machine learning
I: Artificial intelligence
J: Projects on recent advances in machine learning
K: Game theory and agent based modeling

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Contact: abdeldjalil.aissaelbey@imt-atlantique.fr
MPR – PERFORMANCES AND RISK MANAGEMENT (4+3)

Core
A: Performance management
B: Risks management
C: Risks in change management
E: Uncertain optimisation

Electives
D: Contemporary managerial questions
   Company performance management
   Complex systems engineering
   Environment energy: issues and strategies
   Algorithms and automatic learning
F: Operational effectiveness
   Conception risk and performance
G: Maintenance in operational readiness
   Economic performance
H: Performance assessment
   Innovation, a risky approach
I, J, K: free choice of course

Contact: guillaume.massonnet@imt-atlantique.fr
Core
A: Network basis
B: Cloud platforms
C: Networks and platforms regulations

Electives
D: Digital networks
E: Economy et platforms
F: Developing and deploying applications in the cloud
Blockchain et consensus: co-operation in digital platforms
G: Building a technico-commercial answer to an international call for tender
H: Networks virtualisation
I: Networks basics (Msc)
Mobile Networks
J: Contents dissemination architectures
K: Service architecture for the Internet
OPE – ENVIRONMENT OBSERVATION (3+4)

Core
A: Physics of wave propagation and sensors
B: Hardware architecture and sensors networks
C: Observation and perception systems engineering

Electives
D: Radio technologies
   Acoustic systems: architectures and scales
E: Software radio: architecture and applications
   Big data & Cloud computing
F: Electronic integration– from the algorithm to the prototype
   Computational imaging
G: Robotic systems programing
   Computer vision
H: 2D and 3D artificial vision technology
   Machine learning and multi-sensors database advanced processing
I+J: Project JANUS (CNES): Multi-academic partners project for a CubeSat conception
K: Free choice of course

Contact: francois.gallee@imt-atlantique.fr
ROBIN – ROBOTICS AND INTERACTIONS (4+3)

Core
A: Robots modelling
B: Robots control
C: Innovation and robotisation
F: Software architecture for robotics

Electives
D: Contemporary managerial questions
   Company performance management
   Complex systems engineering
   Environment energy: issues and strategies
   Algorithms and automatic learning
E: Prototyping a robotic system
G: Bio-inspired robotics
   Embedded systems
H: Cobotics and haptics
   Distributed and real-time information systems
I, J, K: Free choice of course

Contact: vincent.lebastard@imt-atlantique.fr
SEH – HETEROGENOUS EMBEDDED SYSTEMS (3+3)

Core
A: Digital and analogical integrated circuits  
B: Methodologies: from the algorithm to the chip  
C: Embedded systems: hardware-software interaction

Electives
D: Advanced methods for programing and software development  
Radiofrequencies technologies and devices

E: Seminar: Integrated circuits and systems conception (Grenoble)  
Software radio: architecture and applications

F: Circuits high level conception  
New techniques and uses of visualization and interactive display

G: AI – optimized implementations  
Connected medical devices  
Web applications engineering

H: AI– introduction

I: Energies and sensors  

J: AI– introduction

K: Electronics integration– from the algorithm to the prototype

Contact: amer.baghdadi@imt-atlantique.fr
TEE – ENVIRONMENTAL AND ENERGY TURNAROUND (4+3)

Core
A: Environmental and energy issues
B: Energy grids
C: Strategic and socio-technical analysis of energy and environmental issues
E: Energy and environment risks and management

Electives
D: Contemporary managerial questions
   Company performance management
   Complex systems engineering
   Algorithms and automatic learning

F: Renewable energy production sectors
   Building energy performances
   Machines energy

G: Energy recovery and waste-to-energy and biomass processes
   Building environmental performances
   Energy systems and cycles

H: Environmental assessment
   Sustainable cities and territories
   Innovative low-carbon generation technologies

I, J, K: Free choice of course

Contact: aurelie.joubert@imt-atlantique.fr
Other *UE* outside the *TAFs*

**D slot**

*UE entrepreneurship*

*UE research*