

Master of Science in Engineering
Diplôme d'Ingénieur IMT Atlantique

In-depth study themes
Thématiques d'approfondissement – TAFs
(courses mostly taught in French)



IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

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*

**Computer Science and
Network /**
Informatique, Réseaux

Electrical engineering /
*Robotique, électronique,
Automatique, Télécommunications,
Systèmes embarqués*

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.

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)

ELECTRICAL ENGINEERING

- **ISC**, Communications Systems Engineering (B)
- **OPE**, Observation and perception of the environment (B)
- **SEH**, Embedded and heterogeneous systems * (B)

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.

HOW TO READ THE SLIDES

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*:

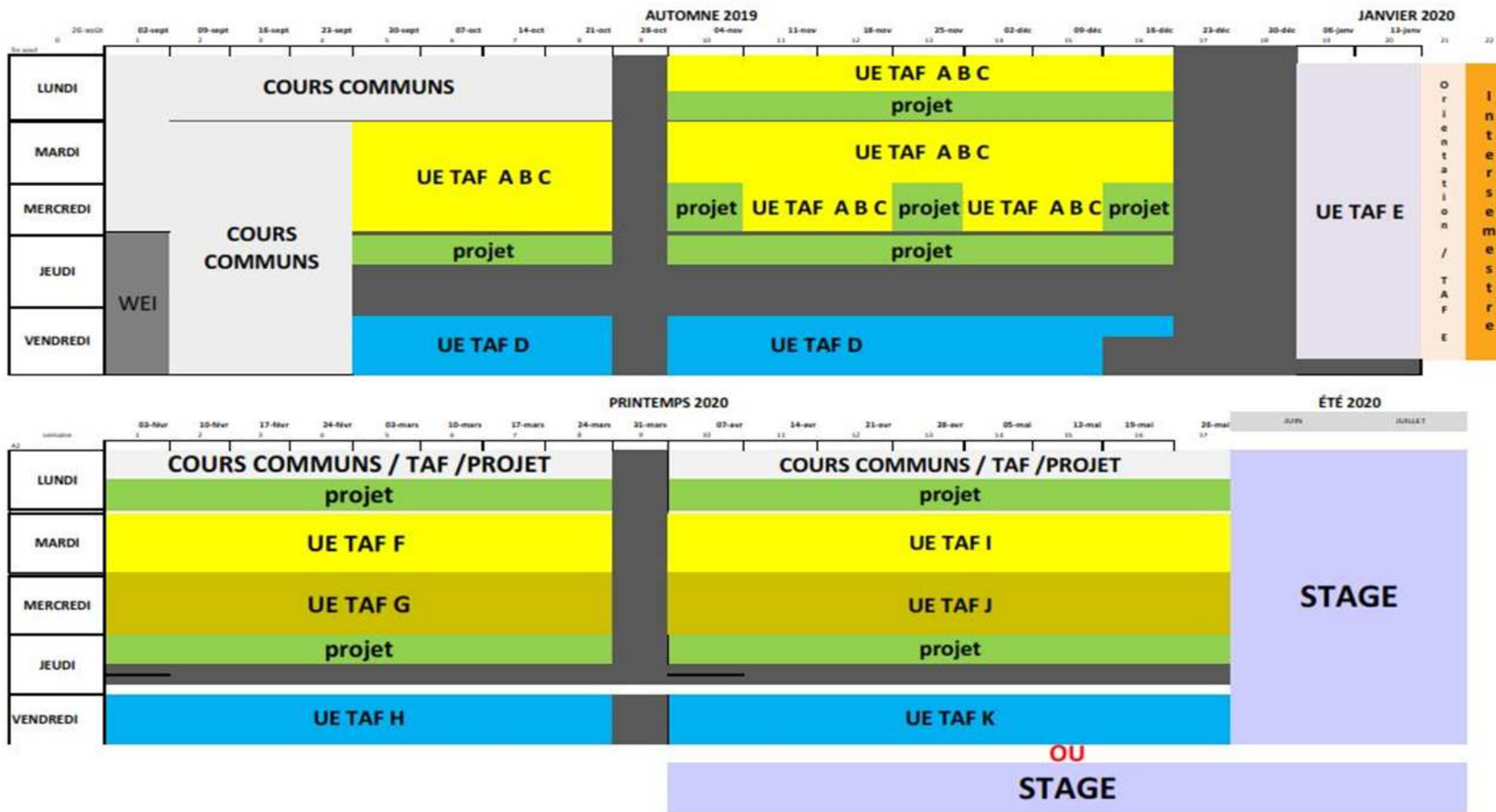
A, B, C, D: September - December

E: January

F, G, H: February, March

I, J, K: April, May

COURSE SCHEDULE



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

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 programming and software development
- E:** Radio software
Decrypting a market
- F:** Evaluation, acceptability and digital resources
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

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 programming**
 - Logistic chain design**
- G: Transport**
 - Implementation case: Decision, Optimisation and Responsibility**
- H: Planification and sequencing**
- I, J, K: free choice of course**

CYBER – CYBERSECURITY (4+3)

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**

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)
Programming 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 programming (B)
Web applications engineering (N)
- J:** Languages and logics (B)
Logical architecture and component based programming (N)
- K:** Algorithms design and analysis (B)
Man-machine interaction – user experience (N)
Certified programming (N)

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DIGIC – DIGITALISATION, INNOVATION AND CHANGES (3+3)

Core

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

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

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

DS – DATA SCIENCE: FROM DATA TO DECISION-MAKER (3+4)

Core

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

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Electives

- D: Statistics and Statistical Analysis Systems (SAS)
Advanced C++ programming
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++ programming
- J: Learning analytics & learners follow-up
Introduction to AI
- K: Game theory & agent based modeling
Digital marketing

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**



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

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 Developpment
- I, J, K:** free choice of course

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

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:** Free choice of course
- K:** Electronic integration: from the algorithm to the prototype

MCE – MATHEMATICAL & COMPUTATIONAL ENGINEERING (3+3)

Core

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

Electives

- D: Advanced C++ programming
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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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

PNUM – DIGITAL PLATFORMS: TECHNOLOGIES AND MARKETS (3+3)

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 programming
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

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

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

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**

Other *UE* outside the *TAFs*

D slot

UE entrepreneurship

UE research

