

MA-IRIF | M-IRIFS | 2023-2024

Master of science in Computer Science and Engineering

Focus Professional

Bloc 1 M-IRIFS MA-IRIF

Tronc commun / Core courses

ELEC-H417	O 5 credits [lecture: 36h, practical work: 24h]
ELEC-H473	Microprocessor architecture Dragomir MILOJEVIC (Coordinator) Image: Start St
INFO-F403	 Introduction to language theory and compiling Gilles GEERAERTS (Coordinator) ⊙ 5 credits [lecture: 24h, tutorial classes: 24h, project: 30h]
INFO-F405	Introduction to cryptography Christophe PETIT (Coordinator) and Gilles VAN ASSCHE ③ 5 credits [lecture: 24h, tutorial classes: 24h, project: 30h]
INFO-H410	Image: Techniques of artificial intelligence Hugues BERSINI (Coordinator) Image: Stredits [lecture: 24h, tutorial classes: 12h] Image: Stredits [lecture: 24h, tutorial classes: 12h]
INFO-H417	Oatabase systems architecture Mahmoud SAKR (Coordinator) O 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] ^m first term
INFO-H422	Theory of information coding computing and complexity Nicolas CERF (Coordinator) and Jérémie ROLAND ③ 5 credits [lecture: 48h, tutorial classes: 12h]

 INFO-H500
 Image acquisition and processing
 Olivier DEBEIR (Coordinator)

 ③ 5 credits [lecture: 24h, practical work: 24h]

 ⁽¹⁾ first term

 ⁽²⁾ English

One course chosen from the following

PROJ-H402 (optional)	Computing project Mauro BIRATTARI (Coordinator) and Mehrdad TERATANI ③ 5 credits [project: 150h]
PROJ-H417 (optional)	Projet coopération au développement Antoine NONCLERCQ (Coordinator) ③ 5 credits [project: 150h] ⑦ French Only on selection : see the Development Unit of the Polytechnic School of Brussels (http://polytech.ulb.be/en/international/development-cooperation)
PROJ-H418 (optional)	Hands-on learning: project manager (chef de projet) Peter BERKE (Coordinator) ② 5 credits [project: 150h] 🛗 first and second terms 👳 French

Elective courses - Block 1

Choisissez 1 module parmi les modules des Electives 1 / Choose 1 complete module among the modules of Electives

An alternative chosen from the four following

Module Computational intelligence and optimization 1

INFO-F422 (optional) Statistical foundations of machine learning Gianluca BONTEMPI (Coordinator) O 5 credits [lecture: 24h, tutorial classes: 12h, project: 60h] 🛗 second term 🔎 English

ULB LIBE	VERSITÉ RE BRUXELLES	Brussels School of Engineering
INFO-F424 (optional)	Combinatorial optimization Bernard FORTZ (Coordinator) and RENAUD CHICOISNE ② 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 12h, project: 30h] 📋 second term 📿 English	
INFO-H413 (optional)	Heuristic optimisation Thomas,T STUTZLE (Coordinator) ② 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 🗂 second term 🔎 English	
or		
49 0 0 0 0 0 0	Module Data science 1	
INFO-H415 (optional)	Advanced databases Esteban ZIMANYI (Coordinator) ② 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h]	
INFO-H420 (optional)	Management of Data Science and Business Workflows Dimitrios SACHARIDIS (Coordinator) ② 5 credits [lecture: 24h, tutorial classes: 36h] 🛱 first term 🔎 English	
INFO-H509 (optional)	Geo-Spatial and web technologies Mahmoud SAKR (Coordinator) ② 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 👚 second term 🔎 English	
or		
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Module embedded design 1	
ELEC-H409 (optional)	Digital architectures and design Dragomir MILOJEVIC (Coordinator) ⊘ 5 credits [lecture: 12h, practical work: 36h]	
ELEC-H410 (optional)	Real-time computer systems François QUITIN (Coordinator) Image: Stredits [lecture: 24h, practical work: 36h] Image: Stredits condition of the second term Image: Stredits condition of the second term Image: Stredit second term Image: Stredit second term Image: Strediter second term	
INFO-F412 (optional)	Formal verification of computer systems Jean-François RASKIN (Coordinator) ③ 5 credits [lecture: 36h, tutorial classes: 12h] 🛗 second term 🔎 English	
or		
	Module multimedia 1	
INFO-H502 (optional)	Virtual Reality Gauthier LAFRUIT (Coordinator) ② 5 credits [lecture: 24h, practical work: 24h, project: 12h]	
INFO-H503 (optional)	GPU computing Gauthier LAFRUIT (Coordinator) and Jan LEMEIRE © 5 credits [lecture: 24h, practical work: 24h, project: 24h] 🛗 second term 🔎 English	
INFO-H516 (optional)	Visual Media Compression Mehrdad TERATANI (Coordinator) and Gauthier LAFRUIT ② 5 credits [lecture: 24h, practical work: 24h, personal assignments: 12h] 🛗 second term 🔎 English	



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Master of science in Computer Science and Engineering

Focus Protessional

Bloc 2 M-IRIFS MA-IRIF

Tronc commun / Core courses - Block 2

GEST-S483	Digital and IT Governance Georges ATAYA (Coordinator) ⊙ 5 credits [lecture: 24h] ⁽¹⁾ second term ⊂ English
INFO-H505	Cloud Computing Dimitrios SACHARIDIS (Coordinator) and Mahmoud SAKR 3 5 credits [lecture: 24h] 🛗 second term 🔎 English
MEMO-H504	Mémoire de fin d'études en Informatique Dimitrios SACHARIDIS (Coordinator) ② 20 credits [mfe/tfe: 600h] academic year French

COURS ELECTIVES/ELECTIVE COURSES - Block 2

Electives 1 and 2

Pour arriver à un total de 60 ECTS, choisissez 35 ECTS de cours parmi les cours d'ELECTIVES 1 pas encore choisi en 1ere année d'étude et les cours d'ELECTIVES 2. Avec l'accord du jury et du titulaire, vous pouvez

aussi choisir maximum 10 ECTS de cours offert dans un autre programme de l'Ecole (y compris les cours des modules transversaux de l'Ecole) et/ou maximum 6 ECTS de cours hors faculté.

Choose, to arrive at a total of 60 credits, 30 credits of courses among the courses of ELECTIVES 1 not chosen in the block 1 of study and the courses of ELECTIVES 2. With the approval of the jury and the lecturer, you may also complete your program by choosing at most 10 credits of courses offered in the other programs of the School (including the courses of the transversal modules of the school) and/or at most 6 credits of courses offered outside of the School.

Up to 35 credits chosen from the following

	Module Computational intelligence and optimization 1
INFO-F422 (optional)	Statistical foundations of machine learning Gianluca BONTEMPI (Coordinator) Image: Statistical foundations Image: Statistical foundations Ima
INFO-F424 (optional)	O 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 12h, project: 30h] Content Conten Content Content
INFO-H413 (optional)	O 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h]
	Module Data science 1
INFO-H415 (optional)	Advanced databases Esteban ZIMANYI (Coordinator) ⊙ 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h]
INFO-H420 (optional)	Management of Data Science and Business Workflows Dimitrios SACHARIDIS (Coordinator) ② 5 credits [lecture: 24h, tutorial classes: 36h] — first term 📿 English
INFO-H509 (optional)	Geo-Spatial and web technologies Mahmoud SAKR (Coordinator) ③ 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] 🛗 second term 📿 English
	Module Embedded design 1
ELEC-H409 (optional)	Digital architectures and design Dragomir MILOJEVIC (Coordinator) Image: The state of the stat



(optional) MARKOWITCH © 5 credits [seminars: 36h, project: 60h] first and second terms English INFO-H414 Swarm Intelligence Marco DORIGO (Coordinator) and Mauro BIRATTARI (optional) © 5 credits [lecture: 12h, practical work: 48h] second term English INFO-H512 Current trends in artificial intelligence Hugues BERSINI (Coordinator) (optional) © 5 credits [lecture: 24h, project: 30h] second term English Module DataScience 2 Module DataScience 2 INFO-H419 Data warehouses Esteban ZIMANYI (Coordinator) © 5 credits [lecture: 24h, tutorial classes: 24h, practical work: 12h] first term English INFO-H423 Data Mining Mahmoud SAKR (Coordinator) © 5 credits [lecture: 24h, tutorial classes: 12h, practical work: 24h] first term English	ELEC-H410 (optional)	Real-time computer systems François QUITIN (Coordinator) ③ 5 credits [lecture: 24h, practical work: 36h]
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Basenti 0 9 credits (jecture 24h, practical work 24h, praject 24h) Basend term English NPD-1-bits Visual Media Compression Mehrdad TERATANI (Coordinator) and Gauthier LAFRUIT 0 9 credits (jecture 24h, practical work 24h, presonal assignments 124) Basend term English NPD-FA03 Learning dynamics Tom LEMAERTS (Coordinator) 0 9 credits (jecture 24h, praject 200) Basend term English NPD-FA03 Advanced Methods in Bioinformatics Mathieu DEFRANCE (Coordinator) and Wim VRANKEN 0 5 credits (jecture 24h, praject 200) Basend term English NPD-F243 Continuous optimization Bernard FORTZ (Coordinator) and Dimitrios PAPADIMITRIOU 0 5 credits (jecture 24h, praject 200) Basend term English NPD-F244 Continuous optimization Bernard FORTZ (Coordinator) and Dimitrios PAPADIMITRIOU 0 5 credits (jecture 24h, praject 200) Basend term English NPD-F441 Swarm Intelligence Marco DORIGO (Coordinator) and Mauro BIRATTARI 0 5 credits (jecture 24h, praject 200) Basend term English NPD-F441 Swarm Intelligence Marco DORIGO (Coordinator) and Mauro BIRATTARI 0 5 credits (jecture 24h, praject 200) Basend term English NPD-F4513 Current tends in artificial Intelligence Hugues BERSINI (Koordinator) 0 5 credits (jecture 24h, tutorial dassec 24h) pra		
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Interval © 5 credits [lecture: 240, project: 601] in stream English NPD-F433 Advanced Methods in Bioinformatics [Matthieu DEFRANCE (Coordinator) and Wim VRANKEN © 5 credits [lecture: 240, project: 601] © second term English NPD-F433 Continuous optimization Bernard FORTZ (Coordinator) and Dimitrios PAPADIMITRIOU © 5 credits [lecture: 240, project: 601] © second term English NPD-F433 Computer science seminar Tom LENAERTS (Coordinator), Jérôme De Boeck, Bernard FORTZ, John IACONO and I MARKOWITCH © 5 credits [lecture: 240, project: 601] [Inst aid second terms] English NPO-F414 Swarm Intelligence Marco DORIGO (Coordinator) and Mauro BIRATTARI [Seconds] © 5 credits [lecture: 240, project: 301]] second term English Module DataScience 2 Intervents © scredits [lecture: 240, project: 240]] second term English NFO-H419 Data warehouses Esteban ZIMANYI (Coordinator) © 5 credits [lecture: 240, tutorial classes: 240, practical work: 240] [Inst term English NFO-H423 Data: Distributed Data Management and Scalable Analytics Dimitrios SACHARIDIS (Coordinator) and Gianlu [Seconds] So credits [lecture: 240, tutorial classes: 120, project: 241]] second term English NFO-H423 Data: Distributed Data Management an		Module Computational intelligence and optimization 2
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(optional) INFO-F521 Graph theory Gwenaël JORET (Coordinator)		-
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INFO-H514 (optional)	Quantum information and computation Nicolas CERF (Coordinator), Ognyan Oreshkov and Jérémie ROLAND ② 5 credits [lecture: 24h, tutorial classes: 24h] 🖞 first term 🖓 English
	Module Embedded design 2
ELEC-H505 (optional)	Advanced digital architecture Dragomir MILOJEVIC (Coordinator) ② 5 credits [lecture: 24h, practical work: 36h] 🛗 second term 🔎 English
INFO-F410 (optional)	Image: Second systems design Jean-François RASKIN (Coordinator) Image: Second term Image: Second term Image: Second term Image: Second term <tr< td=""></tr<>
INFO-F412 (optional)	O 5 credits [lecture: 36h, tutorial classes: 12h]
INFO-Y082 (optional)	Distributed and mobile programming paradigms Elisa GONZALEZ BOIX Image: Constraint of the second
INFO-Y085 (optional)	Image: Second State Sta
INFO-Y087 (optional)	Occlarative programming WIGGINS Geraint and VAN EECKE Paul O 6 credits [lecture: 26h, tutorial classes: 26h] H Second term C English
INFO-Y099 (optional)	Ø 6 credits [lecture: 26h, tutorial classes: 26h]
INFO-Y532 (optional)	Higher order programming Jens Nicolay (Coordinator) Image: Construction of the second seco
	Module Entrepreneurship and management 2
GEST-H501 (optional)	Ogistics Engineering and Management Alassane Ballé NDIAYE (Coordinator) ⊙ 5 credits [lecture: 12h, tutorial classes: 36h]
GEST-H502 (optional)	Supply Chain Performance Analytics Alassane Ballé NDIAYE (Coordinator) ② 5 credits [lecture: 12h, tutorial classes: 36h, personal assignments: 12h] 🖞 second term 📿 English
GEST-S318 (optional)	Introduction to theoretical finance Laurent GHEERAERT (Coordinator) ③ 5 credits [lecture: 24h, tutorial classes: 24h]
GEST-S421 (optional)	Image: Strength Strengt Strength Strength Strength Strengt Strength Strength Strength Str
	Module Stage/Internship
STAG-H500 (optional)	Internship (3 months) Frédéric ROBERT (Coordinator) ① 10 credits [work placement: 300h]

Free elective courses

Students have also the opportunity to choose courses among the courses of the 'transversal modules' of the School.

English : LANG-H500

Engineering and society : PROJ-H421 - GEST-H509 - BIME-G5505 - PHYS-F517

Sustainability : GEST-S492 - ENVI-F405 - CHIM-H504 - ENVI-F452 - ENVI-F454 - ELEC-Y514

Finance, accounting, management, marketing, logistics and quality : GEST-S101 - GEST-S318 - GEST-S421 - GEST-Y501 GEST-H501 - GEST-

H502

Participation to a summer school : EDUC-H601

Free elective courses

Up to six credits chosen from the following

ULB UNIVERSITÉ LIBRE DE BRUXELLES

BIME-G5505	Interfaculty and interdisciplinary program in Healthcare Innovation Hilde STEVENS (Coordinator)
(optional)	② 5 credits [lecture: 40h, tutorial classes: 20h] 🛗 second term 💬 English
CHIM-H504 (optional)	Engineering aspects of circular economy Prakash VENKATESAN (Coordinator) O 5 credits [lecture: 24h, practical work: 36h] Second term C English
DROI-C5174	Approche interdisciplinaire du droit de la propriété intellectuelle/Interdisciplinary Approach to In Julien CABAY (Coordinator)
(optional)	② 5 credits [lecture: 24h] 🛗 first term 🔎 English/French
EDUC-H601 (optional)	Summer School Johan GYSELINCK (Coordinator) Image: State of the stat
ELEC-Y514	Sustainability : an interdisciplinary Approach Cathy MACHARIS (Coordinator) and Waldo Galle
(optional)	③ 6 credits [lecture: 36h, practical work: 24h]
ENVI-F405	Climat: sciences et politiques Frank PATTYN (Coordinator) and Louise Knops
(optional)	② 5 credits [lecture: 40h] 🛗 second term 💬 French
ENVI-F452 (optional)	Image: Environmental impact analysis and management Wouter ACHTEN (Coordinator) Image: Stredits [lecture: 24h, practical work: 12h, project: 24h] Image: Stredits [lecture: 24h, project: 24h]
ENVI-F454	Energie: Société et environnement Michel HUART (Coordinator) and Nadine MATTIELLI
(optional)	◎ 5 credits [lecture: 30h, practical work: 12h, project: 24h]
GEST-H501 (optional)	O 5 credits [lecture: 12h, tutorial classes: 36h]
GEST-H502	Supply Chain Performance Analytics Alassane Ballé NDIAYE (Coordinator)
(optional)	② 5 credits [lecture: 12h, tutorial classes: 36h, personal assignments: 12h] 🛗 second term 🕟 English
GEST-H509 (optional)	🗂 unknown term
GEST-S101	Comptabilité financière Gilles GEVERS (Coordinator) and Laurent GHEERAERT
(optional)	② 5 credits [lecture: 36h, tutorial classes: 8h] 🛗 second term 🔎 French
GEST-S318	Introduction to theoretical finance Laurent GHEERAERT (Coordinator)
(optional)	② 5 credits [lecture: 24h, tutorial classes: 24h] 🛗 second term 💬 English
GEST-S421 (optional)	Image: Construction of the second
GEST-S492	Energy policy, sustainability & management Adel EL Gammal (Coordinator), Julien BLONDEAU and Michel HUART
(optional)	② 5 credits [lecture: 36h, seminars: 24h] — first term — D English
GEST-Y501	Business Management and Entrepreneurship Marc GOLDCHSTEIN (Coordinator)
(optional)	② 3 credits [lecture: 33h] — first term — English
LANG-H500 (optional)	 English for professional purposes Alexander CORNFORD (Coordinator) and Matthew LANGSLEY ⊙ 5 credits [tutorial classes: 48h, personal assignments: 12h]
PHYS-F517	How To Make (almost) Any Experiment Using Digital Fabrication Denis TERWAGNE (Coordinator)
(optional)	② 5 credits [lecture: 24h, practical work: 24h] 🛱 first term 🔎 French
PROJ-H421	Projet polydaire: expériences didactiques innovantes pour le secondaire Simon-Pierre GORZA (Coordinator)
(optional)	② 5 credits [project: 150h] 🛗 academic year 🔎 French