Annex 1: Overall course description of FAME^{AIS} Master

M1 Grenoble INP-UGA HOME UNIVERSITY (first year students)

AUTUMN SEMESTER			
Course Name	**ECTS**	**Workload**	**Module**
FAMEAIS /e-project	5	150	Collaborative course with partners
Solid state chemistry	2	60	Fundamentals of materials science
Crystallography	2	90	
Phase transformation	2	60	
Elaboration I	4	120	Materials Elaboration & Sustainability
Sustainability in industrial engineering or From the idea to innovation & venture	3	90	
Polymers	3	90	
Surfaces & Interfaces	1,5	45	Applied materials
Microstructure & Properties	1,5	45	
Modelling tools & AI techniques in Material Science	4	120	Modelling tools & Functional materials
Functional materials physics	2	60	
TOTAL	**30**		
SPRING SEMESTER			
Course Name	**ECTS**	**Workload**	**Module**
FAMEAIS /e-project	5	150	Collaborative course with partners
Strategy & Finances	2	60	Collaborative project
Materials characterisation	3	90	Materials basics & characterisation
Semiconductor physics	2	60	
Practical Lab Work	2	60	
Elaboration II	3	90	Applied materials
Materials families	2	60	
Advanced modeling for materials	2	60	
Functional polymers	2	60	Modelling tools & applications
Materials science for thin films	2	60	
Internship	5	240	Professional training
TOTAL	**30**		

Functional Advanced Materials Engineering with Artificial Intelligence for Sustainability

M2 Grenoble INP-UGA HOME UNIVERSITY (second year students)

AUTUMN SEMESTER			
Course Name	**ECTS**	**Workload**	**Module**
Numerical modelling for materials & lab projects	6	300	Advanced modelling tools for materials design
Material & process selection	4	180	Materials selection
Life cycle, recycling	2	60	
Clean room Practical works	4	120	From materials to device
Process flow for micro tech.	2	60	
Laboratory project	4.5	135	
Packaging & Durability	1.5	60	
Sustainability in industrial engineering or Sustainable design and management	3	90	Professional training
Seminars & visits	1	30	
Economy and society: environmental issues or Management & work relations	2	60	
TOTAL	**30**		
SPRING SEMESTER			
Master thesis / Professional training			
TOTAL	**30**		

M1 TUDa HOME UNIVERSITY (first year students):

AUTUMN SEMESTER			
Course Name	**ECTS**	**Workload**	**Module**
Mandatory Courses			
FAM/e-project	5	180	Collaborative course with partners
Surfaces and interfaces	5	150	Surfaces and interfaces
Research Lab I	4	120	Research Lab I
Functional Materials	6	180	Functional Materials
Elective courses			
Micromechanics for Materials Science*	6	180	Micromechanics for Materials Science
Computational Material science**	5	150	Computational Material science
TOTAL	**30**		
SPRING SEMESTER			
Course Name	**ECTS**	**Workload**	**Module**
FAM/e-project	5	180	Collaborative course with partners
Advanced Characterization methods of Materials Science	6	180	Advanced Characterization methods of Materials Science
Theoretical Methods in Material Science	6	180	Theoretical Methods in Material Science
Machine Learning in Materials Science	6	180	Machine Learning in Materials Science
Advanced Research Lab (7)	7	360	Professional training
TOTAL	**30**		

* The Course "***Micromechanics for Materials Science***" can be replaced by the course *"Quantum Mechanics for Materials Science (6 ECTS)"*

** The Course "***Computational Material science***" can be replaced by any course of our Materials Science department with 4 ECTS which are listed in "*elective courses M. Sc. Materials Science*" in the TUCaN system (see elective courses for FAME^{AIS} M2 on the next page). Students without a bachelor degree in Materials Science or Physics can also use the course "Concepts in Materials Physics (6 ECTS)" on request.

° The module "**Discussion with Mentor**" is also compulsory

M2 TUDa HOME UNIVERSITY (second year students)

AUTUMN SEMESTER			
Course Name	**ECTS**	**Workload**	**Module**
Mandatory Courses			
Micromechanics for Materials Science *	6	180	806833
Research Lab I	4	120	803911
**Elective courses ** **			
Ceramic Materials: Syntheses and Properties. Part II	4	120	1987662
Concepts in Materials Physics	6	180	39824
Computational Material science	5	150	2068015
Electrochemistry in Energy Applications II:	4	120	1972687
Engineering Microstructures - Processing, Char. and Application	4	120	2275838
Finite Element Simulation in Material Science	4	120	46398
Focused Ion Beam Microscopy: Basics and Applications	4	120	2616244
Fundamentals and Techniques of Modern Surface Science	4	120	2301770
Interfaces - From wetting to friction	4	120	42380
Introduction to Scanning Electron Microscopy	1	30	2188545
Magnetism and Magnetic Materials	4	120	36902
Materials Chemistry	4	120	1969400
Mathematical Methods in Materials Science	4	120	408353
Mechanical Properties of Ceramic Materials	4	120	2714494
Mechanical Properties of Metals	4	120	38728
Metastable Materials: Structure, Properties and Processing	4	120	46763
Micromechanics and Nanostructured Materials	4	120	1888316
Modern steels for automotive applications	4	120	2626106
Organic Functional Materials: From LCD to Molecular Circuits	4	120	46033
Polymer Materials	6	180	413101
Porous Ceramics for Energy-Related Applications	4	120	44937
Quantum Mechanics for Materials Science	6	180	768482
Semiconductor Interfaces	4	120	2287161
TOTAL	**30**		
SPRING SEMESTER			
Master thesis	30	900	
TOTAL	**30**		

* The Course "***Micromechanics for Materials Science***" can be replaced by the course "*Quantum Mechanics for Materials Science (6 ECTS)*"

** All eligible **"E*lective courses*"** are listed in "*elective courses M. Sc. Materials Science*" in the TUCaN system. Only the following courses cannot be chosen: "Surfaces and Interfaces", "Functional Materials", "Materials Science for Renewable Energy Systems "or "Advanced Research Lab". Students without a bachelor degree in Materials Science or Physics can also use the course "Concepts in Materials Physics (6 ECTS)" on request.

° The module "**Discussion with Mentor**" is also compulsory

M2 University of Augsburg (second year students)

AUTUMN SEMESTER			
Course Name	**ECTS**	**Workload**	**Module**
Mandatory Courses			
Laboratory Project	10	300	Conducting and Presenting Scientific Work
Elective Courses from Structural and Functional Materials (1-2)			
Fiber Reinforced Polymers for Engineers	6	180	MRM-0025
Ceramic Matrix Composites	6	180	MRM-0126
Bioinspired Composites	6	180	MRM-0128
Mechanical Characterization of Materials	6	180	MRM-0136
Complex 3D Structures and Components from 2D Materials	6	180	MRM-0142
Physics and Technology of Semiconductor Devices	6	180	PHM-0048
Nanostructures / Nanophysics	6	180	PHM-0049
Solid State Spectroscopy with Synchrotron Radiation and Neutrons	6	180	PHM-0052
Ion-Solid Interaction	6	180	PHM-0056
Physics of Thin Films	6	180	PHM-0057
Organic Semiconductors	6	180	PHM-0058
Magnetism	6	180	PHM-0059
Low Temperature Physics	6	180	PHM-0060
Superconductivity	6	180	PHM-0066
Spintronics	6	180	PHM-0068
Applied Magnetic Materials and Methods	6	180	PHM-0069
Non-Destructive Testing	6	180	PHM-0122
Fiber Reinforced Composites: Processing and Materials Properties	6	180	PHM-0163
Modern Metallic Materials	6	180	PHM-0168
Plasma Material Interaction	6	180	PHM-0193
Physics of Cells	6	180	PHM-0203
Analog Electronics for Physicists and Materials Scientists	6	180	PHM-0225
Digital Electronics for Physicists and Materials Scientists	6	180	PHM-0226

Symmetry concepts and their applications in solid state physics and materials science	6	180	PHM-0228
Optical Excitations in Materials	6	180	PHM-0252
Dielectric Materials	6	180	PHM-0253
Porous Functional Materials	6	180	PHM-0268
Materials for electrochemical energy storage	6	180	PHM-0269
Photonic Materials	6	180	PHM-0271
Materials under extreme conditions	6	180	PHM-0274
Elective Courses from Digital Materials (1-2)			
Analyzing Massive Data Sets	8	240	INF-0277
Machine Learning and Computer Vision	8	240	INF-0316
Finite element modeling of multiphysics phenomena	6	180	MRM-0112
Continuum Mechanics and Material Modeling	6	180	MRM-0152
Theoretical Concepts and Simulation	6	180	PHM-0174
Elective Courses from Sustainable Materials (1)			
Sustainable Chemistry of Materials and Resources - Chemical Reactions and Cycles	6	180	MRM-0087
Oxidation and Corrosion	6	180	PHM-0167
Analytical Methods for Crystalline Sustainable Materials	6	180	PHM-0266
Fundamentals of Materials for Energy	6	180	PHM-0267
SPRING SEMESTER			
Master thesis	26	780	Finals
Colloquium	4	120	Finals
TOTAL	**30**		

Functional Advanced Materials Engineering with Artificial Intelligence for Sustainability

M2 University of Aveiro (second year students)

AUTUMN SEMESTER			
Course Name	**ECTS**	**Workload**	**Module**
Mandatory Courses			
Nanochemistry	6	162	
Project	12	324	Applied projects/ Professional training
Elective Courses (2 to select)			
Free selection from UA's list of electives of 2nd cycle			
Macromolecular Chemistry	6	162	
Spectroscopic Techniques	6	162	
Materials Characterization II	6	162	
Quantum Technologies	6	162	
Materials & Sustainability	6	162	
Advanced Materials & Biomimetics	6	162	
TOTAL	**30**		
SPRING SEMESTER			
Master thesis	30		Professional training
TOTAL	**30**		

M2 University of Bordeaux (second year students)

AUTUMN SEMESTER			
Course Name	**ECTS**	**Workload**	**Module**
Mandatory courses			
Hybrid and Nanomaterials	6	180	
Large Scale Facilities	6	180	
Elective courses			
Magnetic & Dielectric Properties	6	180	
Applied Nanosciences	6	180	
Photonics, Laser and Imaging	6	180	
Energy, Communication & Information	6	180	
Molecular Simulation / Sustainable Materials and Methods	6	180	
Innovative & Composite Materials	6	180	
TOTAL	**30**		
SPRING SEMESTER			
Master thesis	24		
Bibliographic Project / two projects on sustainability and AI	6		
TOTAL	**30**		

M2 Université catholique de Louvain (second year students)

Depending on whether student spreads master thesis over two semesters or not, the courses are taken either in the first SEMESTER or in both the first and second SEMESTERS; the student selects 30 course credits in total.			
Course Name	**ECTS**	**Workload**	**Module**
Mandatory Courses			
Important: these courses must be followed only when no equivalent course was followed before by the student; otherwise, they are replaced by electives			
Polymer Science and Engineering	5	150	
Molecules and materials analysis	5	150	
Science and engineering of metals and ceramics	5	150	
Deformation and Fracture of Materials	5	150	
Elective courses			
(other courses are possible, provided the student demonstrates the consistency of his/her curriculum)			
Physics of Nanostructures	5	150	Nanotechnology
Design of Micro- and Nano-Systems	5	150	Nanotechnology
Macromolecular Nanotechnology	5	150	Nanotechnology
Micro- and Nano-Fabrication Techniques	5	150	Bio- and Nanotechnology
Atomistic and Nanoscopic Simulations	5	150	Nanotechnology
Transport Phenomena in Solids and Nanostructures	5	150	Nanotechnology
Physics of nanostructures	5	150	Nanotechnology
Nanoelectronics	5	150	Nanotechnology
Advanced transistors	5	150	Nanotechnology
Rheology	5	150	Polymers & Macromolecules
Polymer chemistry and Physical chemistry	5	150	Polymers & Macromolecules
High performance metallic materials	5	150	Materials engineering
Sintered materials and surface treatments	5	150	Materials engineering
Crystallographic and microstructural characterisation of materials	5	150	Materials engineering
Welding science and technology	5	150	Materials engineering
Metals processing and recycling	5	150	Materials engineering & sustainable development

Biomaterials	5	150	Biotechnology
Bioinstrumentation	5	150	Biotechnology
Materials selection	5	150	Sustainable development and environment
Durability of materials	5	150	Sustainable development and environment
Societal challenges with polymers	5	150	Sustainable development and environment & Polymers & Macromolecules
Renewable energy sources	5	150	Sustainable development and environment
SECOND SEMESTER (or spread over two semesters)			
Master thesis	25	750	
Master thesis seminar	5	150	
TOTAL	**60**		

M2 Université de Liège (second year students)

Elective courses during Autumn and Spring Semesters (total of 30 ECTS)			
Among the required 30 ECTS, courses for up to 10 ECTS can be chosen as well from other study programmes organized by ULiège, upon validation by the local coordinator			
Course Name	**ECTS**	**Workload**	**Module**
AUTUMN SEMESTER			
Quantum Chemistry	4	120	Quantum materials design
Physics of functional oxides	4	120	Quantum materials design
Physics of nanomaterials	4	120	Quantum materials design
Spectroscopy of materials	4	120	Quantum materials design
Modelling molecules and extended systems	4	120	Quantum materials design
Quantum modelling of materials properties	4	120	Quantum materials design
Macromolecular Chemistry	4	120	Functional materials & nanostructures
Advanced solid-state chemistry	4	120	Functional materials & nanostructures
Nanomaterials, (electro)synthesis & applications	4	120	Functional materials & nanostructures
Characterization of nanostructures by SPM techniques	2	60	Functional materials & nanostructures
Polymers and environment	2	60	Functional materials & nanostructures
Introduction to solid state NMR	2	60	Functional materials & nanostructures
Physics of semiconductors	2	60	Functional materials & nanostructures
Physics of materials for energy	4	120	Functional materials & nanostructures
Introduction to machine learning (from 2024-2025)	4	120	Computational methods
High performance scientific computing (from 2024-2025)	4	120	Computational methods
SPRING SEMESTER			
Physics of magnetic materials	4	120	Quantum materials design
Molecular logic	2	60	Quantum materials design
Intrinsic and induced topological properties of matter	4	120	Quantum materials design
Nanofabrication: principles and techniques	4	120	Functional materials & nanostructures
Physics of superconductors	2	60	Functional materials & nanostructures
Deep learning (from 2024-2025)	4	120	Computational methods
TOTAL	**30**		
ALL YEAR LONG (or only Spring Semester)			

Research master thesis	28		
Physics and chemistry of materials: complements	2		
TOTAL	**30**		
Grand TOTAL	**60**		