Summary of the courses offered at the University of Lille including workloads (Updated 26/04/2023)

Course name	ECTS	Lectures (in hours)	Practical works in lab. or computer room (in hours)
THERMODYNAMICS AND PHASE TRANSFORMATIONS	3	26h	-
DYNAMICS IN THE AMORPHOUS MATERIALS	3	24h	-
ATOMISTIC MODELING : FROM THE GAS PHASE TO SOLIDS *(OPTION A)*	6	24h	20h in computer room - MD simulations (16h) - DFT calculations (4h)
ADVANCED CHARACTERIZATION METHODS (I) *(OPTION B)*	3	14h	16h in lab. Spectroscopies: Terahertz (4h), Raman (4h), FTIR (4h) Dielectric relaxation (4h)
ADVANCED CHARACTERIZATION METHODS (II) *(OPTION B)*	3	14h	16h in lab. and computer room - Rietveld refinement & Data treatment (8h) - Electronic microscopy (4h SEM, 4h TEM)
INTRODUCTION TO DRUG PRODUCT DEVELOPMENT AND PHARMACEUTICAL TECHNOLOGY	3	24h	-
PHYSICAL STATES MANIPULATION, CHARACTERIZATION AND FORMULATION OF PHARMACEUTICALS *(OPTION A & B)*	6	-	48h in lab. or computer room *OPTION A:* MD simulations, DFT calculations, Comput. prediction COSMOtherm (48h at Department of Physics) *OPTION B:* DSC/TGA, DRS, Raman, X-Ray diffraction, Optical microscopy (32h at Department of Physics) and Granulation, compression, film coating, dissolution (16h at College of Pharmacy)
SUB TOTAL	*21*	**98h (option A)** **98h (option B)**	**68h (option A)** **80h (option B)**
TRANSFERRABLE SKILLS	*9*	*72h (including lectures, oral presentations, language courses, case studies,…)*	
TOTAL	**30**	**~ 238 - 250 h**	

Option A “modelling & simulation”

Option B “Advanced experimental techniques”

<table>
<tr><td>Course name</td><td colspan="3">THERMODYNAMICS AND PHASE TRANSFORMATIONS
(Thermo I)</td></tr>
<tr><td>Credit Points (ECTS)
3</td><td>Workload (Face-to Face)
26h</td><td>Duration
1 semester</td><td>Offered (Term)
3</td></tr>
<tr><td>Institution in charge</td><td colspan="3">University of Lille</td></tr>
<tr><td>Instructors</td><td colspan="3">F. Affouard</td></tr>
<tr><td rowspan="2">Purpose of the module</td><td>BIOPHAM Track</td><td colspan="2">Mode</td></tr>
<tr><td>2</td><td colspan="2">Compulsory</td></tr>
<tr><td>Contents</td><td colspan="3">The objective of this course is to present a broad overview of theoretical concepts necessary for the understanding of physical states and phase transformations in large classes of existing materials.
Thermodynamics and phase diagrams - Thermodynamic classification of phase transitions - Stability, metastability and instability - Physical states: crystalline polymorphs, mesophases, amorphous - Dynamics of phase transitions: Nucleation / Growth - Interfaces - Avrami model - TTT diagrams - Vitrification - Links between microscopic and macroscopic properties - Experimental methods to study of phase transformations (DSC, MDSC, TGA).</td></tr>
<tr><td>Examination</td><td colspan="3">Written final exam</td></tr>
<tr><td>Requirement for examination</td><td colspan="3"></td></tr>
<tr><td>More information</td><td colspan="3">CLASSIFICATION: PHYSICS</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">On successful completion of the course students will be able to:
• Construct, describe and interpret a phase diagram from Gibbs energy
• To know the different physical states and the transformations of the main classes of existing materials (molecular materials, metals, polymers, ceramics, composites, glasses, ...)
• Derive simple models of nucleation / growth
• Know how to read a thermogram and know the basic principles of calorimetric techniques for the study of phase transformations</td></tr>
</table>

Course name	DYNAMICS IN THE AMORPHOUS MATERIALS (Dyn. I)		
Credit Points (ECTS) 3	Workload (Face-to Face) 24h	Duration 1 semester	Offered (Term) 3
Institution in charge	University of Lille		
Instructors	E. Dudognon		
Purpose of the module	BIOPHAM Track	Mode	
	2	Compulsory	
Contents	The purpose of this unit is to provide an overview of the different types of mobilities characterising the glass-forming liquids and some mesophases (liquid crystals, plastic crystals) in order to be able to identify the different relaxational processes encountered in the glassy and supercooled liquid states. Program: Short reminder about the different structural organisations of materials (crystals, mesophases, glasses) – Study of the molecular mobility: different scales of dynamics, fluctuation/dissipation theorem, techniques of measurements – Dynamic of glass-forming liquids: non-Arrhenius behaviour and non-exponentiality of the main relaxation, secondary relaxations, evolution with time, other relaxations – The case of mesophases: semi-crystalline materials, liquids crystals, plastic crystal.		
Examination	Written final exam		
Requirement for examination			
More information	CLASSIFICATION: PHYSICS		
Learning outcomes	On successful completion of the course students will be able to: ● Identify the different types of glass-forming liquids ● Characterise a dynamic process by the determination of the associated relaxation time, its behaviour law and its activation energy ● Determine the influence of the dynamic on the molecular properties ● Analyse a relaxation spectrum		

<table>
<tr><td>Course name</td><td colspan="3">ATOMISTIC MODELING : FROM THE GAS PHASE TO SOLIDS</td></tr>
<tr><td>Credit Points (ECTS)
6</td><td>Workload (Face-to Face)
48h</td><td>Duration
1 semester</td><td>Offered (Term)
3</td></tr>
<tr><td>Institution in charge</td><td colspan="3">University of Lille</td></tr>
<tr><td>Instructors</td><td colspan="3">C. Toubin, D. Duflot, F. Affouard, P. Carrez</td></tr>
<tr><td rowspan="2">Purpose of the module</td><td>BIOPHAM Track</td><td colspan="2">Mode</td></tr>
<tr><td>2</td><td colspan="2">Compulsory for Option A “modelling & simulation”</td></tr>
<tr><td>Contents</td><td colspan="3">Modeling methods at the molecular scale are essential because they allow describing the elementary processes at the base of more global phenomena. Simulations can be conducted on systems studied experimentally or otherwise difficult to implement in the laboratory. These methods are used in many fields of physics or chemistry. This course will present the most commonly used approaches with their fields of application:
• Gas phase electronic structure calculation: Hartree-Fock models and density functional theory (DFT)
• Molecular mechanics and classical dynamics (force fields, determination of macroscopic quantities, general notions, thermostats, constraints, summations of Ewald, ...)
• Introduction to the molecular dynamics ab initio (Car Parinello ...) or DFT</td></tr>
<tr><td>Examination</td><td colspan="3">Report on practical work + oral examination
(mark = 50% report + 50% oral)</td></tr>
<tr><td>Requirement for examination</td><td colspan="3">Knowledge of classical mechanics, quantum physics and statistical physics
In terms of know-how: To know how to develop the basic equations in quantum and classical mechanics
In terms of competence: To be able to gather the knowledge acquired in various other courses (mechanics, electromagnetism ...).</td></tr>
<tr><td>More information</td><td colspan="3">CLASSIFICATION: PHYSICS</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">On successful completion of the course students will be able to:
In terms of knowledge: Knowledge of simulation methods and their specificities
In terms of know-how: Acquire the theoretical and practical bases of molecular modeling.
In terms of competence: Being able to differentiate the various methods and their fields of application</td></tr>
</table>

Course name	ADVANCED CHARACTERIZATION METHODS (I)		
Credit Points (ECTS) 3	Workload (Face-to Face) 24h	Duration 1 semester	Offered (Term) 3
Institution in charge	University of Lille		
Instructors	B. Chazalon, E. Dudognon		
Purpose of the module	BIOPHAM Track	Mode	
	2	Compulsory for option B “Advanced experimental techniques”	
Contents	The purpose of this unit is to introduce advanced techniques of structural characterisation of the matter and materials, in particular, spectroscopic techniques. Program: High resolution Terahertz spectroscopy and molecular structure (3h lecture/ 4h practical work) - Raman spectroscopy (3h lecture/ 4h practical work) – Fourier Transform Infrared spectroscopy (3h lecture/ 4h practical work) – Dielectric spectroscopy (3h lectures/ 4h practical work)		
Examination	Report on practical work + oral examination (mark = 50% report + 50% oral)		
Requirement for examination			
More information	CLASSIFICATION: PHYSICS		
Learning outcomes	On successful completion of the course students will be able to: ● To have an overview of the diversity of the spectroscopic techniques ● Record and analyse data from Terahertz, Raman, Infrared and Dielectric spectroscopies		

<table>
<tr><td>Course name</td><td colspan="3">ADVANCED CHARACTERIZATION METHODS (II)</td></tr>
<tr><td>Credit Points (ECTS)
3</td><td>Workload (Face-to Face)
24h</td><td>Duration
1 semester</td><td>Offered (Term)
3</td></tr>
<tr><td>Institution in charge</td><td colspan="3">University of Lille</td></tr>
<tr><td>Instructors</td><td colspan="3">S. Merkel, D. Jacob</td></tr>
<tr><td rowspan="2">Purpose of the module</td><td>BIOPHAM Track</td><td colspan="2">Mode</td></tr>
<tr><td>2</td><td colspan="2">Compulsory for option B “Advanced experimental techniques”</td></tr>
<tr><td>Contents</td><td colspan="3">The purpose of this unit is to introduce advanced techniques of structural characterisation of materials, in particular, X-rays diffraction and electronic microscopies (SEM and TEM).
Program:
Lectures (14h): Overview of the X-rays diffraction techniques – Specificity of the powder diffractions and Rietveld refinement – Electronic microscopies.
Practical work (16h): Rietveld refinement – electronic microscopy</td></tr>
<tr><td>Examination</td><td colspan="3">Report on practical work + oral examination
(mark = 50% report + 50% oral)</td></tr>
<tr><td>Requirement for examination</td><td colspan="3"></td></tr>
<tr><td>More information</td><td colspan="3">CLASSIFICATION: PHYSICS</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">On successful completion of the course students will be able to:
Record and analyse powder diffraction data using Rietveld refinement
Have an overview of the different electronic microscopies and to choose the most appropriate one for the study of a specific compound.</td></tr>
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<table>
<tr><td>Course name</td><td colspan="3">INTRODUCTION TO DRUG PRODUCT DEVELOPMENT AND PHARMACEUTICAL TECHNOLOGY</td></tr>
<tr><td>Credit Points (ECTS)
3</td><td>Workload (Face-to Face)
24h</td><td>Duration
1 semester</td><td>Offered (Term)
3</td></tr>
<tr><td>Institution in charge</td><td colspan="3">University of Lille</td></tr>
<tr><td>Instructors</td><td colspan="3">J. Siepmann, F. Siepmann</td></tr>
<tr><td rowspan="2">Purpose of the module</td><td>BIOPHAM Track</td><td colspan="2">Mode</td></tr>
<tr><td>2</td><td colspan="2">Compulsory</td></tr>
<tr><td>Contents</td><td colspan="3">This course will provide an introduction to drug product development and Pharmaceutical Technology. Students will obtain an overview on the manufacturing and control strategies of the most important pharmaceutical dosage forms administered via different routes, e.g. orally and parenterally. This will include tablets, capsules, pellets, implants and microparticles. Key properties of pharmaceutical ingredients (APIs) and commonly used excipients will be treated. The students will get familiar with different formulation approaches, including those for poorly soluble drugs and controlled drug delivery systems. Special emphasis will be placed on the underlying drug release mechanisms as well as common pitfalls and challenges.</td></tr>
<tr><td>Examination</td><td colspan="3">Final oral exam</td></tr>
<tr><td>Requirement for examination</td><td colspan="3">-</td></tr>
<tr><td>More information</td><td colspan="3">CLASSIFICATION: PHARMACY
The courses will be given at the College of Pharmacy at the University of Lille.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">On successful completion of the course students will be able to:
• Have a deeper knowledge of pharmaceutical materials including active pharmaceutical ingredients and excipients and their specificities
• Identify the key hurdles for the formulation development of a drug
• Know the main approaches involved in the manufacturing and control of a drug product,
• Understand strategies used to formulate poorly soluble drugs and allow for controlled drug delivery</td></tr>
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<table>
<tr><td>Course name</td><td colspan="3">PHYSICAL STATES MANIPULATION, CHARACTERIZATION AND FORMULATION OF PHARMACEUTICALS</td></tr>
<tr><td>Credit Points (ECTS)
6</td><td>Workload (Face-to Face)
48h</td><td>Duration
1 semester</td><td>Offered (Term)
3</td></tr>
<tr><td>Institution in charge</td><td colspan="3">University of Lille</td></tr>
<tr><td>Instructors</td><td colspan="3">N. Correia, E. Dudognon, J-F Willart, M. Guerain, F. Affouard, J. Siepmann, F. Siepmann, Y. Karrout, S. Muschert, M. Hamoudi</td></tr>
<tr><td rowspan="2">Purpose of the module</td><td>BIOPHAM Track</td><td colspan="2">Mode</td></tr>
<tr><td>2</td><td colspan="2">Compulsory</td></tr>
<tr><td>Contents</td><td colspan="3">This course will focus on the different physical states of drugs (crystal, amorphous) and their specific modes of preparation and transformation induced by the typical constraints imposed by pharmaceutical industrial processes. The students will gain a thorough understanding of specific experimental tools suitable for the design and physical characterization of these materials. It will be a transdisciplinary education at the interface between materials science and pharmacy.

The course will be organized as mini projects and case studies including a large amount of practical sessions in laboratories. It will include practical extensive use of various preparation techniques (granulation, compression, film coating, dissolution), analytical techniques (X-Ray diffraction, Raman scattering, Differential Scanning Calorimetry (DSC), Thermogravimetric analysis (TGA), Dielectric Relaxation Spectroscopy (DRS) and computational techniques (MD simulation, DFT and COSMOtherm predictions).</td></tr>
<tr><td>Examination</td><td colspan="3">Oral presentation</td></tr>
<tr><td>Requirement for examination</td><td colspan="3">-</td></tr>
<tr><td>More information</td><td colspan="3">CLASSIFICATION: MATERIALS SCIENCE/PHARMACY
The courses will be given at the Physics Department and the College of Pharmacy at the University of Lille.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">On successful completion of the course students will be able to:
• Identify the specificities of pharmaceutical materials in terms of structure, dynamics and thermodynamics
• Differentiate the various preparation methods of pharmaceuticals, their practical advantages and disadvantages.
• Know the most adapted experimental/numerical techniques to probe the physical states and transformations of pharmaceutical materials</td></tr>
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Course name	TRANSFERRABLE SKILLS SCIENTIFIC WRITING & COMMUNICATION		
Credit Points (ECTS) 3	Workload (Face-to Face) 24h	Duration 1 semester	Offered (Term) 3
Institution in charge	University of Lille		
Instructors	S. Merkel, S. Clausen, T. Danelian		
Purpose of the module	BIOPHAM Track	Mode	
	2	Optional	
Contents	This course is designed to train students to: - The search for information in the scientific literature, - The implementation of automated watch strategies, - Evaluation of the quality and relevance of the information found, - Their organization and archiving for reuse. It will also involve the training of students in publishing practices (peer review, publishing house, open archives, etc.), bibliometrics, as well as the associated ethical rules (plagiarism, identification of co-authors, etc.). The module will be supplemented by a more general training in communication media (writing articles, abstracts, poster or slideshow design) and an introduction to rhetoric to stimulate students' argumentation skills.		
Examination	Continuous control and poster presentation		
Requirement for examination	Master level scientific culture		
More information	CLASSIFICATION: TRANSFERRABLE SKILLS		
Learning outcomes	On successful completion of the course students will become familiar with writing and communication techniques, which will allow him to develop analytical and synthesis skills to maximize his chances of communicating his results to different audiences (peers, general public).		

<table>
<tr><td>Course name</td><td colspan="3">TRANSFERRABLE SKILLS
FRENCH (OR ENGLISH) LANGUAGE COURSE</td></tr>
<tr><td>Credit Points (ECTS)
3</td><td>Workload (Face-to Face)
24h</td><td>Duration
1 semester</td><td>Offered (Term)
3</td></tr>
<tr><td>Institution in charge</td><td colspan="3">University of Lille</td></tr>
<tr><td>Instructors</td><td colspan="3">Course offered by the Graduate Programme “Science for a Changing Planet”. Contact: S. Duquesne, C. Toubin</td></tr>
<tr><td rowspan="2">Purpose of the module</td><td>BIOPHAM Track</td><td colspan="2">Mode</td></tr>
<tr><td>2</td><td colspan="2">Optional</td></tr>
<tr><td>Contents</td><td colspan="3">Build confidence and the ability to evolve in a professional environment where French (or English) is the language of communication, both written and spoken.
Program summary (adaptable according to levels):
• French (or English) conversation
• Business French (or English): interview, resume, phone calls, meetings, negotiations, oral presentations, evolution in a multicultural environment ...</td></tr>
<tr><td>Examination</td><td colspan="3">Written final exam (50%) and oral presentation (50%)</td></tr>
<tr><td>Requirement for examination</td><td colspan="3"></td></tr>
<tr><td>More information</td><td colspan="3">CLASSIFICATION: TRANSFERRABLE SKILLS</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">The aim of this course is to provide young scientists the necessary background to be operational in an French (or English)-speaking work environment.</td></tr>
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<table>
<tr><td>Course name</td><td colspan="3">TRANSFERRABLE SKILLS
PROJECT DESIGN MANAGEMENT</td></tr>
<tr><td>Credit Points (ECTS)
3</td><td>Workload (Face-to Face)
24h</td><td>Duration
1 semester</td><td>Offered (Term)
3</td></tr>
<tr><td>Institution in charge</td><td colspan="3">University of Lille</td></tr>
<tr><td>Instructors</td><td colspan="3">Course offered by the Graduate Programme “Science for a Changing Planet”. Contact: S. Duquesne, C. Toubin</td></tr>
<tr><td rowspan="2">Purpose of the module</td><td>BIOPHAM Track</td><td colspan="2">Mode</td></tr>
<tr><td>2</td><td colspan="2">Optional</td></tr>
<tr><td>Contents</td><td colspan="3">The aim of this course is to provide young scientists the necessary background to highlight the importance of the management in science. It sensitizes young scientists to the central role of project management in their professional careers, and that a science project requires effective management in order to maximise its benefit.
Introduction to project management in science
a. Defining science projects
b. Lifecycle of a scientific project
Management of a scientific project
a. Project management processes (project planning and project execution)
b. Concepts and jargon in project management
c. Tools to efficiently manage a scientific project</td></tr>
<tr><td>Examination</td><td colspan="3">Continuous control and poster presentation</td></tr>
<tr><td>Requirement for examination</td><td colspan="3">Undergraduate level scientific culture</td></tr>
<tr><td>More information</td><td colspan="3">CLASSIFICATION: TRANSFERRABLE SKILLS</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">The student, at the end of this course, will manage to properly build a scientific project defining clearly the objectives and the relevance of the ideas, making a rational work plan, evaluating the risks and challenges to maximize the chance of success and being able to follow the progress of the project and evaluate the results.</td></tr>
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<table>
<tr><td>Course name</td><td colspan="3">TRANSFERRABLE SKILLS
COURSES OFFERED BY THE “HEALTH ENTREPRENEURSHIP PROGRAM” DEGREE</td></tr>
<tr><td>Credit Points (ECTS)
9</td><td>Workload (Face-to Face)
72h</td><td>Duration
1 semester</td><td>Offered (Term)
9</td></tr>
<tr><td>Institution in charge</td><td colspan="3">University of Lille, GIE Eurasanté</td></tr>
<tr><td>Instructors</td><td colspan="3">Courses offered by the “health entrepreneurship program” degree</td></tr>
<tr><td rowspan="2">Purpose of the module</td><td>BIOPHAM Track</td><td colspan="2">Mode</td></tr>
<tr><td>2</td><td colspan="2">Optional</td></tr>
<tr><td>Contents</td><td colspan="3">The purpose of this unit is meant to give the key knowledge to build an entrepreneurship skill, with a focus upon innovation process and creations coming from academic sector. Program : Business and strategy, Intellectual property protection, marketing, economic and strategic intelligence, regulatory affairs, technology transfer, start-up creation, Corporate Management, Market access
More information here:
https://health-entrepreneurship.univ-lille.fr/</td></tr>
<tr><td>Examination</td><td colspan="3">- Case study with a deliverable (50%)
- Oral presentation, with a jury (50%)</td></tr>
<tr><td>Requirement for examination</td><td colspan="3">Undergraduate level scientific culture</td></tr>
<tr><td>More information</td><td colspan="3">CLASSIFICATION: TRANSFERRABLE SKILLS</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">On successful completion of courses, students will be able to :
- Build and evaluate a business strategy, including start-up’s models
- Know how to protect scientific results,
- Determine and targeting pertinent markets,
- Evaluate a market
- Have an overview over corporate management</td></tr>
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