MODULE HANDBOOK

Programs & courses offered in English

At the Faculty of Science and Technology

UPEC
UNIVERSITÉ PARIS-EST CRÉTEIL

FACULTÉ DES SCIENCES
ET TECHNOLOGIE

Introduction

Language of Instruction

French is the main language of instruction at the Faculty of Science and Technology of University of Paris-Est Créteil but there are several courses offered in English or full programmes in English.

Key words of educational programs

Biochemistry, Biology, Biometrics, Computing, Computer Science, Chemistry, Health, Earth and Life Sciences, Environment, Physics.

Structuration of the study years at UPEC

Each Academic year starts in September and finishes in May.
There are 2 semesters per year.
Each semester has been given a number (Licence = Bachelor contains 3 years of studies):

Licence 1: Sem. 1 and 2
Licence 2: Sem. 3 and 4
Licence 3: Sem. 5 and 6

Master 1: Sem. 1 and 2
Master 2: Sem. 3 and 4

Structure of classes

3 types of classes are proposed in each educational program:
lectures, tutorials and laboratory classes.

- ✓ Lecture = Cours magistral
- ✓ Tutorial class = Travaux dirigés or TD
- ✓ Laboratory class = Travaux pratiques or TP

Summary

Bachelor's degree

Components (courses) in English

Year 1 (Licence 1ère année)

Atoms and molecules (semester 1)

Domains: Biology, Biochemistry, Chemistry

6 ECTS, 60 classes (30 lectures, 21 tutorials, 9 laboratory classes)

- Evolution of the models of the atom
- Electronic organization of atoms
- Periodic classification, periodicity of properties
- Chemical bonding, Lewis model, VSEPR
- Concept of nomenclature
- Molecular interactions, low energy interactions
- The atom and the bond in the wave model
- Introduction to organic chemistry: different types of isomerism and representation of organic molecules

Reactivity of chemical systems (semester 2)

Domains: Biology, Biochemistry, Chemistry

6 ECTS, 60 classes (27 lectures, 18 tutorials, 15 laboratory classes)

- Introduction to thermodynamics: state variables, exchanges of energy, transformations, reversibility
- First law of thermodynamics, enthalpy H, additivity rule, reactions heat calculus
- Second law of thermodynamics: concepts on entropy S, Gibbs free energy G
- Laws of chemical equilibrium: equilibrium constant and relation with G, influencing parameters, equilibrium, balance
- Multiple equilibrium: reaction between major species, preponderant reaction
- Equilibrium in solution: acid-base reactions, precipitation and dissolution, redox reactions
- Titration in solution (simple cases)

Kinetics: reaction rate, first and second- order reactions (simple cases), degeneracies or order, reaction half-life, temperature influence.

Year 2 (Licence 2ème année)

Molecular Biology and its applications (semester 3)

Domains: Earth and Life Sciences, Biology, Biochemistry

4 ECTS, 40 classes (22 lectures, 10,5 tutorials, 8 laboratory classes)

- Replication and expression of genomes
- Organization and structure of eukaryotic and prokaryotic genomes
- Replication of DNA - Topoisomerases, prokaryotic and eukaryotic DNA polymerases; The replication process: assembly of the primosome, operation of the replication fork; Regulation of the initiation of replication. Transcription - In preparation for transcription in prokaryotes and eukaryotes: transcription factors, regulatory sequences and transcriptional regulation of the expression of a genome; The notion of transcriptional unity; The transcription process: assembly of the initiation complex and termination of the transcription; Maturation of coding and non-coding pre-RNAs.
- Translation - The elements involved: messenger RNAs, transfer RNAs, ribosomes; The translation process: assembly of the initiation complex of translation, elongation, translocation and termination.
- Recombinant DNA techniques - Techniques for isolation and cloning of nucleotide sequences of interest; Assembly of artificial transcriptional units; Applications in genetic engineering.

Analytical spectral separation techniques (semester 4)

Domains: Biochemistry, Chemistry

3 ECTS, 30 classes (13,5 lectures, 7,5 tutorials, 9 laboratory classes)

Separation techniques

- Generalities on chromatographic methods
- Characteristics values
- High-performance liquid chromatography (partition chromatography, adsorption, ion chromatography, and size exclusion chromatography). Basic concepts
- Capillary electrophoresis. Basic concepts
- Gas chromatography

Spectroscopic techniques

- UV absorption spectroscopy
- Infrared spectroscopy
- Nuclear Magnetic Resonance
- Mass spectroscopy

Cell Biology 2 (semester 4)

Domains: Earth and Life Sciences, Biology, Biochemistry

3 ECTS, 30 classes (19,5 lectures, 10,5 tutorials)

- The molecular logic of life: from molecules to organisms (notions of diversity-uniqueness and structure-function).
- The cell organization of Eukaryotes / Prokaryotes makes it possible to use structural differences to explain the different modes of functioning.
- The core and the communication core / cytoplasm.
- The mitosis and the meiosis or the cell divisions essential for life.
- Cell cycle, its control and cell death: approach to complex regulatory mechanisms in biology.
- "Signals and responses" in cell biology: (first notions of signal transduction).

Microbiology 1 (semester 4)

Domains: Earth and Life Sciences, Biology, Biochemistry

3 ECTS, 30 classes (19,5 lectures, 10,5 tutorials)

- The microbial world
- The prokaryotic cell: structures and functions
- Nutrition and bacterial growth. Interaction microorganisms / environment
- Relation microorganisms and relation microorganisms: hosts
- Control of microorganisms by chemical means. Antimicrobial chemotherapy. Epidemiology
- Control of microorganisms by physical means. Applications
- Bacteriophages and viruses of eukaryotic cells

Master's degree

Full programs in English

Master « Optics, Image, Vision and Multimedia: International Biometrics »

(> Website)

Length of the program: 2 years if starting from Master 1 (60 credits/year). 1 year if starting from Master 2 (60 credits)

Domains: Computer Science, Computer Engineering, Information Technology
All Lectures and Tutorials are taught in English

Master 1 (semester 1, Winter semester)

Measurements and data processing

6 ECTS, 53 classes (28 lectures, 25 laboratory classes)

The purpose of this class is to learn how to deal with signal measurement and image capture, representation, analysis and processing. Only basic methods will be considered. During the labs, Matlab sofware will be considered.

Software integration I

6 ECTS, 50 classes (25 lectures, 25 laboratory classes)

Introduction to JAVA
Introduction to C++
Introduction to Android Programming

Getting started to Android I:
- Android Overview
- Building Your First App
- Supporting Different Devices
- Activity/Activity Life Cycle
- Fragments
- Saving Data
- Best practices
- Tests

Pattern recognition

6 ECTS, 60 classes (30 lectures, 30 laboratory classes)

Lecture 1: What is image analysis? Image applications, challenges image, basic image operations Histograms.
Lecture 2: Noise reduction and image restoration. Spatial and frequency domain filtering. Gaussian vs square kernel. Median filter. Thresholding.
Lecture 3: Edge extraction. Image gradients. Derivatives of Gaussian. Canny edge detector. Advanced image processing techniques. Feature extraction.

Biosciences

4 ECTS, 20 classes (10 lectures, 10 tutorials)

1. Chapter 1: DNA: The fundamentals
   - The building of a multicellular organism from the founder zygotic cell
   - Nature and structure of DNA
   - DNA replication
   - Meiosis and genetic uniqueness
   - Maternal heredity
2. Chapter 2: Methods
   - Biological material
   - DNA extraction
   - Quantification of DNA
   - DNA amplification
   - Amplified DNA product separation
3. Chapter 3: Genetic markers and DNA databases
   - Amelogenin and gender identification
   - Short Tandem repeats
   - Single nucleotide polymorphisms
   - Lineage markers
   - Non-human DNA testing

Practical Course 1: Paternity test

Practical course 2: Forensic Identification

Technical communication

4 ECTS, 10 classes (10 lectures)

The content depends on the lecturer. Students will work by groups on different subjects proposed by the lecturers. Simulation of typical presentations are achieved.

Option: French culture (4 ECTS) or Advanced English (4 ECTS)

Master 1 (semester 2, Spring semester)

Introduction to Biometrics

6 ECTS, 60 classes (30 lectures, 30 laboratory classes)

Chapter 1: Introduction to Biometrics. General definition. Physical and behavioural Biometrics
Chapter 2: Biometrics for security. Biometric modalities. Desirable characteristics. Biometric system architecture (Identification, authentication, enrolment).
Chapter 3: Other types and applications of Biometrics. Biometrics for gender estimation. Biometrics for age estimation. Biometrics for Biomedical engineering applications. Biometrics for games.

Software integration II

6 ECTS, 50 classes (25 lectures, 25 laboratory classes)

Chapter 1: Objective-C
Discovery of Objective-C language programming used for iOS development.
Chapter 2: Presenting Cocoa. Provide here the sub-section titles.
Chapter 3: XCode. The IDE to develop and build applications for iOS.
Chapter 4: View controllers. The Model View Controller.
Chapter 5: Views. UI elements to build interface.
Chapter 6: Drawing. How to draw on the screen.
Chapter 7: Events. How to handle events in iOS applications.
Chapter 8: Video & Audio. How to handle video/audio capture and display/ear.
Chapter 9: Apps deployment. How to deploy and submit application on AppStore.

Computer vision and image synthesis

6 ECTS, 65 classes (35 lectures, 20 tutorials, 10 laboratory classes)

OpenCV : introduction, integration, image processing with OpenCV, Video processing in OpenCV, Labs.

Business and management techniques

2 ECTS, 10 classes (10 lectures)

This class is useful for students interested in creating their own company. Business and management techniques will be presented.

Ethics and Privacy

2 ECTS, 10 classes (10 lectures)

When dealing with biometrics, it is very important to deal with ethics and privacy aspects. Discussion and debates around these subjects will be considered.

Project: (4 ECTS) Individual projects.

Master 2 (semester 3, Winter semester)

Advanced biometrics

4 ECTS, 60 classes (30 lectures, 20 labarotary classes)

In this course some advanced biometric techniques will be presented. Specifically, we will consider: iris recognition algorithms, speech recognition, behavioral biometrics, evaluation of biometric systems, anti-spoofing techniques, etc. The course includes, talks, lectures and labs.

Advanced programming

4 ECTS, 40 classes (40 tutorials)

The purpose of this course is to deal with smartphone applications design. Specifically, IPhone/IPad programming will be considered. Integration of biometrics applications will be discussed (e.g. face recognition). This course includes lectures and labs.

Computer vision and Computer graphics

4 ECTS, 56 classes (26 lectures, 30 tutorials)

Advanced computer vision techniques and fundamental of computer graphics will be considered. Specifically, it concerns stereo-vision data processing, 3D object visualization, processing and software integration. In this course, talks, lectures and labs will be delivered.

Virtual and augmented reality

4 ECTS, 56 classes (40 lectures, 20 tutorials)

From theory to practice, students will learn the state of the art related to both virtual reality and augmented reality. Through numerous labs, they will be able at the end of the course to develop and design their own applications.

Smart systems

4 ECTS, 30 classes (30 lectures)

In this course we will develop basically the Radio-frequency identification (RFID) that may be connected to biometric systems. More specifically, it will be considered: RFID technology, RFID equipment and systems, Standards and norms, RFID deployment, business cases.

Smart biometric applications

4 ECTS, 20 classes (20 lectures)

This is a general-purpose course that includes many talks related to biometrics environment including its application in different fields (e.g. medical, sport, transportation…). Some talks are related socio-economics matter, including business, marketing and project management.

Research and professional culture

2 ECTS, 24 classes (20 lectures, 4 tutorials)

In this course, students will learn how to write research papers and how to publish their work in high impact conferences and journals. For students having professional objectives, they will attend classes provided by professionals in order to deal with the industry matters.

Project: (4 ECTS) Individual projects.

Master 2 (semester 4, spring semester)

Internship / Final project (30 ECTS)

« Sciences and Engineering in Environment »

(http://www.master-sge.com/fr/presentation/m1-sge)

Length: 2 years if starting from Master 1 (60 credits/year). 1 year if starting from Master 2 (60 credits)

Domains: Environment, Chemistry, Physics, Metrology

Master 1 (semester 1, Winter semester)

Functioning of natural and disturbed systems

3 ECTS, 34 classes (20 lectures, 10 tutorials, 4 laboratory classes)
Lectures are taught in French, all tutorials and laboratory classes - in English, course materials in English.

Mass conservation concept via a box model, study of biogeochemical cycles and their disturbance in connection with the operation of natural and cultivated ecosystems.

Air: introduction to the physics and chemistry of the atmosphere

4ECTS, 44 classes (24 lectures, 16 tutorials, 4 laboratory classes)
Lectures are taught in French, all tutorials and laboratory classes - in English, course materials in English.

Physical chemistry of the atmosphere: composition and physical structure of the atmosphere, dynamic elements and meteorology, greenhouse effect and climate, atmospheric chemistry, acid deposition.

Water: environment and treatment, catchment basin

4 ECTS, 40 classes (26 lectures, 14 tutorials, 5 laboratory classes)
Lectures are taught in French, all tutorials and laboratory classes - in English, course materials in English.

Physical chemistry of aquatic environment and water cycle : Water cycle - resource status, hydrogeology, evaluation of the quality of rivers, power management of drinking water, wastewater treatment, special case of stormwater, water analysis, coupling water and biogeochemical cycles.

Polluted soils: environment and treatment

4 ECTS, 40 classes (25 lectures, 15 tutorials)
Lectures are taught in French, tutorials - in English.

Soil science (physical chemistry and soil biology, soil classification, ...), soil pollution (inorganic and organic contaminants), pollution prevention and remediation of soil, sustainable agriculture.

Materials in the environment

3 ECTS, 24 classes (18 lectures, 6 laboratory classes)
Lectures are taught in French, laboratory classes - in English.

Interactions between materials and environmental factors and alteration of materials built and cultural heritage: the extrinsic factors of alteration in external environment, indoor environment and methodology of studies of alteration mechanisms.

Analytical Chemistry and Environment

3 ECTS, 32 classes (12 lectures, 20 laboratory classes)
Lectures are taught in French, laboratory classes - in English, course materials in English.

Strengthening theoretical and methodological foundation for understanding main methods of analysis used in the environment: Specimen preparation, presentation of the main techniques, quality assurance.

Applied statistical modeling and data processing

6 ECTS, 50 classes (20 lectures, 18 tutorials, 12 laboratory classes)
Lectures are taught in French, tutorials and laboratory classes - in English.

Methods of exploratory data analysis (descriptive statistics, law of normal distribution, hypothesis testing, multivariate factor analysis, ...), statistical modeling (model linear, nonlinear models, model for qualitative data).

English

3 ECTS, 26 tutorials

Practice of scientific English

Master 1 (semester 2, Spring semester)

Metrology of the environment: the interpretation of sampling

3 ECTS, 32 classes (20 lectures, 12 tutorials)
Lectures are taught in French, tutorials - in English.

Presentation of the difficulties encountered when measured in natural environmental (air, water and soil) and the main methods of sampling and in situ analysis. Topics discussed: why make measurements? How to make measurements? (Critical analysis of different steps of measurement, sampling, analysis, or in ex situ conservation the sample, choice of analytical technique), interpretation of results.

Field work

3 ECTS, 60 classes (30 lectures, 30 tutorials)
Lectures and tutorials are taught in French.

Study of the impact of human activities on the quality of air environment, water and soil:
- Workshop "air": study of the roles of various dynamic and chemical mechanisms on the occurrence of pollution episodes.
- Workshop "water": anthropogenic impact on the physical and chemical quality of aquatic systems on catchment basin.
- Workshop "soil": impact on soil and sediments of an industrial site.
- Workshop " Microbiology ": anthropogenic impact on the microbiological quality of the water and soil systems.

Pollution, disturbances and impacts

5 ECTS, 100 hours (50 lectures, 50 tutorials)
Lectures and tutorials are taught in French.

Pollution, waste and pollution disturbances (urban development, waste management and treatment, noise) and impact of pollution on ecosystems, pollution and human health.

Environmental Economics

3 ECTS, 60 classes (30 lectures, 30 tutorials)
Lectures and tutorials are taught in French.

Presentation of basic concepts in economics (utility, elasticity, surplus, marginal productivity, partial and general equilibrium...), modeling logics mobilized by the discipline and elements of economic theory necessary for understanding the linkages between economic and environmental spheres.

Environmental Policy and Society

4 ECTS, 80 classes (40 lectures, 40 tutorials)
Lectures and tutorials are taught in French.

Public environmental policy, energy policy and renewable energy sources and press review.

3 ECTS, 24 tutorials

Practice of scientific English

+ 3 Options to choose from the list below (for 9 ECTS):

All optional courses are taught in French.

Physical Chemistry

3 ECTS, 60 classes (30 lectures, 30 tutorials)

Presentation of fundamental knowledge in physical chemistry and their environmental applications: Chemical Kinetics (basic reminders, collision theory, theory of the transition state...), chemical thermodynamics (first and second law of thermodynamics, chemical potential and thermodynamic equilibrium), chemical equilibrium (acid-base equilibrium, complexation, redox...).

Microbiology

3 ECTS, 60 classes (30 lectures, 30 tutorials)

Introduction to the different areas of study of microbiology: bacterial cell nutrition and bacterial growth, the role of microorganisms in large terrestrial cycles, microbial associations, the means to fight against the proliferation of microorganisms, Antibiotics: mechanisms of action, resistance, struggles against the resistance.

Fluid Mechanics

3 ECTS, 60 classes (30 lectures, 30 tutorials)

Presentation of fluid mechanics and bases for application to the environment: introduction and definitions, conservation laws, steady, turbulent flows, flows in driving.

Modeling applied to environmental systems

3 ECTS, 60 classes (30 lectures, 30 tutorials)

Historical review of numerical methods, description and application of some digital basic methods for the environment and application design patterns: System Predator-Prey, simplified climate model: Floreal, chemical diagram dedicated to the study of a plume Ozone.

Introduction to the interactions radiation / matter and applications

3 ECTS, 60 classes (30 lectures, 30 tutorials)

Spectroscopy and thermal radiation, experimental molecular infrared spectroscopy technology, molecular spectroscopy, radiative transfer, and applications to the atmosphere and Astrophysics (greenhouse satellite projects, remote sensing of pollutants).

New analytical techniques for the environment

3 ECTS, 60 classes (30 lectures, 30 tutorials)

Introduction of new advanced techniques for analyzing complex environmental environments (LC-MS-MS, Orbitrap, optical cavity techniques, ...).

Exobiology and planetary environment

3 ECTS, 60 classes (30 lectures, 30 tutorials)

From the origin of matter in the solar system, the solar system, the origin and limits of life on Earth, organic matter other than on Earth.

Energies and environment

3 ECTS, 60 classes (30 lectures, 30 tutorials)

Introduction and fossil fuels, renewable energy (solar thermal, solar photovoltaic, hydro, wind), nuclear energy (basics of nuclear physics, principle of reactor operation, nuclear power at the time of environmental balance, nuclear and the future?).