Option Bioengineering and nanotechnology

Specific courses for Bio-engineering and nanotechnology



CONFÉRENCES ET VISITES

CONFERENCES AND VISITS

Lecturers:Emmanuelle LAURENCEAU, Virginie MONNIER-VILLAUME| Lecturers : 20 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The objective is to make students discover the numerous possibilities of jobs linked to the bio-engineering and nanotechnologies fields. The different thematics will be présented in the form of seminars and conferences by researchers and professionals in these fields. Visits of industrial sites (STMicroelectronic, Sanofi-Pasteur, Becton-Dickinson) and research centers (CEA-LETI, CEA-INES, Synchrotron ESRF) will be also organized.

Keywords : Bio-engineering, nanotechnologies, jobs, conferences, visits.

Programme	 Challenges of medical imaging techniques Damage to prostheses Big-data and genomics Large-scale data processing The AURA industrial fabric in bioengineering and nanotechnologies Clinical trials in silico
Learning outcomes	 Identify/analyze the needs and social-economics constraints linked to health and nanotechnologies. Take into account the international dimension of research in bio- and nanotechnologies. Adopt a global vision and apprehend the field into its complexity. Enlarge scientific and technical knowledge.
Independent study	Objectifs : This activity is not concerned with framed autonomy activities outside personal work.
	Méhodes : This activity is not concerned with framed autonomy activities outside personal work.
Core texts	

100% for participation.

Assessment



PROJET OPTION BIO-INGÉNIERIE ET NANOTECHNOLOGIES PROJECT OPTION BIO-ENGINEERING AND NANOTECHNOLOGY

Lecturers:Emmanuelle LAURENCEAU, Virginie MONNIER-VILLAUME| Lecturers : 0.0 | TC : 0.0 | PW : 50 | Autonomy : 0.0 | Study : 0 | Project : 0.0 | Language : FR

Objectives

Through (transdiciplinary or not) projects proposed by industrial partners or by research labs, students will identify technological hurdles, propose solutions and set up experiments. They will also learn how to present their results (in a written and oral report).

Keywords : Projects, industrial, research.

Programme

Learning	
outcomes	

- Elaborate and apprehend a scientific and technical project.
- Identify the technological hurdles and set up the technological solutions.
 - Achieve a synthesis of informations and a presentation of the results.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

35% (written report), 35% (oral), participation (30%)

Specialisation Bioengineering and nanotechnology



BIO-INGÉNIERIE

BIO-INGÉNIERIE

 Lecturers:
 Emmanuelle LAURENCEAU

 | Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment



IMAGERIES MÉDICALES

IMAGERIES MÉDICALES

Lecturers:Emmanuelle LAURENCEAU, Christelle YEROMONAHOS| Lecturers : 6 | TC : 0.0 | PW : 9 | Autonomy : 6 | Study : 8 | Project : 0.0 | Language : FR

Objectives

Through this course, 3 main imaging and image processing techniques will be discussed: electronic cryo-tomography, X-ray imaging and ultrasound imaging. Concrete examples of image reconstruction and modeling as well as manipulations on devices (RX, US) will help to understand the complete chain of image formation and its interpretation.

Keywords :

Programme	Course (6h): - Principle of electronic cryo-tomography - Principle of X-ray imaging - Principle of Ultra-sound imaging
	Practical work (9h): 1 pratical to choose on one of the 3 imaging techniques
Learning outcomes	 Understand the scientific challenges of medical imaging in terms of information extraction Understand the difficulties associated with reconstructing images from physical measurements and know the methods to overcome them Know the signal processing techniques used in ultrasound imaging
Independent study	Objectifs :
independent study	
	Méhodes : - Processing of electronic cryo-tomography images from free software (eman2 and Jsubtomo) - Bibliographic studies - Processing of data acquired on a research ultrasound system
Core texts	
	75% knowledge (practical report), 25% know-how (oral presentation)

Assessment



INTERACTIONS MATÉRIAU-VIVANT

INTERACTIONS MATÉRIAU-VIVANT

Lecturers:Emmanuelle LAURENCEAU, Vincent FRIDRICI| Lecturers : 3 | TC : 2 | PW : 6 | Autonomy : 6 | Study : 4 | Project : 0.0 | Language : FR

Objectives

Through this course, the fundamental aspects linked to the biological, physicochemical and mechanical phenomena involved during the contact between a surface and a biological medium will be treated. The link with the bioengineering of interfaces and its application will be approached in various forms: analysis of articles, realization of devices, design office

Keywords :

Programme	Course (3h): - Physico-chemistry of interfaces - Biomechanics of interfaces BE (4h): Tribo-mechanics of living tissue Practical work (6h): Realization of a glucose biosensor TD (2h): Restitution of the analysis of scientific articles
Learning outcomes	 Understanding the biomechanical challenges of aging and prosthetic medicine Know some techniques for characterizing living tissue Establishment of an experimental protocol Write a complete technical report, correctly referenced
Independent study	Objectifs : Méhodes : Analysis of scientific articles
Core texts	

Assessment

50% knowledge (oral presentation of review articles), 50% know-how (practical report)



BIOPRODUCTION

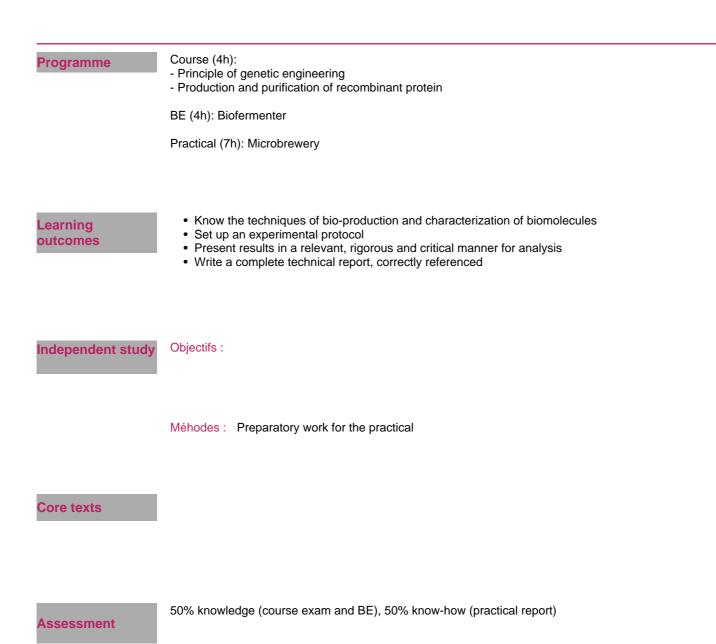
BIOPRODUCTION

Lecturers: Emmanuelle LAURENCEAU | Lecturers : 4 | TC : 0.0 | PW : 7 | Autonomy : 2 | Study : 4 | Project : 0.0 | Language : FR

Objectives

This course will allow engineering students to identify the stages of production of a recombinant protein as well as the different purification methods, their roles and interests in bioproduction processes. The production of recombinant proteins by genetic engineering methods is a common process in most areas of biotechnology. Using perfectly mastered methods, this process makes it possible to obtain specific proteins, in particular of therapeutic interest, with a very high yield.

Keywords :





BIO-INFORMATIQUE, BIO-STATISTIQUE ET MODÉLISATION BIO-INFORMATIQUE, BIO-STATISTIQUE ET MODÉLISATION

Lecturers:Emmanuelle LAURENCEAU, Christelle YEROMONAHOS| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 15 | Project : 0.0 | Language : FR

Objectives

Through this course, basic statistical tools as well as modeling concepts and techniques will be discussed to allow engineering students to analyze and model data in the life sciences. From concrete examples, analysis and modeling strategies will be studied, and the development of a complete model will be worked out.

Keywords :

B	BE 1 (4h): Modeling of living tissue BE 2 (4h): Cell membrane modeling in molecular dynamics BE 3 (4h): Epidemiology and vaccination BE 4 (3h): Statistical tools for life sciences
---	--

Learning outcomes	 Understanding modeling To be able to simulate and analyze a model
outoonnoo	Recognize the application contexts of statistical methods and implement them on datasets
	 Understand the principle of molecular dynamics simulations

Independent study Objectifs : This activity is not concerned with framed autonomy activities outside personal work.

Méhodes : This activity is not concerned with framed autonomy activities outside personal work.

Core texts

Assessment

1 written report for each BE, each counting for 25% of the final mark

Specialisation Nanotechnologies



NANOTECHNOLOGIES

NANOTECHNOLOGIES

Lecturers: Virginie MONNIER-VILLAUME | Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Nanotechnologies receive each year tremendous investments in research and development. Therefore it is a business sector in strong growth. Nanosciences and nanotechnologies are crossing several scientific fields such as electronics, mechanics, chemistry, optics, biology that manipulate objects at the nanometer size. The objective here is to allow generalist engineers to acquire both technical and scientific knowledges to manage transverse projects and technology transfer. Mixing sciences for the engineer and life sciences, this diploma field proposes high level training in strong interaction with industrial needs in information and communication technologies.

Keywords :

Programme

NANO3.1 – Memories for the Internet of Things NANO3.2 – Smart surfaces NANO3.3 – Photonics guiding NANO3.4 – Nano-optics

Learning outcomes	 Model and set up a multidimensional system with interdependent and/or non deterministic components. Set hypotheses and evaluate their impacts/their limits. Apply knowledges to the resolution of pluridisciplinar problems. Analyze in a critical way good practices and progress opportunities.
Independent study	Objectifs :
	Méhodes :

Assessment

Core texts

Students must follow the two first courses and make a choice between the two last courses. NANO3.1 : 33% ; NANO3.2 : 33% ; NANO3.3 : 33% or NANO3.4 : 33%.



MÉMOIRES POUR L'INTERNET DES OBJETS

MÉMOIRES POUR L?INTERNET DES OBJETS

Lecturers: Virginie MONNIER-VILLAUME, Bertrand VILQUIN, Emmanuelle | Lecturers : 0.0 | TC : 0.0 | PW : 16 | Autonomy : 0.0 | Study : 4 | Project : 0.0 | Language : FR

Objectives

During this course, the students will have to understand the different physical properties that can be found inside a unic ferroelectric material with high potential for innovating applications. They will also elaborate, characterize and use miniaturized and ultrafast digital memories pour the Internet of Things (IoT).

The higher electronic mobility will be one of tomorrow challenges, such as IoT. In the future, the interaction with objects will not be done only using electronic chips or specific commands transmitted by a touch screen, but also by objects themselves.

Keywords : Ferroelectric material, digital memories, internet of things, elaboration, characterization.

Programme	 BE1 (2h): clean room technologies, X-Ray diffraction. TP1 (4h): nanomaterials deposition in clean room and elaboration of integrated digital memories. TP2 (2h): structural characterization of ferroelectric digital memories. TP3 (2h): electrical characterization of ferroelectric digital memories. TP4 (8h): conception of electrical systems from digital memories. BE2 (2h): presentation of the results and scientific discussions.
Learning outcomes	 Understand the challenges and problematics of the Internet of Things. Know and use clean room techniques and structural/electrical characterization methods. Conceive the architecture of an electrical system. Present results in a relevant, rigourous and critical manner, in view of an analysis.
Independent study	Objectifs : This activity is not concerned with framed autonomy activities outside personal work.
	Méhodes : This activity is not concerned with framed autonomy activities outside personal work.
Core texts	
	Final mark = 30% Knowledge + 70% Know-how

Knowledge = 100% written report of the work Know-how = 40% continuous assessment (active involvement and participation) + 60%



SURFACES INTELLIGENTES

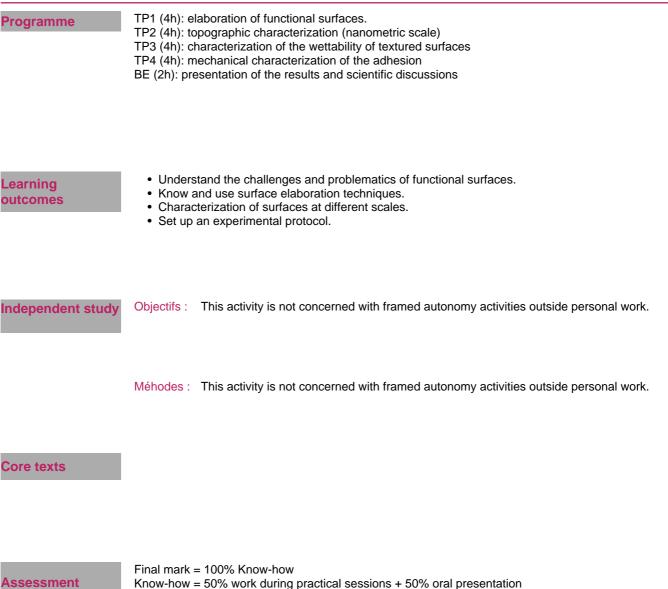
SURFACES INTELLIGENTES

Magali PHANER GOUTORBE, Emmanuelle LAURENCEAU, Stephane Lecturers: Lecturers : 0.0 | TC : 0.0 | PW : 16 | Autonomy : 0.0 | Study : 4 | Project : 0.0 | Language : FR

Objectives

In this course, the students will have to elaborate bio-inspired surfaces with specific functionalities (superhydrophobic, superadhesive,..) thanks to nano/microtexturation. These surfaces will be characterized and analyzed regarding the two specific properties, their wettability and their adhesive potential.

Keywords : Bio-inspired surfaces, surface texturation, wettability, adhesion.





GUIDAGE PHOTONIQUE

GUIDAGE PHOTONIQUE

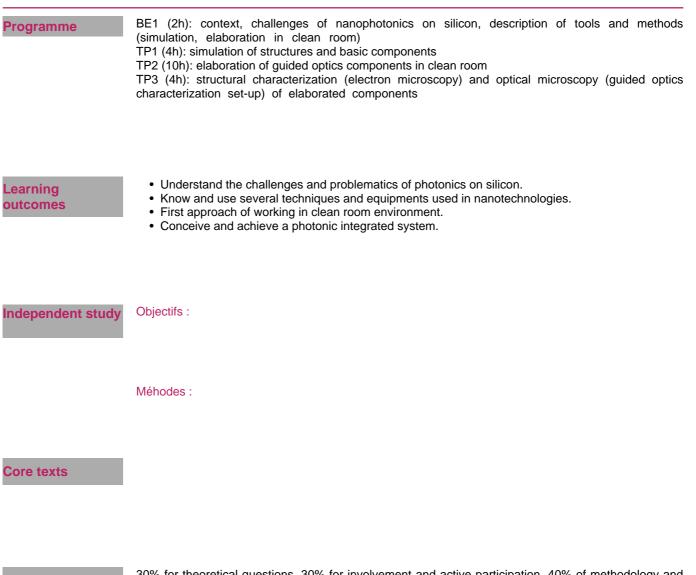
Lecturers: Emmanuel DROUARD, Pedro ROJO ROMEO, Virginie MONNIER-VILLAUME

Objectives

During this course, the students will experiment different aspects of the conception and realization of nanophotonic components in guided optics, on silicon substrate.

After an introduction (about the context of integrated photonics on silicon, challenges), using specific simulation tools, students will conceive the different photonic building blocks necessary to the elaboration of complex systems for routing./guiding light on silicon. They will workin clean room on the different aspects of elaboration (optical and electronic lithography, plasma-assisted etching,...). The elaborated structures will be then characterized by optical and electronic microscopies.

Keywords : Nano-photonics, photonic components, guided optics, lithography, microscopy.



30% for theoretical questions, 30% for involvement and active participation, 40% of methodology and experimental report



NANO-OPTIQUES

NANO-OPTIQUES

Lecturers: Virginie MONNIER-VILLAUME, Christelle MONAT, Emmanuelle | Lecturers : 0.0 | TC : 0.0 | PW : 16 | Autonomy : 2 | Study : 2 | Project : 0.0 | Language : FR

Objectives

This training will be devoted to the elaboration, of nano-optical devices using with particular diffraction/reflection properties due to their periodic structuration at the wavelength scale. Different kinds of periodic systems will be studied and elaborated using physical routes from thin films (clean room technology) and chemical routes (from colloidal dispersions). Their structural and optical properties will be simulated and characterized.

Keywords : Photonic crystals, thin films, nanostructured periodic systems, opals, simulation, spectroscopy.

