

INTERNATIONAL MASTER IN BIO MEDICAL ENGINEERING

BME MASTER PROGRAM

Medical imaging – Surgical devices – Help for treatments



Introduction

BME International Master is a program that aims at giving students the knowledge required to respond to the needs of the industries developing techniques, probes and equipment needed by doctors in their daily work.

The program is based both, on compulsory courses in fundamental sciences (Physics, Electrical, Electronics, Measurements and Automatism and Mechanical Engineering), medical sciences (Anatomy, Ethics, Regulation and Bio-compatible materials) and management and also daily project work.

Every student is mentored weekly by a faculty member who follows his/her progress closely.

Teaching team

The teaching team is composed of faculty members from the different research laboratories of Centrale Lille: LML – Mechanical Engineering ; IEMN – Electronic, Microelectronic and Nanotechnology ; L2EP – Electrical Engineering ; CRISTAL – Computer Sciences and Automatic. All the faculty members carry out research in BioMedical Engineering.

Organisation of semesters

1st Semester

<p>Courses provided by the Medical faculty</p>	<ul style="list-style-type: none"> . Legislation and regulation . Biomedical statistics . Experimental and clinical trials design . Biomedical sciences
<p>Courses provided by the Engineering institution Centrale Lille</p>	<ul style="list-style-type: none"> . Mathematics for biomedical engineering . Algorithm & programming . French as a Foreign Language . Technical English . Upgrade in Physics . Upgrade in Electricity, Electronic and Automatism . Upgrade in Mechanical Engineering

2nd semester

<p>Courses provided by the Medical faculty</p>	<ul style="list-style-type: none"> . Material and bio-compatibility . Development of implantable devices . Medical computer sciences
<p>Courses provided by the Engineering institution Centrale Lille</p>	<ul style="list-style-type: none"> . Project management . Theragnostics . Signal processing . Upgrade in Electricity, Electronics and Control systems . Mechanical Engineering . French as a Foreign Language

3rd semester

<p>Courses provided by the Medical faculty</p>	<ul style="list-style-type: none">. Ethic. e-health
<p>Courses provided by the Engineering institution Centrale Lille</p>	<ul style="list-style-type: none">. Project management. Valorization and intellectual property. Physics. Signal processing. Upgrade in Electricity, Electronics and Control systems. Mechanical Engineering.. French as a Foreign Language

Details of courses

1st semester

Code	Title Contents	ECTS	Nb hours	
			Lessons	training
For all				
BME 101	Legislation & Regulation Ethical, Regulatory and legal issues facing health care practitioners and biomedical researchers. <i>The course will cover ethical and legal issues involved in their work and explain regulatory processes across EU and US</i>	3	22	-
BME 102	Biomedical Statistics Fundamentals statistical approaches with biomedical applications. <i>It covers topics in data presentation sampling, experimental design, probability and probability distributions, significance tests and clinical trials</i>	2	14	8
BME 103	Experimental and clinical trials design Introduction to experimental design for biomedical research with animals and humans <i>The course covers the methods for Clinical design, protocol submission and review for clinical trials</i>	3	22	-
BME 114	Mathematics for biomedical engineering This course aims to enhance or develop the skills needed to bridge the gap between qualitative and quantitative approaches to the study of biological processes. <i>Topics include review of single and multivariable calculus and instruction (or recall) in differential equations, boundary conditions value problem, Fourier series and linear systems equations</i>	2	14	12
BME 115	Algorithm & programming Use of computational tools for biological applications. <i>Algorithmic, programming instruction in Python and Matlab as well as in Labview for use in instrumentation.</i>	2	6	4
BME 125	Technical English	3	10	-
BME 126	2nd Language French as foreign language	3	34	-

Three courses to be chosen, depending on students background

BME 107	<p>Biomedical sciences</p> <p><u>Part I:</u> Fundamentals of biology and physiology from an engineering perspective <i>Genetics, molecular biology and basic cellular physiology</i></p> <p><u>Part II:</u> Topics will be covered for structure and function with an emphasis on engineering principles and control systems in the body <i>Muscle and nerve functions, cardiovascular systems and respiration, renal and digestive systems nervous, endocrine and immune system</i></p>	4	60	-
BME 122	<p>Upgrade in physics</p> <p>This course provides the required knowledge in Physics covering the key points dealing with medical imaging <i>It covers knowledge in the field of Physics of waves, Electromagnetisms, Magnetism and Solid Physics</i></p>	4	60	60
BME 123	<p>Upgrade in EEA engg.</p> <p>This course provides the required knowledge in Electronics, Electricity and Control Systems needed to deal with measurements, signals and analysis of signals obtained by sensors <i>It covers knowledges in the field of Electricity, Electronics, Control Systems, Circuits, Component Physics (transistors, diode), Electronic logic</i></p>	4	60	60
BME 124	<p>Upgrade in Mechanical engg.</p> <p>This course provide the required knowledges in Electronics, Electricity and Control Systems needed to deal with forces, displacements, strain and stretch of the body, organs and equipments <i>It covers knowledge in the field of Fluid Mechanics, rigid body and motion, Continuum Mechanics</i></p>	4	60	60
TOTAL		30	302	192

2nd semester

Code	Title Contents	ECTS	Nb hours	
			Lessons	training

General courses

BME 201	Materials and Bio-compatibility <i>Materials used in the body as well as functionalization of materials. Topics include classification of materials (ceramic, metals, polymers), mechanical properties, failure modes, immune response to biomaterials, etc.</i>	3	10	-
BME 202	Development of implantable medical devices <i>This course combines lectures, demonstrations, discussions and problem-solving exercises exploring design of medical devices. Emphasis is placed on manufacturing skills and design for manufacturing and assembly</i>	2	20	-
BME 203	Project management <i>Principles of the design process, problem-solving, and decision-making, using case studies. Marketing strategies for different markets. Management for large corporations including economics, budgeting, human resources, etc.</i>	3	18	-
BME 204	Medical computer sciences <i>Medical treatments require big data processing. This courses will introduce these techniques big-data treatment</i>	3	20	-
BME 221	2nd Language French as foreign language	3	34	-

Engineering courses

BME 211	<p>Theragnostics</p> <p>This course provides the required knowledge in physics to follow the key points dealing with medical imaging</p> <p><i>It covers knowledge in Techonology of (MRI), US transducers, introduction to multi-physics simulation (COMSOL)</i></p>	4	48	-
BME 212	<p>Signal treatment</p> <p>This course provides the required knowledge in physics to follow the key points dealing with signal processing obtained by sensors</p> <p><i>It covers knowledge Sampling & approximation theory, principal fundamental methods, statistical learning for signal processing</i></p>	4	48	-
BME 213	<p>EEA</p> <p>This course provides the required knowledge in physics to follow the key points dealing with sensors</p> <p><i>It covers knowledge in the field of Sensors (Basic operating principles to industrial sensors), Electric actuators (in connection with medical equipment & safety), CEM.</i></p>	4	48	-
BME 214	<p>Mechanical engg.</p> <p>This course provides the required knowledge in physics to follow the key points dealing with sensors</p> <p><i>It covers knowledge in the field of Mechanical behavior of human tissues, Structures & Systems</i></p>	4	48	-
BME 220	2nd Semester project	-	-	400
TOTAL		30	294	400

3rd semester

Code	Title Contents	ECTS	Nb hours	
			Lessons	training

General courses

BME 301	Ethics <i>It covers knowledge in the field of animal and human ethic, ethical committee procedures</i>	3	12	-
BME 302	Enhancement and intellectual property This deals with Valorization and protection of intellectual property and new developments. <i>It covers knowledge in the field of law and patents</i>	2	12	-
BME 303	Project management <i>Principles of the design process, problem-solving, and decision-making using case studies. Marketing strategies for different marketplaces. Management for large corporations including economics, budgeting, human resources, etc.</i>	3	24	-
BME 304	E-health <i>This course introduces the new technology developed for e-treatment, as well as the ethical and legislation constraints.</i>	3	24	-
BME 321	2nd Language French as foreign language	3	28	-

Engineering courses

BME 311	Physics This course provide the required knowledges in physics to follow the key points dealing with micro & nano electronic. It covers knowledges in the field of micro & nano actuators, multiphysics FE simulation	4	40	-
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BME 312	Signal treatment This course provides the required knowledge in physics to follow the key points dealing with signal processing obtained by sensors <i>It covers knowledge Sampling & approximation theory, principal fundamental methods, statistical learning for signal processing</i>	4	40	-
BME 313	EEA This course provides the required knowledge in physics to follow the key points dealing with sensors <i>It covers knowledge in the field of Sensors (Basic operating principles to industrial sensors), Electric actuators (in connection with medical equipment & safety), CEM.</i>	4	40	-
BME 314	Mechanical engg. This course provides the required knowledge in physics to follow the key points dealing with sensors <i>It covers knowledge in the field of Mechanical behavior of human tissues, Structures & Systems</i>	4	40	-
BME 320	2nd Semester project	-	-	240
TOTAL		30	260	240

4th semester

6 months full-time industrial internship

Application

Bachelor's Degree in Engineering is required. Background in Physics, Mechanical, Electronics, Biotech or Computer Science are required.

Contact

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