



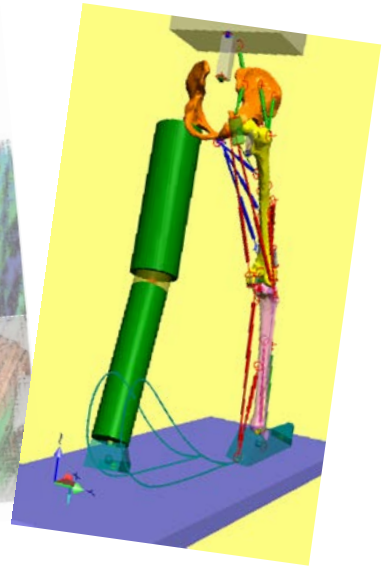
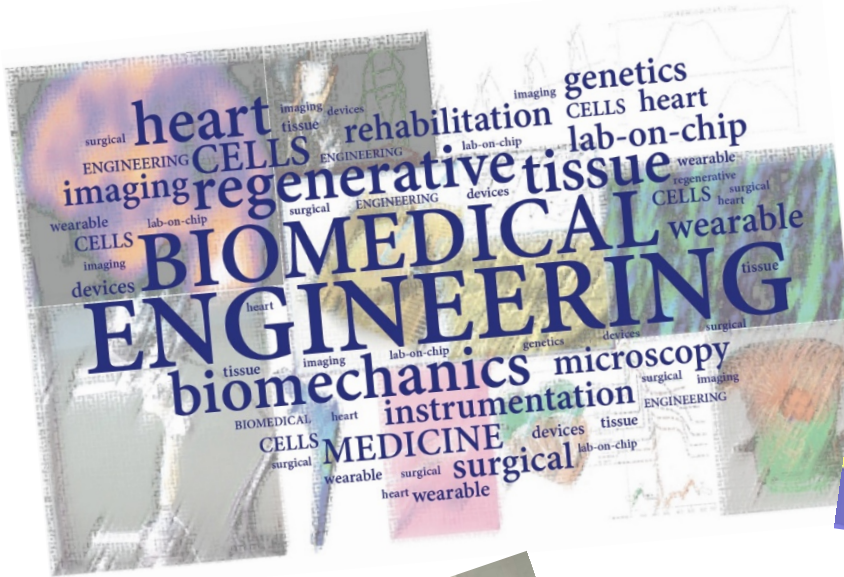
POLITECNICO
MILANO 1863

SCHOOL OF INDUSTRIAL
AND INFORMATION ENGINEERING

Master of Science

Biomedical Engineering

The world of Biomedical Engineering



Why you could choose Biomedical Engineering?

Nowadays, the most of the scientific and technological development is in the **Life Sciences field**, with particular reference to health, nutrition, environment, gene therapy and biotechnology.

The contribution of **Biomedical Engineering** to the scientific and technological progress of these sectors is increasingly important. The study of living systems, the interaction with the biological environment, the synthesis of new drugs, the engineering of new materials, prostheses and artificial organs, the development of biomedical technology and instrumentation, the processing of biomedical image and signals, and the design of novel ICT applications represent an essential contribution to this progress and stimulate important investments thus creating new job opportunities.

The educational objective of the **Master's Degree in Biomedical Engineering** is to create graduate students with a solid background in the engineering methodologies and technologies applied to medical and biological problems. The knowhow includes the capability to analyze medical/biological systems and biosignals, to design and develop biomaterials, devices and instruments for diagnosis, therapy, organ replacement and rehabilitation and to play a role in the management of healthcare systems, patient workflow and correlated information systems in line with ethical regulations and procedures.

What you could do after the Master Degree?

Graduates in Biomedical Engineering will work in **professional contexts** like R&D, advanced design, planning and management of complex systems, as consultant or hired in commercial firms, in private or public health systems, in public administrations.

The graduates in MS Biomedical Engineering will find job in firms working in biomedical and pharmaceutical areas, companies which provide systems and disposables for diagnosis, care and rehabilitation, in private or public hospitals, in companies for medical device management or which provide services like telemedicine and rehabilitation, in specialized laboratories.

The professionally is the result of a wide study offer, such as in the biomedical instrumentation (measurement systems of bioelectric potential, morphological or functional biomages, therapeutics systems), this is appreciated in the clinical context, e.g. in the management of medical devices and plants for different medical applications.

Employment outlet of the graduates in MS Biomedical Engineering is the technician or commercial technician in industries which require a deep knowledge in the instrumentation, biomedical devices and in their development.

The competencies to conceive and develop aids and prostheses (e.g. cardiac or orthopedic device) will be acquired by studying techniques and methodologies for the rehabilitation.

What you are going to study?

The Master of Science in Biomedical Engineering is **offered** in both **Italian** and **English**.

The MS course in Biomedical Engineering offers **5 tracks** (Previously Approved Study Plans; "Piani di Studio Preventivamente Approvati" - PSPA), organized on a two-year programme, for a total of 120 credits ("crediti formativi" - CFU):

- Biomechanics and Biomaterials (BBB)
- Information Bioengineering (BIF)
- Technologies for Electronics (BTE)
- Cells, Tissues and Biotechnology (BCT)
- Clinical Engineering (BIC)

International exchange programs (e.g., Erasmus, Time) are available with more than 60 foreign research institutions worldwide.

Double degree projects are offered (in this case, the Master is organized on a three-year programme):

- double degree with University of Illinois, Chicago
- double degree in Biomedical Engineering - Mechanical Engineering
- double degree in Biomedical Engineering - Materials Engineering and Nanotechnology

What characterizes this Master course?

The Biomedical Engineering Master course is characterized by a strong presence of **design or laboratory teaching activities**, carried out in research structures and laboratories at the Department of Electronics, Information and Bioengineering and the Department of Chemistry, Materials and Chemical Engineering.

During the second year of Master, students choose a **laboratory course**, in order to deepen the aspects of Biomedical Engineering in which they are interested. They will be able to carry out experiments on biomaterials, prostheses, devices and structures for tissue regeneration. They will analyse signals and diagnostic images, motor system, respiration, the cardiovascular system and the neurological activity. Students will model pathologies and simulate the functioning of devices.

The **experimental activity** can continue in a specific area during the **thesis project**. The project can be carried out in Politecnico's laboratories, in Italian or foreign research centres with which the professors collaborate.

BIOINGENEERING

EMPLOYED: 95.8%

(6 months after Master degree)

RESEARCH

ERASMUS

LIFE SCIENCES



BBB - 1° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
C	MAT/05 MAT/08	MATHEMATICAL AND NUMERICAL METHODS IN ENGINEERING [I.C.]		1	12.0	12.0
B	ING-INF/06	BIOINGEGNERIA DEL SISTEMA MOTORIO		1	5.0	10.0
B	ING-IND/34	MECHANICS OF BIOLOGICAL STRUCTURES		1	5.0	
B	ING-INF/06	BIOENGINEERING OF PHYSIOLOGICAL CONTROL SYSTEMS		1	5.0	
B	ING-INF/06	BIOENGINEERING OF THE RESPIRATORY SYSTEM		1	5.0	
B	ING-IND/34	STRUTTURE BIOARTIFICIALI E BIOMIMETICHE		1	5.0	
B	ING-IND/34	COMPUTATIONAL BIOLOGY OF THE HEART		2	5.0	
B	ING-IND/34	BIOMACHINES (WITH LABORATORY)		2	5.0	
B	ING-IND/34	COSTRUZIONI BIOMECCANICHE		2	10.0	
B	ING-IND/34	BIOMATERIALI [C.I.]		2	10.0	
B	ING-IND/34	PROGETTAZIONE DI ENDOPROTESI [C.I.] ^(a)		1	10.0	
B	ING-IND/34	FENOMENI DI TRASPORTO NEI SISTEMI BIOLOGICI		1	10.0	
B	ING-INF/06	VALUTAZIONE FUNZIONALE E RIABILITAZIONE MOTORIA [C.I.]		2	10.0	
--	--	Courses to be chosen from Group BASE	--	--	--	10.0
--	--	Courses to be chosen from Group GES	--	--	--	
--	--	Courses to be chosen from Group INGLM-BBB	--	--	--	
--	--	Courses to be chosen from Group MED	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	

BBB - 2° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
B	ING-IND/34	APPLICAZIONI BIOTECNOLOGICHE E BIOREATTORI [C.I.]		2	10.0	20.0
B	ING-IND/34	LIFE SUPPORT SYSTEMS		2	10.0 [1.0	
B	ING-IND/34	TECNOLOGIE PER LA MEDICINA RIGENERATIVA [C.I.]		1	10.0	
B	ING-IND/34	ADVANCED MODELING APPROACHES FOR CARDIOVASCULAR SURGERY [I.C.]		1	10.0	
B	ING-IND/34	LABORATORIO DI CARATTERIZZAZIONE DEI TESSUTI		1	5.0 [1.0	5.0
B	ING-IND/34	BIOMATERIALS AND INSTRUMENTAL ANALYSIS LABORATORY		1	5.0 [2.0	
B	ING-IND/34	LABORATORIO DI BIOFLUIDODINAMICA		1	5.0 [1.0	
B	ING-IND/34	COMPUTATIONAL BIOMECHANICS LABORATORY		1	5.0 [1.0	
B	ING-IND/34	LABORATORIO DI COSTRUZIONI BIOMECCANICHE		2	5.0 [1.0	
B	ING-IND/34	COMPUTATIONAL BIOMECHANICS LABORATORY		2	5.0 [1.0	
--	--	Courses to be chosen from Group LAB	--	--	--	5.0
--	--	Courses to be chosen from Group MOD	--	--	--	
--	--	Courses to be chosen from Group INGLM-BBB	--	--	--	
--	--	Courses to be chosen from Group BASE	--	--	--	10.0
--	--	Courses to be chosen from Group GES	--	--	--	
--	--	Courses to be chosen from Group INGLM-BBB	--	--	--	
--	--	Courses to be chosen from Group LAB	--	--	--	
--	--	Courses to be chosen from Group MED	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	
--	--	Courses to be chosen from Group SPEC	--	--	--	
--	--	Courses to be chosen from Group SOFT SKILLS	--	--	--	
--	--	FINAL WORK (BIO LM)	--	1	18.0	18.0
--	--	FINAL WORK (BIO LM)	--	2	18.0	



BIF - 1° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
C	INF/01 ING-INF/04	MODEL IDENTIFICATION AND MACHINE LEARNING [I.C.]		1	12.0	12.0
B	ING-INF/06	BIOINGEGNERIA DEL SISTEMA MOTORIO		1	5.0	10.0
B	ING-INF/06	BIOENGINEERING OF THE RESPIRATORY SYSTEM		1	5.0	
B	ING-INF/06	BIOENGINEERING OF NEUROSENSORY SYSTEMS		1	5.0	
B	ING-INF/06	BIOENGINEERING OF PHYSIOLOGICAL CONTROL SYSTEMS		1	5.0	
C	BIO/10	BIOINFORMATICA E GENOMICA FUNZIONALE		1	5.0	
B	ING-INF/06	ANALISI E ORGANIZZAZIONE DI SISTEMI SANITARI (C.I.)		2	10.0	30.0
B	ING-INF/06	VALUTAZIONE FUNZIONALE E RIABILITAZIONE MOTORIA [C.I.]		2	10.0	
B	ING-INF/06	MEDICAL INFORMATICS [I.C.]		2	10.0 [1.0	
B	ING-INF/06	TECHNOLOGIES FOR SENSORS AND CLINICAL INSTRUMENTATION - BIOE 430		2	10.0 [1.0	
B	ING-INF/06	BIOMEDICAL SIGNAL PROCESSING AND MEDICAL IMAGES - BIOE 540-421 [I.C.] ^(a)		1	10.0 [1.0	
--	--	Courses to be chosen from Group INGLM-BIF	--	--	--	10.0
--	--	Courses to be chosen from Group BASE	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	

BIF - 2° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
B	ING-INF/06	ADVANCED SIGNALS AND DATA PROCESSING IN MEDICINE [I.C.]		2	10.0	20.0
B	ING-INF/06	METHODS FOR BIOMEDICAL IMAGING AND COMPUTER AIDED SURGERY		2	10.0	
B	ING-INF/06	E-HEALTH METHODS AND APPLICATIONS [I.C.]		1	10.0 [1.0	
B	ING-INF/06	TECHNOLOGIES FOR MOTOR BEHAVIOUR ANALYSIS AND VIRTUAL MODELLING (I.C.)		1	10.0	
B	ING-INF/06	NEUROENGINEERING [C.I.]		1	10.0 [1.0	
B	ING-INF/06	LABORATORIO DI ELABORAZIONE DI BIOIMMAGINI		1	5.0 [1.0	5.0
B	ING-INF/06	MEDICAL ROBOTICS AND TECHNOLOGIES FOR COMPUTER AIDED SURGERY LABORATORY		1	5.0 [1.0	
B	ING-INF/06	BIOMEDICAL SIGNAL PROCESSING LABORATORY		1	5.0 [1.0	
B	ING-INF/06	FUNCTIONAL EVALUATION LABORATORY		2	5.0 [1.0	
B	ING-INF/06	ELECTRONIC TECHNOLOGIES AND BIOSENSORS LABORATORY		2	5.0 [1.0	
--	--	Courses to be chosen from Group INGLM-BIF	--	--	--	5.0
--	--	Courses to be chosen from Group LAB	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	
--	--	Courses to be chosen from Group GES	--	--	--	10.0
--	--	Courses to be chosen from Group INGLM-BIF	--	--	--	
--	--	Courses to be chosen from Group LAB	--	--	--	
--	--	Courses to be chosen from Group MED	--	--	--	
--	--	Courses to be chosen from Group SPEC	--	--	--	
--	--	Courses to be chosen from Group SOFT SKILLS	--	--	--	
--	--	FINAL WORK (BIO LM)	--	1	18.0	18.0
--	--	FINAL WORK (BIO LM)	--	2	18.0	



BTE - 1° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
C	MAT/05 MAT/08	MATHEMATICAL AND NUMERICAL METHODS IN ENGINEERING [I.C.]		1	12.0	12.0
C	INF/01 ING-INF/04	MODEL IDENTIFICATION AND MACHINE LEARNING [I.C.]		1	12.0	
B	ING-INF/06	BIOINGEGNERIA DEL SISTEMA MOTORIO		1	5.0	10.0
B	ING-INF/06	BIOENGINEERING OF NEUROSENSORY SYSTEMS		1	5.0	
B	ING-INF/06	BIOENGINEERING OF THE RESPIRATORY SYSTEM		1	5.0	
B	ING-INF/06	BIOENGINEERING OF PHYSIOLOGICAL CONTROL SYSTEMS		1	5.0	
B	ING-INF/06	ELETTRONICA BIOMEDICA ^(a)		1	10.0	30.0
B	ING-IND/34 ING-INF/06	IMPIANTI OSPEDALIERI E SICUREZZA [C.I.]		1	10.0	
B	ING-INF/06	MEDICAL INFORMATICS [I.C.]		2	10.0 [1.0	
B	ING-INF/06	TECHNOLOGIES FOR SENSORS AND CLINICAL INSTRUMENTATION - BIOE 430		2	10.0 [1.0	
B	ING-INF/06	VALUTAZIONE FUNZIONALE E RIABILITAZIONE MOTORIA [C.I.]		2	10.0	
--	--	Courses to be chosen from Group BASE	--	--	--	
--	--	Courses to be chosen from Group GES	--	--	--	10.0
--	--	Courses to be chosen from Group INGLM-BTE	--	--	--	
--	--	Courses to be chosen from Group MED	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	

BTE - 2° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
B	ING-INF/06	E-HEALTH METHODS AND APPLICATIONS [I.C.]		1	10.0 [1.0	20.0
B	ING-INF/06	NEUROENGINEERING [C.I.]		1	10.0 [1.0	
B	ING-INF/06	METHODS FOR BIOMEDICAL IMAGING AND COMPUTER AIDED SURGERY		2	10.0	
B	ING-INF/06	TECHNOLOGIES FOR MOTOR BEHAVIOUR ANALYSIS AND VIRTUAL MODELLING (I.C.)		1	10.0	
B	ING-INF/06	LABORATORIO DI TECNOLOGIE ELETTRONICHE E BIOSENSORI		1	5.0 [1.0	5.0
B	ING-INF/06	ELECTRONIC TECHNOLOGIES AND BIOSENSORS LABORATORY		2	5.0 [1.0	
B	ING-INF/06	MEDICAL ROBOTICS AND TECHNOLOGIES FOR COMPUTER AIDED SURGERY LABORATORY		1	5.0 [1.0	
B	ING-INF/06	BIOMEDICAL SIGNAL PROCESSING LABORATORY		1	5.0 [1.0	
B	ING-INF/06	LABORATORIO DI ELABORAZIONE DI BIOIMMAGINI		1	5.0 [1.0	
B	ING-INF/06	FUNCTIONAL EVALUATION LABORATORY		2	5.0 [1.0	
--	--	Courses to be chosen from Group LAB	--	--	--	5.0
--	--	Courses to be chosen from Group MOD	--	--	--	
--	--	Courses to be chosen from Group INGLM-BTE	--	--	--	
--	--	Courses to be chosen from Group BASE	--	--	--	10.0
--	--	Courses to be chosen from Group GES	--	--	--	
--	--	Courses to be chosen from Group LAB	--	--	--	
--	--	Courses to be chosen from Group INGLM-BTE	--	--	--	
--	--	Courses to be chosen from Group MED	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	
--	--	Courses to be chosen from Group SPEC	--	--	--	
--	--	Courses to be chosen from Group SOFT SKILLS	--	--	--	
--	--	FINAL WORK (BIO LM)	--	1	18.0	
--	--	FINAL WORK (BIO LM)	--	2	18.0	18.0



BCT - 1° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
C	CHIM/07	BIOMOLECULES: STRUCTURE AND FUNCTIONS		1	7.0	12.0
C	BIO/10	BIOINFORMATICA E GENOMICA FUNZIONALE		1	5.0	
B	ING-INF/06	BIOENGINEERING OF PHYSIOLOGICAL CONTROL SYSTEMS		1	5.0	10.0
B	ING-INF/06	BIOENGINEERING OF THE RESPIRATORY SYSTEM		1	5.0	
B	ING-INF/06	BIOENGINEERING OF NEUROSENSORY SYSTEMS		1	5.0	
B	ING-IND/34	MECHANICS OF BIOLOGICAL STRUCTURES		1	5.0	
B	ING-IND/34	STRUTTURE BIOARTIFICIALI E BIOMIMETICHE		1	5.0	
B	ING-IND/34	COMPUTATIONAL BIOLOGY OF THE HEART		2	5.0	
B	ING-IND/34	BIOINGEGNERIA CELLULARE ^(a)		1	10.0	30.0
B	ING-INF/06	BIOMEDICAL SIGNAL PROCESSING AND MEDICAL IMAGES - BIOE 540-421 [I.C.]		1	10.0 [1.0	
B	ING-IND/34	BIOMATERIALI [C.I.]		2	10.0	
B	ING-IND/34	FENOMENI DI TRASPORTO NEI SISTEMI BIOLOGICI		1	10.0	
--	--	Courses to be chosen from Group BASE	--	--	--	10.0
--	--	Courses to be chosen from Group GES	--	--	--	
--	--	Courses to be chosen from Group INGLM-BCT	--	--	--	
--	--	Courses to be chosen from Group MED	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	

BCT - 2° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
B	ING-INF/06	NEUROENGINEERING [C.I.]		1	10.0 [1.0	20.0
B	ING-IND/34	TECNOLOGIE PER LA MEDICINA RIGENERATIVA [C.I.]		1	10.0	
B	ING-IND/34	APPLICAZIONI BIOTECNOLOGICHE E BIOREATTORI [C.I.]		2	10.0	
B	ING-IND/34	BIOARTIFICIAL SYSTEMS AT THE MICRO AND NANO SCALE [I.C.] - BIOE 505 - BIOE 548		2	10.0	
B	ING-INF/06	ADVANCED SIGNALS AND DATA PROCESSING IN MEDICINE [I.C.]		2	10.0	
B	ING-IND/34	BIOMOLECULAR MODELLING LABORATORY		1	5.0 [1.0	5.0
B	ING-IND/34	LABORATORIO DI BIOFLUIDODINAMICA		1	5.0 [1.0	
B	ING-IND/34	LABORATORIO DI MICRO E NANOSTRUTTURE		1	5.0 [1.0	
B	ING-IND/34	COMPUTATIONAL BIOMECHANICS LABORATORY		1	5.0 [1.0	
C	CHIM/07	PROTEOMICS LABORATORY		2	5.0 [1.0	
B	ING-IND/34	LABORATORIO DI BIOCAMPATIBILITA' E COLTURE CELLULARI		2	5.0 [1.0	
B	ING-IND/34	COMPUTATIONAL BIOMECHANICS LABORATORY		2	5.0 [1.0	
--	--	Courses to be chosen from Group LAB	--	--	--	5.0
--	--	Courses to be chosen from Group INGLM-BCT	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	
--	--	Courses to be chosen from Group BASE	--	--	--	10.0
--	--	Courses to be chosen from Group GES	--	--	--	
--	--	Courses to be chosen from Group LAB	--	--	--	
--	--	Courses to be chosen from Group INGLM-BCT	--	--	--	
--	--	Courses to be chosen from Group MED	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	
--	--	Courses to be chosen from Group SPEC	--	--	--	
--	--	Courses to be chosen from Group SOFT SKILLS	--	--	--	
--	--	FINAL WORK (BIO LM)	--	1	18.0	
--	--	FINAL WORK (BIO LM)	--	2	18.0	



BIC - 1° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
C	ING-IND/35	MANAGEMENT OF ORGANIZATIONS AND PROJECTS		1	5.0	10.0
C	INF/01	MACHINE LEARNING		1	5.0	
--	ING-INF/03	FUNDAMENTALS OF COMMUNICATION NETWORKS		1	5.0	10.0
--	--	Courses to be chosen from Group INGLM-BIC	--	--	--	
--	--	Courses to be chosen from Group MOD	--	--	--	
B	ING-INF/06	CLINICAL TECHNOLOGY ASSESSMENT		1	5.0 [1.0	5.0
B	ING-IND/34 ING-INF/06	IMPIANTI OSPEDALIERI E SICUREZZA [C.I.]		1	10.0	10.0
--	--	Courses to be chosen from Group BASE	--	--	--	
B	ING-INF/06	ANALISI E ORGANIZZAZIONE DI SISTEMI SANITARI (C.I.)		2	10.0	20.0
B	ING-INF/06	BIOMEDICAL SIGNAL PROCESSING AND MEDICAL IMAGES - BIOE 540-421 [I.C.]		2	10.0 [1.0	
B	ING-INF/06	MEDICAL INFORMATICS [I.C.]		2	10.0 [1.0	
B	ING-INF/06	TECHNOLOGIES FOR SENSORS AND CLINICAL INSTRUMENTATION - BIOE 430		2	10.0 [1.0	
C	ING-IND/35	HEALTH CARE MANAGEMENT		2	5.0 [1.0	5.0

BIC - 2° YEAR

Educational activities	SSD	Course Title	Language	Sem	CFU	CFU Group
B	ING-INF/06	ADVANCED SIGNALS AND DATA PROCESSING IN MEDICINE [I.C.]		2	10.0	20.0
B	ING-INF/06	METHODS FOR BIOMEDICAL IMAGING AND COMPUTER AIDED SURGERY		2	10.0	
B	ING-INF/06	E-HEALTH METHODS AND APPLICATIONS [I.C.]		1	10.0 [1.0	
B	ING-IND/34	LIFE SUPPORT SYSTEMS		2	10.0 [1.0	
B	ING-INF/06	TECHNOLOGIES FOR MOTOR BEHAVIOUR ANALYSIS AND VIRTUAL MODELLING (I.C.)		1	10.0	
B	ING-INF/06	NEUROENGINEERING [C.I.]		1	10.0 [1.0	
--	--	Courses to be chosen from Group BASE	--	--	--	10.0
B	ING-IND/34 ING-INF/06	INTERNSHIP BIC	--	1	10.0	10.0
B	ING-IND/34 ING-INF/06	INTERNSHIP BIC	--	2	10.0	
--	--	FINAL WORK (BIO LM)	--	1	20.0	20.0
--	--	FINAL WORK (BIO LM)	--	2	20.0	



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