UNIVERSITÀ DEGLI STUDI DI PALERMO

Characteristics

    

Educational objectives

The 1st cycle Degree Course in Biomedical Engineering has the specific objective to train professionals with technical-biological skills, differing from the skills of other graduates of the class L-9. In detail, these skills will be adequately provided through the integration of industrial engineering, information engineering and medical-biological knowledge.
The professional profile of Biomedical Engineer (ISTAT code 2.2.1.8.0) must therefore be versatile and able to fit profitably in the labour market and namely in the biomedical professions. Starting from the knowledge of the methodological and operational aspects of basic sciences, engineering and biology, it aims to train graduates in Biomedical Engineering able to carry out activities such as the assessment of the reliability, quality and safety of devices for the biomedical, pharmacological use, of support-aid devices for the disabled, up to their design with specific reference to new prostheses and artificial organs. More specific skills that will be acquired through the training are related to the use and development of software for biomedical applications and to the management of services and systems supporting clinical decisions.
The degree course in Biomedical Engineering starts with a group of common educational activities, and continues with four different curricula, one more oriented to Biomaterials, another to Biomechanics, one to Bioelectronics/Bioinformatics and the last one to Applied technologies for Medicine. Within the course, it is possible to divide educational activities in well-defined learning areas, both common and specific curricular ones, reflecting the specific objectives of the educational program as a whole. The principal areas are: Basic Engineering knowledge, basic Industrial Engineering knowledge, Biology and Physiology, Biomaterials and Industrial Bioengineering, Electronics Bioengineering and Bio imaging.
Thanks to the solid technical and scientific groundings provided during common activities, and the specific teachings provided in the curricula, the degree course in Biomedical Engineering can ensure a profitable integration into work environments already at the end of the studies, but also allows graduates to deepen their skills by entering to a 2nd cycle Degree Course.

Professional opportunities

Profile: Biomedical Engineer - specialization in Biomaterials for Medicine

Functions:
Graduates in Biomedical Engineering in the field of Biomaterials are responsible for preparing and characterizing biomaterials for application in the field of prosthetics, diagnostic and treatment, with particular attention to the study of the relationships between the processing, structure and properties. In detail, these professionals must be able to design and evaluate the use of materials suitable for diagnostic medical devices, for the prevention and treatment of diseases or disabilities, for the replacement or modification of the anatomy or of a physiological process. The biomaterials must be actively used for the development of biosensors, of new prostheses and artificial organs, of devices for biomedical, pharmacological use and for support-aid for the disabled.

Skills:
Graduates possess solid groundings in engineering disciplines, supported by the knowledge of the main characteristics and properties of biomaterials and of the nature of the interactions among them and biological tissues. Moreover, they are able to design artificial systems for the functional recovery of the tissue or organ to replace, integrate or rehabilitate. To operate properly, they must have adequate basic skills in mathematics, chemistry, physics and biomechanics. In particular, they should be able to use the methodological and computing tools necessary for the description of fluids and substances transport phenomena in the biomedical field.

Professional Opportunities:
Graduates in Biomedical Engineering will be able to operate as freelancers, in industrial companies, hospitals, health and specialized clinical laboratories, as well as in research centres and universities. With respect to Biomaterials, graduates in this field will be able to carry out their professional activity in the research, design and/or production of materials with particular reference to biomaterials for biomedical devices, systems and equipment for the diagnosis, treatment and rehabilitation and for biomechanical and study applications for motion, as well as functional devices for controlled release. They may also choose to continue their studies in the 2nd cycle Degree Courses in Materials Engineering (LM-53).
In addition, in accordance with regulations in force, graduates in Biomedical Engineering can access the profession after

passing the national qualification examination and registration in the national Board. Finally, a degree in Biomedical Engineering allows, after a period of apprenticeship under the guidance of the relevant qualified expert, to access the qualifying exam for enrolment in the list of qualified experts in charge of radiation protection physical surveillance.

Profile: Biomedical Engineer – specialization in biomedical information Technologies

Functions:
Graduates in Biomedical Engineering - area Technologies for diagnostics - carry out the study and description of electric and/ or magnetic phenomena, the processing of data and images, the modelling of physiological systems, the implementation and application of methods for the management and transmission of medical information. In addition, they must be able to design, produce and test medical devices and plants for diagnosis, therapy and monitoring. They also deal with the design and production of biosensors, electro-medical equipment, support systems for medical decision-making, medical information systems and, finally, with the development of medical software.

Skills:
Graduates possess solid basic groundings in engineering disciplines, namely in the electronic, mechatronic and robotic areas, supported by core competences in the medical-biological sector, and knowledge of the relevant applications. To operate properly, they must have adequate basic skills in mathematics, chemistry and physics. They should be able to process and analyse medical-biological signals, images and data, and be able to apply the techniques for designing electronic circuits, methodological tools and quantitative methods for the study of physiological systems.

Professional opportunities:
Graduates in Biomedical Engineering may work as freelancers, as well as in industrial companies, hospitals, health and specialized clinical laboratories, and also in research centres and universities. They may work in the design, production, operation and control of biomedical and pharmaceutical equipment, in the solution of methodological and technological problems in the physiological sector, in providing healthcare services and in the use of specific medical software for diagnostic assistance, Finally, graduates in Biomedical Engineering may work as engineers in charge of quality, safety and organization services in the healthcare area, engineers in charge of health information systems, and as engineers supporting the activities of biomedical laboratories and radiology facilities. An important opportunity consists in the continuation of studies in the 2nd cycle Degree Course in Electronics Engineering (LM-29). In addition, in accordance with regulations in force, they may access the profession after passing the national qualification examination and registration in the national Board. Finally, a degree in Biomedical Engineering allows, after a period of apprenticeship under the guidance of the relevant qualified expert, to access the qualifying exam for the enrolment in the list of qualified experts in charge of the level of radiation protection physical surveillance.

Profile: Biomedical Engineer – specialization in Biomechanics

Functions:
Graduates in Biomedical Engineering - area Biomechanics – possess general skills in biomechanics and human movement, as well as on the methodological and calculation tools needed for bio fluid-dynamics and on computational biomechanics.

Skills:
Graduates possess solid basic groundings in engineering disciplines, supported by the knowledge of the main properties of bio-fluid mechanics and biomechanics.
To operate properly, they must have adequate basic skills in mathematics, chemistry, physics, and biomechanics. They should be able, in particular, to use methodological tools and quantitative methods for the description of the phenomena of fluid and substance transportation in the biomedical field.

Professional opportunities:
Graduates in Biomedical Engineering may work as freelancers, as well as in industrial companies, hospitals, healthcare and specialized clinical laboratories, and also in research centres and universities.
Graduates will be able carry out their activities in the field of research, treatment and rehabilitation and in biomechanical and movement study applications.
In addition, in accordance with existing legislation, they may access the profession after passing the national qualification examination and registration in the national Board. Finally, a degree in Biomedical Engineering allows, after a period of apprenticeship under the guidance of the relevant qualified expert, to access the qualifying exam for the enrolment in the list of 1st level qualified experts in charge of the physical surveillance of radiation protection.

Profile:
Biomedical Engineer: specialization in Technologies Applied to Medicine

functions:
Graduates in Biomedical Engineering in the area of Technologies applied to medicine deal with the study and application

description of new biomedical technologies in the clinical setting and actively participate in the experimentation processes. They assist doctors on medical-biological issues thanks to their solid training in engineering technologies and methodologies. They support the physician in identifying the therapeutic measures to combat pathologies by applying the most appropriate and innovative technologies whenever the latter have undoubted advantages. They use specific electrical and/or magnetic phenomena, data and image processing, modelling of physiological systems, implementation and application of methods for the management and transmission of medical information. In addition, these professionals must be able to design, manufacture and test medical devices and implants intended for diagnosis, therapy or monitoring. In addition, they deal with electro-medical instrumentation, clinical decision support systems, health information systems and, finally, with the development of medical software.

skills:
Graduates in Biomedical Engineering have a solid basic training in engineering disciplines, especially in the fields of electronics, mechatronics and robotics, supported by basic groundings in the medical-biological sector with knowledge of specific applications. To operate correctly, they must have adequate basic skills in mathematics, chemistry and physics with technological and engineering knowledge and application skills in diversified fields. They are able to use scientific and technological knowledge in the biomedical field and the ability to participate in interdisciplinary research groups and clinical trials. They promote the integration of multi-omics, information technology, sensoristics, robotics, mechatronics, modelling and biomechanics technologies, as well as of technologies related to the analysis and processing of signals and images to support all clinical pathways. They acquire the ability to collaborate and interact effectively with different professional profiles in the performance of health and related activities and effectively use engineering technologies in the understanding and possible solution of medical-biological problems. They master the technologies based upon artificial intelligence both in research and in the achievement of diagnostic and therapeutic objectives, in the context of precision medicine. They are able to design and develop experimental activities, analyse measurements, select and calibrate biomedical equipment in order to identify innovative solutions for human health problems.
professional opportunities:
Graduates in Biomedical Engineering can work both as freelancers and in industrial companies, hospitals, health facilities and specialized clinical laboratories, health services management bodies, national healthcare organizations and, finally, in research centres and universities. These professionals can be used in the design, production, management and testing of biomedical and pharmaceutical equipment, in the solution of methodological and technological problems in the physiological field, in the provision of health services and in the use of appropriate medical software for diagnostic assistance. Finally, graduates in Biomedical Engineering can be employed as engineers in charge of the quality, safety, organization services in the health sector, engineers in charge of health information systems, and as support engineer for the activities of Biomedical Laboratories and health radiology structures.
An important professional opportunity is also represented by the continuation of studies in the 2nd cycle Degree in Electronic Engineering (LM-29).

Furthermore, in accordance with regulations in force, graduates in Biomedical Engineering can access the profession after passing the national qualification exam and enrolling in the register. Finally, the achievement of the degree in Biomedical Engineering allows, after a subsequent internship period and under the guidance of the relevant qualified expert, to access the qualification exam for enrolment in the list of first level qualified experts in charge of the physical surveillance of radiation protection.

Final examination features

To obtain the degree, students must have acquired 180 credits including those relating to the final examination (3 credits). The final test has the objective of assessing the level of maturity and critical skills of the undergraduate, with respect to learning and to acquired knowledge, on completion of the activities provided by the course syllabus. The final examination consists of a written or oral test, in accordance with the rules fixed every year by the Degree Course Regulations for the final examination, respecting and consistent to the calendar, the ministerial requirements and to the relevant Guidelines of the University.

Subjects 1 ° year	CFU	Sem.	Val.	Att.	SSD	TAF
01788 - CHEMISTRY *Marci'(PO)*	9	1	V		CHIM/07	A
03675 - GEOMETRY	6	1	V		MAT/03	A
18414 - HEALTHCARE SYSTEMS MANAGEMENT *Mazzola(PA)*	6	1	V		ING-IND/35	B
19109 - MATHEMATICAL ANALYSIS - INTEGRATED COURSE	12	Ann.	V			
- MATHEMATICAL ANALYSIS - MODULE 1 *Bongiorno(PA)*	*6*	*1*			*MAT/05*	*A*
- MATHEMATICAL ANALYSIS - MODULE 2 *Bongiorno(PA)*	*6*	*2*			*MAT/05*	*A*
04677 - ENGLISH LANGUAGE	3	1	G			E

Legenda: Per. = periodo o semestre, Val. = Valutazione (V=voto, G=giudizio), TAF= Tipologia Attività Formativa (A=base, B=caratterizzante, C=Affine, S=stages, D=a scelta, F=altre)

Subjects 1 ° year	CFU	Sem.	Val.	Att.	SSD	TAF
22207 - BIOMEDICAL COMPUTER SCIENCE *Gambino(RU)*	6	2	V		ING-INF/05	A
02605 - COMPUTER AIDED DESIGN *Cirello(RD)*	9	2	V		ING-IND/15	B
03295 - PHYSICS 1 *Lorenzo(PA)*	9	2	V		FIS/03	A
	60					

Subjects 2 ° year	CFU	Sem.	Val.	Att.	SSD	TAF
11077 - ELEMENTS OF ANATOMY AND PHYSIOLOGY	9	Ann.	V			
- PRINCIPLES OF ANATOMY *Macaluso(PO)*	*3*	*1*			*BIO/16*	*C*
- PHYSIOLOGY *Serio(PO)*	*6*	*2*			*BIO/09*	*C*
07870 - PHYSICS II *Carollo(PA)*	6	1	V		FIS/01	A
18409 - TRANSPORTATION PHENOMENA AND THERMAL DYNAMICS *Brucato(PO)*	9	1	V		ING-IND/24	B
02965 - ELECTRICAL DEVICES AND CIRCUITS *Ala(PO)*	9	2	V		ING-IND/31	B
18410 - ELEMENTS OF BIOCHEMISTRY AND CELL BIOLOGY *Campora(RD)*	6	2	V		BIO/10	C
06328 - SCIENCE AND TECHNOLOGY OF MATERIALS *Botta(PA)*	9	2	V		ING-IND/22	B
Stage and others	3					F
Free subjects (suggested)	15					D
	66					

Subjects 3 ° year	CFU	Sem.	Val.	Att.	SSD	TAF
19354 - BIOMEDICAL DATA AND SIGNAL PROCESSING	9	1	V		ING-INF/06	B
21192 - BIOMEDICAL DEVICES *Pasta(PA)*	6	1	V		ING-IND/34	B
06313 - MECHANICS OF MATERIALS AND THEORY OF STRUCTURES *Zingales(PO)*	9	1	V		ICAR/08	B
03472 - PRINCIPLES OF ELECTRONICS *Stivala(PA)*	9	1	V		ING-INF/01	C
18412 - BIOMEDICAL SENSORS AND EQUIPMENT *Faes(PO)*	9	2	V		ING-INF/06	B
05917 - FINAL EXAMINATION	3	2	V			E
Optional subjects	9					C
	54					

OPTIONAL SUBJECTS

Stage and others	CFU	Sem.	Val.	Att.	SSD	TAF
21167 - INTERNSHIP 2 CREDITS	2	1	G			F
11033 - INTERNSHIP 3 CREDITS	3	1	G			F

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OPTIONAL SUBJECTS

Stage and others	CFU	Sem.	Val.	Att.	SSD	TAF
11034 - OTHER EDUCATIONAL ACTIVITIES - 1 CREDIT	1	1	G			F
11035 - OTHER EDUCATIONAL ACTIVITIES - 2 CREDITS	2	1	G			F
11036 - OTHER EDUCATIONAL ACTIVITIES - 3 CREDITS	3	1	G			F
Optional subjects	**CFU**	**Sem.**	**Val.**	**Att.**	**SSD**	**TAF**
18411 - BIOIMAGING *Grassedonio(RD)*	9	1	V		MED/36	C
18396 - CHEMISTRY OF BIOLOGICAL MOLECULES *Giacalone(PO)*	9	1	V		CHIM/06	C
21337 - PHYSICAL METHODOLOGY AND EQUIPMENT IN MEDICINE *Abbene(PA)*	9	2	V		FIS/07	C
07393 - SIGNAL THEORY *Garbo(PO)*	9	2	V		ING-INF/03	C
Free subjects (suggested)	**CFU**	**Sem.**	**Val.**	**Att.**	**SSD**	**TAF**
18107 - ALGORITHMS AND OPTIMIZATION METHODS	9	1	V		ING-INF/05	D
21188 - BLOOD AND PLASMA SEPARATION AND PROCESSING	6	1	V		ING-IND/34	D
18451 - ELECTROMAGNETIC FIELDS FOR BIOENGINEERING *Cino(PA)*	6	1	V		ING-INF/02	D

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