



# UNIVERSITÀ DEGLI STUDI DI PALERMO

**Department: Engineering**

**A.Y. 2021/2022**

## **DEGREE COURSE IN BIOMEDICAL ENGINEERING - BIOMATERIALS FOR REGENERATIVE MEDICINE -**

### **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 L9. 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 including 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 consist in the use and development of software for biomedical applications and in the management of clinical decision support services and systems. The degree course in Biomedical Engineering starts with a group of common training activities, and continues with two different curricula, one more oriented to biomaterials and the other to Bioelectronics/Bioinformatics and related technologies. 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 two 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 a solid basic groundings in engineering disciplines, supported by the knowledge of the main characteristics and properties of biomaterials and of the nature of the interactions between these 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

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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 Biomedical Engineering.

In addition, in accordance with existing legislation, 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 physical surveillance radiation protection.

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. They may also continue their studies in the 2nd cycle Degree Course in Electronic Engineering (LM-29). 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 qualified experts in charge of the level of physical surveillance radiation protection.

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 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.

Graduates will be able carry out their activities in the field of research, treatment and rehabilitation and in biomechanical and movement study applications.

They may also continue their studies in the 2nd cycle Degree Course in Electronic Engineering (LM-29). 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 qualified experts in charge of the level of physical surveillance radiation protection.

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## 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 the 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.	SSD	TAF
20270 - ADVANCED BIOMECHANICAL MODELLING <i>Borino(PO)</i>	6	1	V	ICAR/08	C
20279 - CELL BIOENGINEERING <i>Pasta(PA)</i>	9	1	V	ING-IND/34	B
21904 - HEALTHCARE OPERATIONS MANAGEMENT <i>Mazzola(PA)</i>	6	1	V	ING-IND/35	C
20275 - MECHANICAL AND THERMAL MEASUREMENTS FOR BIOMEDICS <i>Scardulla(RD)</i>	6	1	V	ING-IND/12	C
21905 - ADVANCED TECHNOLOGIES OF REGENERATIVE MEDICINE <i>Lopresti(RD)</i>	9	2	V	ING-IND/34	B
21234 - STATISTICAL ANALYSIS OF BIOMEDICAL SIGNALS <i>Faes(PO)</i>	9	2	V	ING-INF/06	B
18415 - TISSUE ENGINEERING <i>La Carrubba(PA)</i>	9	2	V	ING-IND/34	B

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Subjects 2 ° year	CFU	Sem.	Val.	SSD	TAF
20273 - MATERIALS BIOCOMPATIBILITY AND BIODEGRADATION - INTEGRATED COURSE	12	1	V		
- <i>BIOCOMPATIBILITY AND BIODEGRADATION OF METALLIC AND CERAMIC MATERIALS</i> <i>Di Franco(PA)</i>	6	1		ING-IND/23	C
- <i>BIOCOMPATIBILITY AND BIODEGRADATION OF POLYMERIC MATERIALS</i> <i>Dintcheva(PA)</i>	6	1		ING-IND/22	C
20276 - TRASNSPORTATION PHOENOMENA IN BIOLOGICAL SYSTEMS <i>Brucato(PO)</i>	6	1	V	ING-IND/24	C
17371 - BIOMATERIALS <i>Scaffaro(PO)</i>	9	2	V	ING-IND/22	C
20280 - IMAGE DIAGNOSTICS EQUIPMENT <i>Pirrone(PO)</i>	9	2	V	ING-INF/06	B
05917 - FINAL EXAMINATION	15	2	G		E
Stage and others	6				F
Free subjects	9				D

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## OPTIONAL SUBJECTS

Stage and others	CFU	Sem.	Val.	SSD	TAF
21167 - INTERNSHIP 2 CREDITS	2	1	G		F
11033 - INTERNSHIP 3 CREDITS	3	1	G		F
15458 - INTERNSHIP 4 CREDITS	4	1	G		F
11351 - INTERNSHIP 5 CREDITS	5	1	G		F

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## OPTIONAL SUBJECTS

Stage and others	CFU	Sem.	Val.	SSD	TAF
11028 - INTERNSHIP 6 CREDITS	6	1	G		F
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
11037 - OTHER EDUCATIONAL ACTIVITIES - 4 CREDITS	4	1	G		F
11038 - OTHER EDUCATIONAL ACTIVITIES - 5 CREDITS	5	1	G		F
11039 - OTHER EDUCATIONAL ACTIVITIES - 6 CREDITS	6	1	G		F

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