



# UNIVERSITÀ DEGLI STUDI DI PALERMO

<b>DEPARTMENT</b>	Ingegneria
<b>ACADEMIC YEAR</b>	2021/2022
<b>MASTER'S DEGREE (MSC)</b>	BIOMEDICAL ENGINEERING
<b>SUBJECT</b>	TISSUE ENGINEERING
<b>TYPE OF EDUCATIONAL ACTIVITY</b>	B
<b>AMBIT</b>	50351-Ingegneria Biomedica
<b>CODE</b>	18415
<b>SCIENTIFIC SECTOR(S)</b>	ING-IND/34
<b>HEAD PROFESSOR(S)</b>	LA CARRUBBA VINCENZO                      Professore Associato                      Univ. di PALERMO
<b>OTHER PROFESSOR(S)</b>	
<b>CREDITS</b>	9
<b>INDIVIDUAL STUDY (Hrs)</b>	144
<b>COURSE ACTIVITY (Hrs)</b>	81
<b>PROPAEDEUTICAL SUBJECTS</b>	
<b>MUTUALIZATION</b>	
<b>YEAR</b>	1
<b>TERM (SEMESTER)</b>	2° semester
<b>ATTENDANCE</b>	Not mandatory
<b>EVALUATION</b>	Out of 30
<b>TEACHER OFFICE HOURS</b>	<b>LA CARRUBBA VINCENZO</b> Tuesday    11:00    12:00    Studio docente, edificio 6 secondo piano Thursday   11:00    12:00    Studio docente, edificio 6 secondo piano

<b>PREREQUISITES</b>	Fundamentals of continuum mechanics: - stress/deformation, types of loads (tensile, compressive, shear), mechanical properties Fundamentals of applied chemistry: - classes of materials, their characteristics and properties Knowledge of thermodynamics - phase diagrams Knowledge of transport phenomena - mass transfer, mass balance
<b>LEARNING OUTCOMES</b>	Knowledge and understanding Introducing the tissue engineering and regenerative medicine concept. Define the key concepts of cell biology, bioengineering, histology and anatomy useful for understanding the tissue engineering and regenerative medicine paradigm. Define properties and features of materials and processes used in tissue engineering. Define properties and features of biochemical engineering with reference to physiology. Applying knowledge and understanding Choosing the most appropriate processes and materials for a given tissue engineering application . Describe delivery and release processes taking place in physiology by using typical engineering modelling tools. Making judgements Identifying the most important processes and materials for tissue engineering applications, highlighting differences, analogies, advantages and disadvantages in a comparative way. Identifying processes of delivery and release and their qualitative and quantitative description. Communication skills Students should be able to communicate with competence and language skills about materials and processes for tissue and biochemical engineering applications, including mechanical properties, biodegradation, surface properties, porosity requirements, physiology description (models). Learning skills Students should be able to assess with autonomy a basic release and tissue engineering problem, with the aim of defining the solution strategies
<b>ASSESSMENT METHODS</b>	The final exam consists of the global evaluation of various distinct assignments (for groups of 3-5 students): - one written report (max 15-20 pages) on lab activities attended by the students (according to the topics listed at the end of this form) - one written assignment (max 25-30 pagine) related to a specific design problem of a tissue engineering scaffold, followed by an oral presentation by the students (see the topics at the end of this form) - one written numerical exercise on compartmental modelling (see the topic list at the end of this form) The final assessment, properly graded, will be made on the basis of the following conditions: a) sufficient knowledge of subjects and theories addressed in the course; sufficient degree of awareness and autonomy in the application of theories to solve chemical problems (rating 18-21); b) Good knowledge of subjects and theories addressed in the course; fair degree of awareness and autonomy in the application of theories to solve chemical problems (rating 22-25); c) Good knowledge of subjects and theories addressed in the course; good degree of awareness and autonomy in the application of theories to solve chemical problems (rating 26-28); d) Excellent knowledge of subjects and theories addressed in the course; excellent level of awareness and autonomy in the application of theories to solve problems (rating 29-30L). An evaluation according to the point a, b, c and d will be carried out for each item i), ii) and iii), and an arithmetic averaging will be operated with a final round up. The exam and the related evaluation will be the same for non-attending students.
<b>EDUCATIONAL OBJECTIVES</b>	1. Introduce the fundamentals of prosthetic systems and regenerative medicine 2. Define the main structural and functional properties of the materials used for regenerative medicine and tissue engineering 3. Scrutinize the main production processes of tissue engineering scaffolds and regenerative medicine devices 4. Selecting the most appropriate production process with respect to a well defined target 5. Define the delivery and release processes taking place in physiology and use the appropriate engineering tools to describe, quantify and model them

<b>TEACHING METHODS</b>	Frontal teaching, practise, lab experience
<b>SUGGESTED BIBLIOGRAPHY</b>	Reviews, book chapters, scientific articles and slides supplied in electronic format

## SYLLABUS

<b>Hrs</b>	<b>Frontal teaching</b>
3	The History of prosthetic devices, Tissue Engineering and Regenerative Medicine.
4	Short notes on cell biology and cell cultures: culture media, growth and differentiation, tissue formation. Tissue types. Cell-biomaterial interaction. Inflammatory and immunitary response.
5	Tissue Engineering and Regenerative Medicine paradigm: Goals and methods.
6	Scaffolds for tissue engineering. Strategies for design and production.
5	Short notes on histology and anatomy: skin, cartilage, bone, cardiovascular system (blood vessels) and respiratory system (bronchial tube)
5	Materials used in tissue engineering applications: natural and synthetic polymers
5	Methods used in tissue engineering (scaffold production)
6	Methods for scaffold production based on phase separation: thermodynamics and kinetic implications
3	Biodegradation issues in tissue engineering: hydrolytic and enzymatic degradation. Biomimetic materials
14	Introduction to biochemical engineering. Physiology. Drugs, active principles and excipients. Unitary operations. Transport phenomena in human body and modelling (compartments).
<b>Hrs</b>	<b>Practice</b>
6	Case studies of in-vitro tissue engineering: skin, blood vessels, bronchiole tube, bone
13	Examples of Transport phenomena in human body and compartmental modelling (one and two compartments)
<b>Hrs</b>	<b>Workshops</b>
6	Case studies of in-vitro tissue engineering: skin, blood vessels, bronchiole tube, bone