UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2020/2021
MASTER'S DEGREE (MSC)	BIOMEDICAL ENGINEERING
SUBJECT	TISSUE ENGINEERING
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50351-Ingegneria Biomedica
CODE	18415
SCIENTIFIC SECTOR(S)	ING-IND/34
HEAD PROFESSOR(S)	LA CARRUBBA VINCENZO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**LA CARRUBBA VINCENZO** Tuesday 11:00 12:00 Studio docente, edificio 6 secondo piano Thursday 11:00 12:00 Studio docente, edificio 6 secondo piano

DOCENTE: Prof. VINCENZO LA CARRUBBA

PREREQUISITES	Knowledge of mechanics: - stress/deformation, types of loads (tensile, compressive, shear), mechanical properties Knowledge of applied chemistry: - classes of materials, their characteristics and properties Knowledge of thermodynamics - phase diagrams Knowledge of transport phenomena - mass transfer, mass balance
LEARNING OUTCOMES	Knowledge and understanding Introducing the tissue engineering and regenerative medicine concept. Define the key concepts of cell biology, bioengineering, istology and anatomy useful for undestanding the tissue engineering and regenerative medicice 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 processes taking place in physiology by using typical chemical engineering tools. Making judgements Identifying the most important processes and materials for tissue engineering applications, highlighting differences, analogies, advantages and disavantages in a comparative way. Identifying processes of release and delivery in the human body 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 biochemical and tissue engineering problem, with the aim of defining the solution strategies
ASSESSMENT METHODS	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.
EDUCATIONAL OBJECTIVES	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 release and delivery processes taking place in physiology and use the appropriate engineering tools to describe, quantify and model them
TEACHING METHODS	Frontal teaching, practise, lab experience

SUGGESTED BIBLIOGRAPHY	Reviews, book chapters, scientifc articles and slides supplied in electronic format

SYLLABUS

Hrs	Frontal teaching
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 istology 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: hydrolitic 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).

Hrs	Practice
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)

Hrs	Workshops
6	Case studies of in-vitro tissue engineering: skin, blood vessels, bronchiole tube, bone