



BIOMEDICAL PHYSICS INSTRUMENTATION

Enrollment year	2020/2021
Academic year	2021/2022
Regulations	DM270
Academic discipline	FIS/07 (APPLIED PHYSICS (CULTURAL HERITAGE, ENVIRONMENT, BIOLOGY AND MEDICINE))
Department	DEPARTMENT OF PHYSICS
Course	
Curriculum	Fisica biosanitaria
Year of study	2°
Period	1st semester (04/10/2021 - 19/01/2022)
ECTS	6
Lesson hours	60 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	MARIANI MANUEL (titolare) - 2 ECTS BRERO FRANCESCA - 4 ECTS
Prerequisites	Knowledge of the concepts learned on the courses of the first three year of University (scientific faculty): in particular statics and dynamics of real and ideal fluids, mechanics, electromagnetism, fundamental concept of quantum mechanics and structure of matter. The aspects illustrated and learned on the "Diagnostic Techniques" courses are also suggested.
Learning outcomes	The aim of the course is to introduce the student to the world of the largely diffused diagnostic and biomedical instrumentations through lectures which treat, from a theoretical point of view the physical principles which underlie of the principles of operation of the instrumentation and followed by laboratories where, in practice, the principles of operation of the instrumentation and the procedure of data acquisition are explained. During laboratories the students will work by themselves with the instrumentation.

	At the end of the course the student will have a deep knowledge of the physical principles underlying the principles of operation and the principles of operation themselves of the instrumentation presented and the skill to work with the instrumentation almost autonomously.
Course contents	Principles of operation of the most used electro-medical equipments, in particular to the instruments for diagnosis and therapeutics which do not use ionizing radiations. The principles of the Nuclear Magnetic Resonance (NMR) and the related medical application of this technique to Magnetic Resonance Imaging (MRI) will be presented. The ultrasound based apparatus for echography and echo-tomography will be studied as well as the equipments to measure the general and capillary blood viscosity. A SQUID based apparatus for magneto-encephalography will also be introduced. All the theoretically treated arguments will be experimentally tested by using the equipments of the Biomedical-Physics laboratory(NMR spectrometer, MRI tomography, Viscometers, etc.) and at the Institute of Radiology of the IRCCS Policlinico S. Matteo di Pavia (Echo-tomography)
Teaching methods	The course is based on an alternation of front side lectures, during which the main theoretical concepts regarding the techniques presented will be explained, and laboratory activities, during which these concepts will be put into practice. Further laboratories are planned, in order to make the student almost autonomous in working with the instrumentation and in acquiring data.
Reccomended or required readings	<ol style="list-style-type: none"> 1) Bioimmagini. G. Coppini, S. Diciotti, G. Valli – Patron Editore 2) Tecniche di CT e MRI nella Diagnostica per Immagini. L. Cei, A. La Fianza, C. Baluce. - Società Editrice Universo (Roma) 3) Medical Imaging Physics. W.R. Hendee, E.R. Ritenour – Wiley-Liss 4) Slides provided by the lecturer about the topics treated in the front side lectures and during laboratories
Assessment methods	The examination consists of a report on the laboratory activities, sent to the professor before taking the examination, in which both the knowledge of the fundamental theoretical concepts and of the experimental instrumentation used in laboratory are evaluated. The subject of the report is further analyzed during the oral examination. The oral examination consists, also, of other questions regarding the other subjects of the course, to evaluate both the theoretical and experimental knowledge learned by the student.
Further information	The examination consists of a report on the laboratory activities, sent to the professor before taking the examination, in which both the knowledge of the fundamental theoretical concepts and of the experimental instrumentation used in laboratory are evaluated. The subject of the report is further analyzed during the oral examination. The oral examination consists, also, of other questions regarding the other subjects of the course, to evaluate both the theoretical and experimental knowledge learned by the student.
Sustainable development goals - Agenda 2030	\$lbl_legenda_sviluppo_sostenibile