UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche
ACADEMIC YEAR	2018/2019
BACHELOR'S DEGREE (BSC)	BIOTECHNOLOGIES
SUBJECT	BIOPHYSICS AND BIO-INSTRUMENTATION
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50083-Discipline matematiche, fisiche, informatiche e statistiche
CODE	13691
SCIENTIFIC SECTOR(S)	FIS/07
HEAD PROFESSOR(S)	MILITELLO VALERIA Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52
PROPAEDEUTICAL SUBJECTS	09464 - APPLIED PHYSICS
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MILITELLO VALERIA** Monday 15:00 17:00 Ufficio personale al primo piano dell'Edificio 18 Viale delle Scienze. Si prega di contattarmi preventivamente via email per conferma.

DOCENTE: Prof.ssa VALERIA MILITELLO

PREREQUISITES	Propaedeutic with Physics and knowledge in Chemistry
LEARNING OUTCOMES	Knowledge and ability to understand: the student must to know the composition of the biological matter and show the relationship between structure, function and dynamics in organic molecules; the student must to know information on the effects of the interactions between the molecules and the surrounding environment and between the light and the biological matter. Capacity to apply knowledge and understanding: the students must know the application of the concepts listed above recognizing which spectroscopic technique, and related instruments, should be used to obtain specific information; the students must to build and distinguish graphs and spectra analysis methodologies; the students have to know information about new frontiers of experimental biophysics. Independent judgments: the student must get independent judgment in the evaluation and interpretation of experimental data taken from the specialized scientific literature. Communicative comprehension: the student have to acquire skills and tools for presenting experimental and bibliographic data. Learning Capacity: development and deepening of the acquired knowledges by consulting databases and research of recent literature on a chosen topic.
ASSESSMENT METHODS	Exam: oral discussion. The exam is intended to assess whether the student possesses knowledge and understanding of the teaching program topics, independent judgment, ability to apply the acquired knowledges, discipline-specific language. Minimum number of questions: for passing the exam, the student will have to answer to a minimum of three questions, which will cover all the topics of the teaching program, with reference to the recommended texts. Evaluation and its criteria: the evaluation is shown in the diagram below. A – A+ Excellent 30-30 cum laude Eccellente Excellent knowledge of teaching contents; students should show high analytical and synthetic capabilities and should be able to apply their knowledge to solve highly complex problems. B Very good 27-29 Ottimo Very good knowledge of the teaching contents and excellent language control; students should show analytical and synthetic skills and be able to apply their knowledge to solve problems of medium and, in some cases, even higher complexity. C Good 24- 26 Buono Good knowledge of teaching contents and good language control; the students should be able to apply their knowledge to solve problems of medium complexity D Satisfactory 21-23 Discreto Average knowledge of the teaching contents, in some cases limited to the main topic; acceptable ability to use the specific discipline language and independently apply the acquired knowledge. E Sufficient 18-20 Sufficiente Minimum teaching content knowledge, often limited to the main topic; modest ability to use the subject specific language and independently apply the acquired knowledge. F Fail Insufficiente Lack of an acceptable knowledge of the main teaching content knowledge; very little or no ability to use the specific subject language and apply independently the acquired knowledge.
EDUCATIONAL OBJECTIVES	At the end of the course the students should be able to: - understand the basic principles of spectroscopy; - know the effects due to the interaction light-matter; - know the principles which support some of the most common biomedical technologies and distinguish their use. The course is divided into a theoretical part and an experimental part in which are studied the applications of the theory studied and the instruments to be used. There will be the possibility to visit the laboratories of Biophysics at the Department DIFC and ATEN center, both located in Building 18, with the aim to take vision of various instruments studied.
TEACHING METHODS	lessons
SUGGESTED BIBLIOGRAPHY	Halliday, Resnick, Walker “Fondamenti di Fisica - Fisica Moderna” Casa Ed Ambrosiana Cutnell and Johnson “Elettromagnetismo e Fisica Moderna” Ed. Zanichelli D. C. Giancoli "Fisica con Fisica moderna" – Seconda edizione – Casa Ed Ambrosiana

SYLLABUS

Hrs	Frontal teaching
12	Theoretical part: Molecular Biophysics Structure of biological matter: from the atom to the proteins. The hydrogen atom. The hydrogen molecule. Molecular bonds. Bond energies. Atomic and molecular orbitals. Solvent properties. The water. Interaction between molecules and solvent. Structures of proteins and biopolymers. Relationship between structure, function and dynamics of proteins. Folding and unfolding of proteins. Energy Landscape. Aggregation and polymerization of natural and artificial macromolecules.
16	Theoretical part: Elements of spectroscopy. Elements of Optics. Electromagnetic waves. Properties of light. Spectral regions. Electromagnetic radiation and photons. Ionizing and non ionizing radiation. Elements of quantum mechanics. Energy, frequency and wavelength. Light-matter interaction. Energy levels and their populations. Electronic transitions, vibrational, rotational. Absorption and emission of photons. X-ray diffraction, scattering of light, the Beer-Lambert Law and spectrophotometry in the visible and UV. Fluorescence. IR spectroscopy (FTIR, ATR). Raman spectroscopy. Geometrical optics. Advanced microscopy (confocal microscope and methodologies).
6	New Frontiers in Biophysics: Nanotechnology. Biomaterials. Biosensors. Bioinformatics. Examples and recent literature.
14	Experimental part: Instruments and experimental techniques. Scheme of instrumentation used in spectroscopy and microscopy. Graphical representation of spectra. Analysis of the experimental data in spectroscopy. Experimental errors.
52	Theoretical part: Molecular Biophysics Structure of biological matter: from the atom to the proteins. The hydrogen atom. The hydrogen molecule. Molecular bonds. Bond energies. Atomic and molecular orbitals. Solvent properties. The water. Interaction between molecules and solvent. Structures of proteins and biopolymers. Relationship between structure, function and dynamics of proteins. Folding and unfolding of proteins. Energy Landscape. Aggregation and polymerization of natural and artificial macromolecules. Theoretical part: Elements of spectroscopy. Elements of Optics. Electromagnetic waves. Properties of light. Spectral regions. Electromagnetic radiation and photons. Ionizing and non ionizing radiation. Elements of quantum mechanics. Energy, frequency and wavelength. Light-matter interaction. Energy levels and their populations. Electronic transitions, vibrational, rotational. Absorption and emission of photons. X-ray diffraction, scattering of light, the Beer-Lambert Law and spectrophotometry in the visible and UV. Fluorescence. IR spectroscopy (FTIR, ATR). Raman spectroscopy. Geometrical optics. Advanced microscopy (confocal microscope and methodologies). New Frontiers in Biophysics: Nanotechnology. Biomaterials. Biosensors. Bioinformatics. Examples and recent literature. Experimental part: Instruments and experimental techniques. Scheme of instrumentation used in spectroscopy and microscopy. Graphical representation of spectra. Analysis of the experimental data in spectroscopy. Experimental errors. Visit in laboratories.

Hrs	Workshops
4	visit in laboratories