UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche
ACADEMIC YEAR	2020/2021
BACHELOR'S DEGREE (BSC)	BIOLOGICAL SCIENCES
INTEGRATED COURSE	PHYSICS AND CHEMICAL PHYSICS WITH PRACTICE
CODE	19762
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	FIS/07, CHIM/02
HEAD PROFESSOR(S)	SALADINO MARIA LUISA Professore Associato Univ. di PALERMO AGLIOLO GALLITTO AURELIO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	SALADINO MARIA LUISA Professore Associato Univ. di PALERMO MICELI MARCO Professore Associato Univ. di PALERMO AGLIOLO GALLITTO AURELIO Professore Associato Univ. di PALERMO LOMBARDO RENATO Ricercatore Univ. di PALERMO
CREDITS	9
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**AGLIOLO GALLITTO AURELIO** Tuesday 14:00 16:00 Via Archirafi 36, studio del docente (per gli studenti di Scienze Fisiche). Viale delle Scienze, Ed.18 (per gli studenti di Ottica e Optometria e gli studenti di Scienze Biologiche). Modalita a distanza. Su appuntamento. Thursday 14:00 16:00 Via Archirafi 36, studio del docente (per gli studenti di Scienze Fisiche). Viale delle Scienze, Ed.18 (per gli studenti di Ottica e Optometria e gli studenti di Scienze Biologiche). Modalita a distanza. Su appuntamento. **LOMBARDO RENATO** Tuesday 10:00 12:00 Dipartimento STEBICEFStudio 1/B4, edificio 17, viale delle Scienze Thursday 10:00 12:00 Dipartimento STEBICEFStudio 1/B4, edificio 17, viale delle Scienze **MICELI MARCO** Wednesday 14:30 16:30 Dipartimento di Fisica e Chimica, via Archirafi 36 (con prenotazione via email) Thursday 14:30 16:30 Dipartimento di Fisica e Chimica, via Archirafi 36 (con prenotazione via email) **SALADINO MARIA LUISA** Monday 14:00 16:00 Dipartimento STEBICEF, Edificio 17, piano I Wednesday 14:00 16:00 Dipartimento STEBICEF, Edificio 17, piano I Thursday 14:00 16:00 Dipartimento STEBICEF, Edificio 17, piano I

DOCENTE: Prof. AURELIO AGLIOLO GALLITTO- *Lettere L-Z*

PREREQUISITES	Prerequisites are the topics of Maths, Physics and Chemistry requested to access the Course. Attendance of first semester subject of Maths and General Chemistry are necessary to fully achieve the learning outcomes.
LEARNING OUTCOMES	Knowledge and understanding. Knowledge of the basic concepts of classical physics, thermodynamics, physical chemistry and chemical kinetics. Knowledge of the scientific method. Applying knowledge and understanding. Students become capable of solving simple problems of general physics, classical thermodynamics and chemical kinetics as samples of rigourous application of the scientific method. Making judgements. Students are able of autonomous choice of physical laws and solving method to simple problem of general physics. They are able to evaluate energy balance and mechanism of simple chemical reactions and biological processes. Communication. Students are able of explain clearly and concisely the fundamental laws of classical physics, of thermodynamics and chemical kinetics. Lifelong learning skills. Students are able of understand and deepen the grounds of classical physics, of thermodynamics and chemical kinetics. They are able of understand the physical bases of the operation of instrumentation used in biological and biomedical laboratories.
ASSESSMENT METHODS	The ongoing test is a self-assessment test (not mandatory) and will not be taken into consideration for the evaluation of the final exams. Final assessment consists of an oral examination preceded, for each scheduled exam, by written resolution of simple Physics and Physical-Chemistry exercises. The written resolution of exercises or tests will be held at the time and place published for every scheduled exam. The written resolution of exercises consists of doing, without the aid of textbooks or notes, basic exercises that involve the main laws of mechanics, fluids, classical thermodynamics, electromagnetism and physical-chemistry. Samples of such exercise are available online through the UNIPA web site. The written resolution of problems is done to check, at equal conditions for all candidates, the degree of knowledge of the physical laws and the ability to apply them in simple situations. Scheduling of the oral test will be announced during the exercises resolution. The oral test consists of an examination-interview concerning discussion of the exercises, with particular reference to the mistakes and the shortcomings highlighted in the resolution of exercises, and knowledge of topics of the syllabus. This test is done to evaluate also the scientific language skills of student and his ability of clear and direct wording. The final assessment, properly graded, will be drawn on the basis of the following conditions: a) basic knowledge of the topics studied, limited language skills (18-21 rating); b) good knowledge of the topics studied and sufficient ability to apply the laws in simple situations, even in a guided way, sufficient presentation and language skills (22-25 rating); c) In-depth knowledge of the topics studied and good ability to apply the laws in simple situations autonomously, good language skills (26-28 rating); d) In-depth knowledge of the topics studied and good ability to apply the laws to new situations autonomously, excellent language and communication skills (29-30L rating).
TEACHING METHODS	The whole subject is scheduled on second semester of the first year and contains two subject: Physics and Physical-Chemistry. Students have to attend frontal teaching during which the couse subjects are introdused and simple exercises are resolved. A break is done at half of the semester to do an ongoing evaluation (not mandatory) on mechanics, fluids and thermodynamics, which will be assessed as described in the "Assessment methods" section. Only Physics lectures are done before break. Chemical-Physics lectures start after the break.

MODULE
PHYSICS WITH PRACTICE

Prof. AURELIO AGLIOLO GALLITTO - Lettere L-Z, - Lettere L-Z

SUGGESTED BIBLIOGRAPHY

Libro di testo: R.A. Serway, J. W. Jewett Jr, Principi di Fisica, V Ed., Edises
Libro consigliato: P.L. Kesten, D.L. Tauck, Fondamenti di Fisica, Zanichelli
Libro consigliato: J.S. Walker, Fondamenti di Fisica, Pearson - Addison Wesley

Libro di consultazione: R.C. Davidson, Metodi Matematici per un Corso Introduttivo di Fisica, EdiSES

Libro di approfondimento: A. Bartolotta, Meccanica dei Fluidi, EdiSES

Il materiale didattico relativo al modulo è consultabile al seguente link: https://sites.google.com/site/aurelioagliologallitto/didattica/fisica

AMBIT	50025-Discipline matematiche, fisiche e informatiche
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

The subject is devoted to acquire basic knowledge of classical physics, also by resolving simple problems and exercises.

SYLLABUS

Hrs	Frontal teaching
6	Physical quantities, units of measurement, errors, plots. Vectors. Kinematics of a particle in one, two and three dimensions. Motion with constant velocity, motion with constant acceleration, uniform circular motion. Basic elements of rotational kinematics.
6	Dynamics of a particle: Newton's laws of motion. Gravitational force, normal force, frictional forces, centripetal force, tension, elastic spring forces. Torque. Basic elements of rotational dynamics.
6	Kinetic energy. Work-energy theorem. Conservative and non-conservative forces. Gravitational potential energy. Conservation of mechanical energy. Momentum. Conservation of momentum. Center of mass. Elastic and inelastic collisions. Simple harmonic oscillator.
6	Fluid statics: pressure, laws of Pascal and Stevin, Archimedes' principle. Fluid hydrodynamics: flow of an ideal fluid, equation of continuity, Bernoulli's equation. Elemets of viscous fluids, sedimentation and surface tension.
6	Thermodynamics. Thermal equilibrium. Temperature scales. Thermal expansion. Heat capacity and specific heat. The ideal gas law. Kinetic theory of gases. The first law of thermodynamics. Internal energy of an ideal gas. Reversible and irreversible thermodynamic transformations. Thermodynamic cycles. Performance of a thermal engine. The second law of thermodynamics and entropy.
10	Electric charge, conductors and insulators, Coulomb's force, superposition principle . Electrostatic field. Electric dipole. Electrostatic potential energy, electrostatic potential. Capacitor. Electric current. Ohm's law. DC circuits. Lorentz's force. Magnetic field. Faraday induction. Electromagnetic waves. Introduction to the interaction of electromagnetic waves with biological matter. Newtonian optics.

Hrs	Practice
12	Exercises for the preparation for the in itinere test and the exam. It is expected 2 hours for each of the arguments specified in the lectures.

MODULE
PHYSICS WITH PRACTICE

Prof. MARCO MICELI - Lettere A-K, - Lettere A-K

SUGGESTED BIBLIOGRAPHY

- R.A. Serway, J. W. Jewett Jr, Principi di Fisica, V Ed., Edises
- J.S. Walker, Fondamenti di Fisica, Pearson - Addison Wesley

AMBIT	50025-Discipline matematiche, fisiche e informatiche
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

Strong general knowledge of classical physics (mechanics, fluid dynamics, thermodynamics, electromagnetism); expertise on the scientific method; capability to solve and discuss simple problems of classical physics.

SYLLABUS

Hrs	Frontal teaching
6	Physical quantities, definition and measures. Scalars and vectors. Particle kinematics
6	Newton's laws and particle mechanics. Inertial and non-inertial systems. Friction. Newton's law of universal gravitation.
6	Kinetic energy. Work. Conservative forces and potential energy. Mechanical energy conservation. Momentum and its conservation Collisions
6	Hydrostatics. Stevin and Pascal laws. Archimedes' principle. Hydrodynamics. Continuity equation and Bernoulli's law. Viscosity
8	Termodynamics. Zero-th principle. Thermometry and calorimetry. Heat capacity and specific heat capacity. Ideal Gas. First law of thermodynamics. Kinetic theory of ideal gas. Internal energy of an ideal gas. Energia interna di un gas ideale. Reversible and irreversible thermodynamic processes. Thermodynamic cycles and thermal efficiency. Second law of thermodynamics and entropy
8	Electric charge. Coulomb's law. Superposition principle. Electric field. Electrostatic potential. Electric current. Ohm's law. Magnetic field. Lorentz force. General notes on electromagnetic waves and their interaction with biological systems

Hrs	Practice
12	Exercises and problem solving (approx. 2 hours for each of the aforementioned items)

MODULE
PHYSICAL CHEMISTRY

Prof. RENATO LOMBARDO - Lettere L-Z, - Lettere L-Z

SUGGESTED BIBLIOGRAPHY

Atkins, P.W.; De Paula, J. Elementi di Chimica Fisica, Zanichelli, 2018
Atkins, P.W.; De Paula, J. Elements of Physical Chemistry, Oxford University Press, 2017

AMBIT	10665-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	51
COURSE ACTIVITY (Hrs)	24

EDUCATIONAL OBJECTIVES OF THE MODULE

Provide cultural tools to link atomic-molecular vision to macroscopic vision and understand Biomolecular phenomena in the light of energy based on thermodynamic principles.

SYLLABUS

Hrs	Frontal teaching
4	Matter at the atomic scale and intermolecular interactions: phenomena and applications. Microscopic structure of matter. Macroscopic-microscopic correlation. Aggregration states. Microscopic interpretation of state transitions. Intermolecular potential. Attractive and repulsive contribution. Scale of interactions. Lennard-Jones Potential. Hydrogen bond.
3	First law of thermodynamics. System and surroundings. System Classification: Open, Closed, Isolated and Adiabatic. Internal energy. Energy transfer between system and surroundings. Work and heat. Enthalpy. Termochimica. Hess's law. Kirchoff's Law.
5	Second First law of thermodynamics. 351/5000 Statistical Entropy. Spontaneous and non-spontaneous transformations and equilibrium. The Third Principle of thermodynamics. Second law enunciates. Gibbs Free Energy. Free energy variation for physical processes and chemical reactions. Equlibrium Reactions. Thermodynamic constant of equilibrium. Effect of temperature and pressure.
4	Physical transformations. Thermodynamically stable phases. Chemical potential. Phase Diagram:Definition, identification of characteristic points and phase boundaries. Phase boundaries. Thermodynamic derivation of phase boundaries. The rule of phases. The phase diagram of water, carbon dioxide and helium.
4	Multiple components systemsMixtures and solutions. Solution Properties. Non-electrolytic solutions. Raoult Law.Colligative properties: freezing point depression, boiling point elevation, osmotic pressure.
4	Rate and mechanism of chemical and biochemical reactions Dependence of properties on concentration. Measurement of concentration as function of time. Instant rate. Kinetic law, kinetic constant and reaction order. The method of insulation. The method of initial rates and integrated ratess.The chemical equilibrium from the kinetic point of view. Dependence of kinetic constant on temperature: Arrhenius law. Activation energy.

MODULE
PHYSICAL CHEMISTRY

Prof.ssa MARIA LUISA SALADINO - Lettere A-K, - Lettere A-K

SUGGESTED BIBLIOGRAPHY

Atkins, P.W.; De Paula, J. Physical Chemistry for the Life Sciences, Oxford University Press, 2011
Atkins, P. W.; De Paula, J. Chimica fisica biologica: 1; Zanichelli: Bologna, 2008.
Atkins, P.W.; De Paula, J. Elementi di Chimica Fisica, Zanichelli: Bologna, 2018
Atkins, P.W.; De Paula, J., Keeler J., Chimica fisica, Zanichelli: Bologna, 2020

AMBIT	10665-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	51
COURSE ACTIVITY (Hrs)	24

EDUCATIONAL OBJECTIVES OF THE MODULE

To provide the cultural tools to connect the atomic-molecular vision with that at the macroscopic level and to interpret biomolecular phenomena in terms of energy by means of thermodynamic principles.

SYLLABUS

Hrs	Frontal teaching
4	Matter at the atomic scale and intermolecular interactions: phenomena and applications Structure of the matter at microscopic level. Correlation of macroscopic evidences on the basis of microscopic model. States of aggregation. Microscopic interpretation of state transitions. Interaction potentials. On the nature of attractive and repulsive contributions to the total interaction. Scale of interaction strength. Lennard-Jones potential. Hydrogen bond.
3	First law of thermodynamics. System and surroundings. Open, closed, insulated and adiabatic systems. Internal energy. Tranfers of energy from system to surrounding. Heat and work. Enthalpy. Thermochemistry. Hess law. Kirchoff law.
5	Second law of thermodynamics Statistical entropy. Spontaneous, non-spontaneous and equilibrium processes. Third law of thermodynamics. Gibbs free energy. Free energy of physical processes and chemical reactions. Equilibrium reactions. Thermodynamics constant of equilibrium. Dependency from temperature and pressure.
4	Physical transformations. Thermodynamics phases. Chemical potential. Phase diagram: phase boundaries, triple and critical points. Derivation of phase boundaries on thermodynamics basis. Gibbs phase rule. Water, carbon dioxide phase diagrams.
4	Multiple components systems. Mixtures and solutions. Solution properties. Partial molar properties. Non electrolytic solutions. Raoult's law. Colligative properties: Boiling and freezing point, osmotic pressure
4	Rate and mechanism of chemical and biochemical reactions Physical property-concentration dependency. Measure of concentration as a function of time. Instantaneous speed. The rate laws, kinetics constant and order of reactions. Methods of evaluation of order of reactions. Kinetics approach to the chemical equilibrium. Kinetics constant: effect of temperature, the Arrhenius law. Activation energy.