



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche		
ACADEMIC YEAR	2023/2024		
MASTER'S DEGREE (MSC)	BIOMOLECULAR INDUSTRIAL BIOTECHNOLOGIES		
SUBJECT	CHEMICAL-PHYSICAL MODELS AND METHODS FOR BIOLOGICAL SYSTEMS		
TYPE OF EDUCATIONAL ACTIVITY	C		
AMBIT	20883-Attività formative affini o integrative		
CODE	23336		
SCIENTIFIC SECTOR(S)	CHIM/02		
HEAD PROFESSOR(S)	LOMBARDO RENATO	Ricercatore	Univ. di PALERMO
OTHER PROFESSOR(S)			
CREDITS	6		
INDIVIDUAL STUDY (Hrs)	102		
COURSE ACTIVITY (Hrs)	48		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	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		

DOCENTE: Prof. RENATO LOMBARDO

PREREQUISITES	<p>Mathematics: concepts needed for this course are those provided in any introductory course at the undergraduate level. In particular: exponents and scientific notation, logarithms, differential differential calculus, integral calculus.</p> <p>Physics: concepts needed for this course are those provided in any introductory course at the undergraduate level. In particular: unit of measurements and measurement systems, extensive and intensive properties, forces, force fields, work and energy.</p> <p>Chemistry: concepts needed for this course are those provided in any introductory course at the undergraduate level. In particular: atomic and molecular structure of matter, method to express quantity of matter and concentration, chemical reactivity.</p>
LEARNING OUTCOMES	<p>Interpretare i fenomeni su scala macroscopica in base alla dispersione, interazione e reazione su scala atomico-molecolare.</p> <p>Capacita' di analizzare i fenomeni in termini di trasformazione, trasferimento e distribuzione di energia e analisi della loro direzione basata sulla entropia/energia libera.</p> <p>Capacita' di applicare i principi termodinamici ai sistemi chimici e biochimici in trasformazione con particolare riguardo all'equilibrio di fase e chimico in ambito biologico.</p> <p>Conoscenza dei principi che regolano la velocita' delle trasformazioni chimiche con particolare attenzione alla catalisi enzimatica e al ripiegamento delle proteine.</p>
ASSESSMENT METHODS	<p>The ongoing assessment will be conducted through tests and/or other activities on the university e-learning platform. Each test consists of a set of questions aimed at ascertaining the possession of the knowledge inherent in the program carried out up to that point. In particular, the knowledge of the quantities discussed and of their relationships through the models of the discipline and the experimental methods will be evaluated. The evaluation will be expressed in thirtieths by attributing a positive score to each correct answer and no score to each incorrect answer. The scores will be appropriately balanced taking into account the difficulty of each question. On the e-learning platform there can be individual or group activities that may involve the production of short written papers or presentations, participation in forums or wikis or other activities. The positive outcome of the tests will be taken into account in the formation of the final result after the oral exam (see below).</p> <p>Single oral exam. The exam consists of an interview in which the questions will be used to ensure that the student acquired the skills and knowledge provided by the course. In particular, will be 'evaluated the ability to relate the different concepts, to provide solutions to typical problems of the subject and the ability to express themselves effectively in scientific language of this field.</p> <p>Possible results are: Excellent: 30 - 30 cum laude Outcome: Excellent knowledge of the topics, language, and skills in the use of tools. Good competence in applying what has been acquired to new problems. Good: 27 - 29 Outcome: Good knowledge of the topics, language, and skills in the use of tools. Fair competence in applying what has been acquired to new problems. Fair: 24 - 26 Outcome: Fair knowledge of the topics, language, and skills in the use of tools. Sufficient competence in applying what has been acquired to new problems. Sufficient: 18 - 23 Outcome: Sufficient knowledge of the topics, language, and skills in the use of tools. Minimum competence in applying what has been acquired to new problems.</p>
EDUCATIONAL OBJECTIVES	<p>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.</p> <p>To illustrate examples of application of the typical tools of physical chemistry to issues of interest for biotechnology.</p>
TEACHING METHODS	Class lectures, online e-learning platform.
SUGGESTED BIBLIOGRAPHY	<p>Testi di base: Atkins, P.W.; De Paula, Elementi di Chimica Fisica, Zanichelli, 2018, ISBN 9788808220684 Atkins, P.W.; De Paula, J. Elements of Physical Chemistry, Oxford University Press, 2017, ISBN 9780198727873 Atkins, P.W.; De Paula, J.; Keeler J. Chimica Fisica, Zanichelli, 2020, ISBN 9788808620521</p> <p>Testi di approfondimento: Kuriyan, J.; Konforti, B.; Wemmer, D. The Molecules of Life: Physical and Chemical Principles; Garland Science: New York, 2004. ISBN 978-0-8153-4188-8</p>

Cooper, A. Biophysical Chemistry, 2 edizione.; Royal Society of Chemistry: Cambridge, 2011. ISBN 978-1-84973-081-5
Sheehan, D. Physical Biochemistry: Principles And Applications, 2 edizione.; John Wiley & Sons Inc Print on: Chichester, UK ; Hoboken, NJ, 2009., ISBN 978-0-470-85603-1

SYLLABUS

Hrs	Frontal teaching
6	Matter at the atomic scale and the intermolecular interactions: phenomena and applications
5	Molecular dynamics
4	Energy and Thermodynamics
6	The direction of transformations
4	Gibbs' energy
4	Multiple components systems and phase transitions
4	Equilibrio chimico
4	Applications of thermodynamic to biological systems
4	Rate and mechanism of chemical reactions
7	Applications of kinetics to biological systems