Main course information	
Academic subject	Physical Chemistry of Complex system
Degree course	Bachelor degree in Chemistry
Degree class	L-27
ECTS credits (CFU)	6
Compulsory attendance	
Teaching language	Italian
Accademic Year	2020/2021

Professor/Lecturer	
Name & SURNAME	Elisabetta Fanizza Gerardo Palazzo
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Tel.	
Tutorial time/day	Wednesday

Course details	Pass-fail exam/Exam with mark out of 30	SSD code	Type of class
	Exam with mark out of 30	CHIM02	Lectures and laboratory experiments

Teaching schedule	Year	Semester
	III	I

Lesson type	CFU/ECTS	Lessons (hours)	CFU/ECTS lab	Lab hours	CFU/ECTS tutorial/workshop	Tutorial/workshop hours	CFU/ECTS field trip	Field trip Hours
	5	40	1	15	0	0	0	0

Time management	Total hours	Teaching hours	Self-study hours
	150	55	95

Academic Calendar	First lesson	Final lesson
	October	January

Syllabus	
Course entry requirements	Fundamental knowledge of Physical, Inorganic and Organic Chemistry.
Expected learning outcomes (according to Dublin Descriptors) (it is recommended that they are congruent with the learning outcomes contained in A4a, A4b, A4c tables of the SUA-CdS)	
Knowledge and understanding	Basic knowledge of physical chemistry, thermodynamic of irreversible systems and inorganic/organic chemistry as fundamental background to understand complex systems arising from reversible weak interactions among building blocks
Applying knowledge and understanding	Ability to apply the acquired knowledge to understand the complex systems as part of the biological world, ruled by soft chemistry and exploited in nanochemistry. The skills acquired will be verified by conducting classroom exercises, and during the written / oral examination.
Making informed judgements and choices	Students must demonstrate to have acquired aptitude for scientific reasoning and developed critical skills in the analysis of the complex world. The achievement of these objectives will be verified by carrying out exercises in the classroom and during the written / oral examination.
Communicating knowledge and understanding	Acquisition of the correct terminology in the scientific and chemical field, acquisition of exhibition skills characterized by clarity and language properties. Students must be able

	to correctly expose definitions, fundamental concepts, theories concerning the contents of the course itself and to discuss clearly the problems presented to them. Students will be stimulated to actively participate during the lecture.
Capacities to continue learning	Acquisition of the ability to investigate issues and topics related to the teaching discipline in an autonomous way through the consultation of texts, databases and scientific works available in the library or on the web and to identify the connections with other disciplines of the course of study. The acquisition of this ability will be verified by discussing the topics of the exam.

Syllabus	
Course content	Complex System. Definition of complex system and its main characteristics (non linearity, large number of inter-related agents, self-organization, dynamic, evolutionary characteristics, redundancy) Thermodynamic of open systems and irreversible processes (non-equilibrium-thermodynamic and evolution) Weak interactions: definition (hydrogen bonds, ions-ions interactions, ion-dipole interaction, Van der Waals interactions, London forces, Lennard Jones potential, hydrophobic interaction, π-π interaction) Supramolecular chemistry. Host guest interaction. Physical and chemical adsorption and adsorption isotherm Colloids. Surfactants, critical packing parameters and self-organization. Critical micelle concentration. Double electric layer theories. Activity in electrolyte solution and the limiting low of Debey-Huckel. Phospholipids and cellular membrane. Liposomes and natural vescicles. Nanochemistry
Course books/Bibliography	Handouts will be provided to the students
Notes	Integration with other books available in library and lectures notes
Teaching methods	Power point Lectures, lab experiences.
Assessment methods (indicate at least the type written, oral, other)	Oral Examination and reports of the experimental laboratory activity
Evaluation criteria (Explain for each expected learning outcome what a student has to know, or is able to do, and how many levels of achievement there are	The evaluation criteria include an oral test that will be preceded by an oral examination 1) the acquired level of knowledge of the course contents and the use of correct terminology to describe the phenomena (insufficient, superficial, good, complete, excellent); 2) the ability to apply theoretical concepts and laws, and to interpret chemical phenomena (insufficient, discrete, good, excellent); 3) the capacity for critical analysis and judgment autonomy (fair, good, excellent); 4) clarity of exposition and ownership of language (confused and insecure; clear and correct; excellent and safe); 5) the ability to study in depth individual contents of the course and interdisciplinary links (discreet, good, excellent). Other factors, such as the active participation of students in lectures and laboratory

	activities, the work done individually by the student and the laboratory reports will also be evaluated in a positive sense.
Further information	