UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Fisica e Chimica - Emilio Segrè
ACADEMIC YEAR	2023/2024
MASTER'S DEGREE (MSC)	CHEMISTRY
SUBJECT	INTERPHASES PHYSICAL CHEMISTRY
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50483-Discipline chimiche inorganiche e chimico-fisiche
CODE	01889
SCIENTIFIC SECTOR(S)	CHIM/02
HEAD PROFESSOR(S)	CAVALLARO GIUSEPPE Ricercatore a tempo determinato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**CAVALLARO GIUSEPPE** Monday 11:00 12:00 Studio del dott. Giuseppe Cavallaro (1/B22) viale delle scienze pad. 17 Wednesday 11:00 12:00 Studio del dott. Giuseppe Cavallaro (1/B22) viale delle scienze pad. 17 Friday 11:00 12:00 Studio del dott. Giuseppe Cavallaro (1/B22) viale delle scienze pad. 17

DOCENTE: Prof. GIUSEPPE CAVALLARO

PREREQUISITES	Each student has to be acquired the knowledge of the concepts provided by the courses of Physical Chemistry on the basis of thermodynamics and physical chemistry at interface.
LEARNING OUTCOMES	Knowledge and understanding Critical acquisition of the physico-chemical theories for the processes at the interface. Ability to use the language and the specific terminology of the discipline. Applying knowledge and understanding Capacity to select and apply the mathematical tools to expose the basic principles and to solve problems of physico-chemical interfacial phenomena. Making judgments To be able to extract and evaluate the information obtained from the experimental results, and evaluate the reliability of data. Communication skills Knowing how to explain in clear and strict terms, with the help of features and / or diagrams. Learning ability The student at the end of the course should have the tools to deal with and understand advanced topics in physical-chemistry of interfaces that are interest for pratical applications.
ASSESSMENT METHODS	The final examination aims at assessing not only the candidate knowledge and his ability to apply it to real situations (not necessarily mentioned during the course) but also the possession of the properties of scientific language and exposure abilities . The commission invites the student to discuss a theme based on his/her choice and then continues with questions about other topics. Different classes of evaluation will be done based on the following considerations: 1) Basic knowledge of topics and limited capacity of processing knowledge for application to new situations. Sufficient capacity analysis of the proposed phenomena and exposure of the pursued procedure (rating 18-21) 2) Good knowledge of topics and good capacity of processing knowledge for application to new situations. Rather good capacity of analysis of the proposed phenomena and exposure of the pursued procedure (rating 22-24) 3) Very good knowledge of topics and ability in processing knowledge for application to new situations. Good capacity of analysis of the proposed phenomena and exposure of the pursued procedure (rating 25-27) 4) Excellent knowledge of the topics, excellent and prompt capacity of knowledge processing for application to new situations. Very good capacity of analysis of the proposed phenomena and and exposure of the pursued procedure (rating 28-30) 5) Excellent knowledge of the topics, excellent and very smart capacity of processing in order to apply them to new situations. Excellent capacity of analysis of the presented phenomena and and exposure of the pursued procedure (rating 30 cum laude)
EDUCATIONAL OBJECTIVES	The course aims to provide a thorough understanding of the physico-chemical principles of the interfacial phenomena. The teaching will help provide an advanced knowledge for the graduate to the second level to interpret and predict the evolution of the interfacial processes. The use of new methodologies and complex equipment for the study of these processes will be discussed in-depth. Such knowledge will be useful in various business fields such as industry, pharmaceutics, environment and energy, Cultural Heritage, Material science.
TEACHING METHODS	The course is given by oral lectures.
SUGGESTED BIBLIOGRAPHY	Ayao Kitahara, Akira Watanabe "Electrical Phenomena at Intefaces", 1984 Marcel Dekker Hans-Jürgen Butt, Karlheinz Graf, Michael Kappl "Physics and Chemistry of Interfaces" 2003 Wiley-VCH Verlag & Co. KGaA P. Atkins – J. De Paula Chimica Fisica –Zanichelli 2016 Giuseppe Lazzara and Rawil Fakhrullin "Nanotechnologies and Nanomaterials for Diagnostic, Conservation and Restoration of Cultural Heritage," 2018 Elsevier.

SYLLABUS

Hrs	Frontal teaching
4	Introduction of the soft matter. Colloidal systems. Definitions, backgorund and physico-chemical properties. Geometrical characteristics of micellization.
6	Charged interfaces.. The electric double layer.. The Poisson-Boltzmann equation. Distribution of the ions concentration and charge density on dependence of the potential. Debye length. Discrete models and Stern layer. Grahame equation. Gibbs free energy of the double electric layer. Gouy-Chapman model of the double electric layer
6	Electrocapillarity. Electrokinetic phenomena: electrophoresis and electroosmosis. The zeta potential. Henry equation. Hückel-Smoluchowski approximation. Applications on colloidal systems and study cases.
6	Intermolecular forces at interface. Van der Waals interactions between molecules. Van der Waals interactions between macrosopic objects. Molecule/planar surface and planar surface/planar surface interactions
14	Stability of colloids. Disjoining Pressure. DLVO Theory. Colloidal Stability: electric and van der Waals contibutions. Phenomena of coagulation and flocculation. Flocculation kinetics: Davies and Rideal models. Steric stabilization: role of polymers. Volume restriction effect and osmotic effect. Bridge effect. Depletion flocculation e depletion stabilization. Kelvin and Gibbs-Thomson equations. Confinement effect. Oswald Ripening. Plateau border effect. Total mechanism of destabilization of a colloidal system.
4	Adsorption at interface. Adsorption models. Henry adsorption isotherm. Langmuir adsorption isotherm.Freundlich adsorption isotherm. BET isotherm. Adsorption isotherms of surfactants: cooperative process. Application of BET for foods. Adsorption isotherms with hysteresis: cylindrical capillaries and ink-bottle. Determination of the porosity of a solid by mercury porosimeter. Knudsen thermogravimetry.
4	Thermodynamics of adsorption in colloidal systems: experimental techniques and study cases.
4	Colloids and applications: drug delivery, detergence, remediation e restoration. Role of builders, surfactants and defoaming. Use of collodial systems for cleaning and restoration of Cultural Heritage. Release mechanisms and applications in pharmaceutics.