UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche
ACADEMIC YEAR	2019/2020
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 and, specifically, the topics on classical thermodynamics and the basic concepts of the physical chemistry of interfases.
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 to 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 to evaluate the information obtained from the experimental results and to evaluate the reliability of data. Communication skills Knowing how to explain in clear and strict terms, with the help of functions and / or diagrams, the acquired topics. Learning ability The student at the end of the course should possess the tools to deal with understanding advanced topics on physical-chemistry of interfaces topics 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 examination is based on two questions dealing with topics treated during the course. 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 at providing a thorough understanding of the physico-chemical principles of the interfacial phenomena. The course will provide an advanced knowledge to the master student who is able to interpret and to predict the evolution of the interfacial processes. The use of new methodologies and complex equipments for the study of such processes will be widely and deeply discussed. Such a knowledge will be useful in various application fields such as industry, pharmaceutics, environment and energy as well as Cultural Heritage and Material Science.
TEACHING METHODS	The course is given by 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 Giuseppe Lazzara and Rawil Fakhrullin "Nanotechnologies and Nanomaterials for Diagnostic, Conservation and Restoration of Cultural Heritage," 2018 Elsevier.

SYLLABUS

Hrs	Frontal teaching
3	Aims of the course. Emulsions and microemulsions: definitions, background and physico-chemical properties. Formation, stability and destabilization of emulsions.
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. The 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 the interface. Van der Waals interactions between molecules. Van der Waals interactions between macrosopic objects. Hamaker and Lifshitz theories.
2	Role of the intermolecular forces in the stability of kinetic unstable systems.
2	Role of the charged interfaces in the coagulation, flocculation and stability of dispersions (kinetic stability).
6	Stability of colloids. Debye-Huckel and DLVO theories. Electrostatic and steric stabilization.
6	Adsorption at the interface: kinetics and thermodynamics. Adsorption models. Langmuir adsorption isotherm. BET isotherm. Adsorption on heterogeneous surfaces.
6	Thermodynamics of adsorption in colloidal systems: experimental techniques and study cases.
5	Colloids and applications. The case of detergency and of conservation and restoration of Cultural Heritage.