UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2023/2024
MASTER'S DEGREE (MSC)	CHEMICAL ENGINEERING
SUBJECT	PHYSICAL CHEMISTRY OF DISPERSED SYSTEMS
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20911-Attività formative affini o integrative
CODE	21893
SCIENTIFIC SECTOR(S)	ING-IND/23
HEAD PROFESSOR(S)	DI FRANCO FRANCESCO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**DI FRANCO FRANCESCO** Monday 13:00 14:00 Studio personale. Wednesday 13:00 14:00 Studio personale. Friday 13:00 14:00 Studio personale.

DOCENTE: Prof. FRANCESCO DI FRANCO

PREREQUISITES	General chemistry and thermodynamics.
LEARNING OUTCOMES	Knowledge and understanding At the end of the course student is expected to have a deep understanding of the fundamental aspects of Thermodynamics of interfaces and surfaces forces, structure of the solid-liquid interface and electrical double layer, surface forces in dispersed systems and evolution of a disperse system. These fundamental knowledge will be applied to understand the main phenomena occurring in heterogeneous finely dispersed systems, and to quantitatively predict and control their dynamics, with a special focus on food processing. Applying knowledge and understanding Student will be able to: - derive thermodynamic data about Thermodynamics of interfaces; - describe structure of the solid-liquid interface and electrical double layer; - design solution for problems about heterogeneous finely dispersed systems, and to quantitatively predict and control their dynamics. Making judgments Staring from knowledge of the theoretical aspects the student is expected to know the main evolution mechanisms of a dispersion and to be able to select proper methods to control or modify the size distribution and the morphology of a disperse phase. Communication Student is expected to be able to discuss about fundamental aspects of Physical chemistry of surfaces and dispersed systems and its in food processing. Learning skills Following a deep understanding of the theoretical aspects, student is expected to be able manage technical issues taking advantage of technical manuals, scientific literature updating frequently his/her knowledge.
ASSESSMENT METHODS	The assessment will be performed through an oral exam with questions focused on four main subjects: - Thermodynamics of interfaces and surfaces forces; - Structure of the solid-liquid interface and electrical double layer; - Surface forces in dispersed systems and Evolution of a disperse system; - Food processing applications of Physical chemistry of surfaces and dispersed systems. The student must support the answers qualitatively and quantitatively taking advantage of the technical tools provided by the evaluation committee (Handbook of thermodynamic constants and kinetic parameters, etc.). The student will also discuss a case study (selected among different options) of practical relevance in the field of Physical chemistry of surfaces and dispersed systems for food processing applications. The interview is aimed at determining the student abilities to process the knowledge gained by using them to solve problems and the ability to express the teaching content using a technically correct language. More specifically, the student must show how he/she is able to use the knowledge of Thermodynamics of interfaces and surfaces forces, structure of the solid-liquid interface and electrical double layer, surface forces in dispersed systems, evolution of a disperse system, food processing applications of Physical chemistry of surfaces and dispersed systems. The vote is expressed in thirtieths with possible praise. A maximum of 24/30 will be attributed according to the student reply on the proposed questions, while the remaining 6/30 and praise will be attributed according to the discussion on the case study. In order to get the minimum score for a positive evaluation (18/30), the student must know the general aspects of the course content (Thermodynamics of interfaces and surfaces forces, structure of the solid-liquid interface and electrical double layer, surface forces in dispersed systems, evolution of a disperse system, food processing applications of Physical chemistry of surfaces and dispersed systems). His/her command of technical language must be sufficient to clearly discuss with the evaluation committee about the main aspects of the course. Higher score will be attributed according to their ability in applying knowledge and skills learned in this course to practical and technical problems, according to what extent students are aware of the steps they go through in solving problems and how well can they explain their problem-solving steps.
EDUCATIONAL OBJECTIVES	At the end of the course student is expected to have a deep understanding of the fundamental aspects of Thermodynamics of interfaces and surfaces forces, structure of the solid-liquid interface and electrical double layer, surface forces in dispersed systems and evolution of a disperse system. These fundamental knowledge will be applied to understand the main phenomena occurring in heterogeneous finely dispersed systems, and to quantitatively predict and control their dynamics, with a special focus on food processing.
TEACHING METHODS	Frontal lectures and exercise.

SUGGESTED BIBLIOGRAPHY	H.J. Butt, K. Graf, M. Kappl, Physics and Chemistry of Interfaces, Wiley-VCH ISBN: 978-3-527-60640-5; J.C. Berg, An Introduction to Interfaces and Colloids: The Bridge to Nanoscience, World Scientific ISBN: 978-981-4293-07-5; P.C. Hiemenz, R. Rajagopalan, Principles of Colloid and Surface Chemistry, CRC Press ISBN 9780824793975.

SYLLABUS

Hrs	Frontal teaching
6	Thermodynamics of interfaces, Surface and interfacial tension, Young-Laplace equation, capillary rise, contact angle, surface tension and stress in solids, Kelvin equation and capillary condensation, dynamic effects on surface tension and contact angle, Gibbs Equation, Wettability measurements. Surface forces. Measurement of surface forces.
4	Electrolyte solutions. Electrochemical Potential. Debye-Huckel theory.
6	The electrostatic double-layer force, physico-chemical models of double layers, Zeta Potential, Electrokinetic phenomena,
8	Van der Waals forces; Electrical double layer interaction; colloidal systems; Electrostatic stabilisation of colloidal dispersions and DLVO theory
5	Surfactants, Thermodynamics of micellization, The critical micelle concentration, Macroemulsions, Microemulsions, Foams.
8	Evolution of a disperse system; Aggregation-coalescence: kinetics and mechanisms.
8	Case studies of heterogeneus dispersed systems in food processing

Hrs	Practice
3	Thermodynamics of interfaces, Surface and interfacial tension, Young-Laplace equation, capillary rise, contact angle, surface tension and stress in solids, Kelvin equation and capillary condensation, dynamic effects on surface tension and contact angle, Gibbs Equation, Wettability measurements. Surface forces. Measurement of surface forces.
3	The electrostatic double-layer force, physico-chemical models of double layers, Zeta Potential, Electrokinetic phenomena,
3	Van der Waals forces; Electrical double layer interaction; colloidal systems; Electrostatic stabilisation of colloidal dispersions and DLVO theory