Programme of "Chimica delle superfici e delle interfasi": "Chemistry of Surfaces and Interfaces"		
• Code: I0739 **• type of course unit (compulsory, optional): Optional** **• level of course unit: Second Cycle** **• year of study 1st year, semester: 1st**		
Number of ECTS credits: 6 (workload is 150 hours; 1 credit = 25 hours)		
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1	**Course objectives**	The goal of this course is to give candidates the fundamental knowledge of physical/chemistry of interface phenomena. Specific objectives are the principles and the application of different characterization techniques and the principles of surface functionalization. On completion of this course, students will be able to demonstrate an awareness of the importance of processes that occur at interfaces, and to give examples of the applications of surface chemistry and the functionality of materials.
2	**Course content and Learning outcomes (Dublin descriptors)**	Topics of the module include: **Introduction on the states of matter.** The gaseous state. The condensed states: solid, liquid. **The technique of vacuum.** Vacuum levels; Ultra High Vacuum (UHV). **Fundamentals of surface phenomena.** Type of interphases and its features. Surface tension: determination in liquids and solids. Elements of thermodynamics of surfaces and interfaces. Surface free energy and stability. Phenomena of adhesion and cohesion. Surface effect: Laplace-Young equation. **Models of interphase.** The surface phase approach The excess surface approach: the Gibbs surface. **Adsorption.** Physical and chemical adsorption. Adsorption models: isotherms (BET). Chemisorption. Adsorption from solution. Amphiphilic adsorption. **Solid-liquid interaction.** Contact angle and wettability: Young-Dupré equation. Surface tension measurements. Hysteresis. Surface roughness. Wenzel Cassie. **Surfaces Characterization Techniques.** Structural characterization: morphology, defects, thickness. **Microscopic Characterization**. Optical and Fluorescence microscopy. Electron microscopy (TEM, SEM). Scanning Probe Microscopy (STM). Atomic force microscopy (AFM). **Spectroscopic characterization.** UV-Visible Spectroscopy. IR-Raman spectroscopy. X-ray photoemission spectroscopy (XPS). Auger electron spectroscopy (AES). **Modification of surfaces.** Deposition of thin and thick films. Physical Vapor (PVD) and Chemical Vapor Deposition (CVD). Deposition from solution. Drop casting, spin coating, dip coating and Langmuir- Blodgett films. Lithographic techniques: Photolithography and Soft- lithography. **Self -assembled monolayers (SAM).** Formation and properties. Defects, stability and reproducibility. SAM of thiols and silanes. Cleaning and activation of surfaces. Chemical gradients on surface: wettability gradients. On successful completion of this module, the student should: - have profound **knowledge** of the concept of surface energy to study capillary phenomena; adhesion and cohesion; wetting, - have **knowledge and understanding** of physical and chemical adsorption at interfaces solid/gas and solid/liquid, - **recognize** properties of the interface between two different material phases and understand the chemical processes that occur at such interfaces - **understand and explain** surface analysis at the micro- and nano-scale, - **understand** the fundamentals of vacuum techniques**,** - have profound **knowledge** of thin films and self-assembling monolayers, - **demonstrate skill** in surface cleaning protocols and **ability** to modify surface properties. - demonstrate **capacity** for reading and understand other texts on related topics.
3	**Prerequisites and learning activities**	The student must know the basic knowledge of **General and Inorganic Chemistry** and **Chemical Thermodynamics**.
4	**Teaching methods and language**	Lectures, laboratory experiments. **Language:** Italian/English **Ref. Text books** "An Introduction to Interfaces & Colloids: The Bridge to Nanoscience" - J. C. Berg, Publisher: World Scientific (ISBN: 978-981-4299-82-4).
5	**Assessment methods and criteria**	Oral exam, short report on a research article related to a topic of the course, laboratory report.