UNIVERSITÄT LEIPZIG

Leipzig University

Semester 3 syllabus

Course catalog	ECTS
Internship and Transferrable Skills	10
Surface Analysis of Solids	5
Bioorganic Chemistry	5
Chemistry of Natural Products	5
Physical Chemistry of Clusters	5
Computational Chemistry of Solids	5
Computational Spectroscopy	5
Function Control at Complex Surfaces	5
Nano Structured Catalytic Systems	5
Protein Crystallography	5
Methods and Procedures for Trace Analysis	5

Mandatory

Elective courses: 20 ECTS to choose

UNIVERSITÄT LEIPZIG

Course title	SURFACE ANALYSIS OF SOLIDS		
Information	Number of credits: 5 ECTS	Number of taught hours 45 h lecture	Number of hours expected of student personal work: 105 h
Synopsis	Structure of solid state surfaces and interfaces, gas adsorption, physical basics, instruments und examples of application of analytical methods for surface investigations: electronspectroscopy: photoelectron (XPS, UPS) and Auger electron spectroscopies (AES), electron energy loss spectroscopy (EELS), quantitative lateral distribution and depth profile analysis of the chemical states, analytical results of adsorption, catalysis, corrosion, adhesion, film growth and segregation. Electron diffraction (LEED,XPD). Secondary ion Mass Spectrometry (SIMS, SNMS). scanning microscopies: STM, AFM, scanning electrochemical microscopy (SECM)		
Learning outcomes / skills and competencies	The aims of this unit are: Basic knowledge of the methods of surface spectroscopy. After completing this unit the student should be able to cope with: Solid state surface structures, gas solid state interaction, growth of thin layers and be able to compare the more important techniques of surface analytics.		
Teaching staff and contact email	Prof. Dr. Reinhard Denecke: denecke@uni-leipzig.de		
Examination			

UNIVERSITÄT LEIPZIG

Course title	BIOORGANIC CHEMISTRY		
Information	Number of credits: 5 ECTS	Number of taught hours 30 h lectures, 30 h seminar	Number of hours expected of student personal work: 90 h
Synopsis	Synthesis methods and strategies of Peptides, carbon hydrates and nuclein acids, chemical modification, introduction of fluorescence dyes, radio ligands and biotin, as well as their applications, molecular probes for biological topics and their selective introduction.		
Learning outcomes / skills and competencies	The students will know and understand bioorganic Synthesis and analysis methods.		
Teaching staff and contact email	Prof. Dr. Annette Beck-Sickinger: abeck-sickinger@uni-leipzig.de		
Examination			

UNIVERSITÄT LEIPZIG

Course title	CHEMISTRY OF NATURAL PRODUCTS		
Information	Number of credits: 5 ECTS	Number of taught hours 45 h lectures, 15 h seminar	Number of hours expected of student personal work: 90 h
Synopsis	Modern methods for synthesis of chiral non proteinogen amino acids; carbon hydrates; bioactive lipids; terpenes, steroides, alkaloides, antibiotics.		
Learning outcomes / skills and competencies	The students will know the chemical and biochemical aspects of important natural products. This includes among others amino acids (incl. non-proteinogene amino acids), hydrocarbons and lipids.		
Teaching staff and contact email	Prof. Dr. Tanja Gulder: tanja.gulder@uni-leipzig.de		
Examination			

UNIVERSITÄT LEIPZIG

Course title	PHYSICAL CHEMISTRY OF CLUSTERS		
Information	Number of credits: 5 ECTS	Number of taught hours 30 h lectures, 15 h seminar	Number of hours expected of student personal work: 105 h
Synopsis	Classification and production of clusters, size-dependent properties of clusters, non-scalable regime, rare gas-, molecular, metal, semiconductor, ionic and microsolvatised clusters, experimental characterization of cluster properties in the gasphase and at surfaces: Mass spectrometry, laser spectroscopy and scanning microscopy, clusters in the atmosphere, catalytic properties of deprotonated clusters, cluster beam synthesis of nanostructured materials		
Learning outcomes / skills and competencies	The students will know the concepts and methods to study and describe nanoscaled matter in the range between single atoms and bulk solids.		
Teaching staff and contact email	Prof. Dr. Knut Asmis: knut.asmis@uni-leipzig.de		
Examination			

UNIVERSITÄT LEIPZIG

Course title	COMPUTATIONAL CHEMISTRY OF SOLIDS		
Information	Number of credits: 5 ECTS	Number of taught hours 30 h lectures, 45 h practicals	Number of hours expected of student personal work: 75 h
Synopsis	Crystal lattice, reciprocal lattice, Sommerfeld model, bandstructure, electronic density of states, magnetismn, phonons, nanostructures, two-dimensional crystals, topological insulators.		
Learning outcomes / skills and competencies	The students will learn about methods for the quantum-theoretical description of solids. They will know the basics of the electronic and vibronic structure of solids and obtain insight into current research topics of materials chemistry by suitable examples.		
Teaching staff and contact email	PD Dr. Agnieszka Kuc: a.kuc@hzdr.de		
Examination			

UNIVERSITÄT LEIPZIG

Course title	COMPUTATIONAL SPECTROSCOPY		
Information	Number of credits: 5 ECTS	Number of taught hours 30 h lecture, 45 h practical	Number of hours expected of student personal work: 75 h
Synopsis	Basics of density functional theory, optimization of geometry, ionisation potential and electron affinity, polarizability, vibrational spectroscopy (IR and Raman), NMR, EPR and UV/Vis spectroscopy		
Learning outcomes / skills and competencies	The students will learn to calculate spectra using modern methods of computational chemistry and to determine structure and properties of molecules by comparison with calculated parameters.		
Teaching staff and contact email	PD Dr. Agnieszka Kuc: a.kuc@hzdr.de		
Examination			

UNIVERSITÄT LEIPZIG

Course title	FUNCTION CONTROL AT COMPLEX SURFACES		
Information	Number of credits: 5 ECTS	Number of taught hours 30 h lectures, 15 h seminar	Number of hours expected of student personal work: 105 h
Synopsis	Changing topics from current research fields for the preparation and modification of functional surfaces and functional nano- and microstructured systems. This includes the preparation of nonocomposites and linked porous polymer systems. The beam and photon-modified materials obtain extraordinary mechanic, thermal, biocompatible or barrier or membrane properties with specific functionalities.		
Learning outcomes / skills and competencies	The students will know current and application-driven problems and solutions for the development of functionalized polymer and hybrid materials as well as the usage of beam-induced and photochemical technologies.		
Teaching staff and contact email	Prof. Dr. Bernd Abel: bernd.abel@uni-leipzig.de		
Examination			

UNIVERSITÄT LEIPZIG

Course title	NANO STRUCTURED CATALYTIC SYSTEMS		
Information	Number of credits: 5 ECTS	Number of taught hours 30 h lectures, 30 h exercise	Number of hours expected of student personal work: 90 h
Synopsis	Catalytic systems (monoliths, random packing, catalytic micro reactor systems), application, importance, modelling of reaction engineering Non destructive 3D Tomography		
Learning outcomes / skills and competencies	The aims of this unit are: Knowledge of catalyst structures. After completing this unit the student should be able to: Understand the influence of the structure of the catalysts in nano dimensions on the properties of catalysts.		
Teaching staff and contact email	Prof. Dr. Roger Gläser: roger.glaeser@uni-leipzig.de		
Examination			

UNIVERSITÄT LEIPZIG

Course title	PROTEIN CRYSTALLOGRAPHY		
Information	Number of credits: 5 ECTS	Number of taught hours 30 h lectures, 15 h exercises, 15 h seminar	Number of hours expected of student personal work: 90 h
Synopsis	With the method X-ray crystallography the structure or organic molecules, inorganic solid-state compounds as well as biological macromolecules can be determined to atomic resolution. The lecture course treats the basics of these methods with special emphasis on bio-crystallography. Single topics are: crystallisation,, crystals, symmetry and space groups, X-ray sources and detectors, data collection, scattering of X-rays and neutrons, phase problem, phasing and phase refinement, structure dtermination of small compounds using Patterson function and direct methods, structure determination of bio-molecules by molecular replacement, heavy atom replacement and anomalous dispersion, model building and structure visualisation, structure refinement, validation and interpretation, comparison with NMR data.		
Learning outcomes / skills and competencies	The aims of this unit are: basics of structure determination of proteins by X-ray crystallography. After completing this unit the student should be able to cope with: Problems of crystallization, symmetry and space groups, X-ray instrumentation, application of X-ray methods to biomolecules.		
Teaching staff and contact email	Prof. Dr. Norbert Sträter: strater@bbz.uni-leipzig.de		
Examination			

UNIVERSITÄT LEIPZIG

Course title	METHODS AND PROCEDURES FOR TRACE ANALYSIS		
Information	Number of credits: 5 ECTS	Number of taught hours 30 h lecture, 15 h seminar, 15 h practical	Number of hours expected of student personal work: 90 h
Synopsis	The module contains lecture and seminar about selected topics of organic trace analysis and the element trace analysis including speciation analysis, from water, soil, air and biological materials; Including sampling techniques, sample treatment (enhancement, extraction, solution etc) and sample cleaning procedures. Applications oft he following methods will be treated: Gas chromatography, liquid chromatography, coupling with mass spectrometry; Atom spectroscopy, Element mass spectrometry; Coupling with Chromatography, Photometry, electrochemical methods. In addition, a hands-on training in selected instrumental trace analysis techniques (analysis of water and/or sediments) enables to obtain experience.		
Learning outcomes / skills and competencies	The students will know trace analysis methods for a quantitative proof of organic and inorganic trace materials in water, soil, air and biological materials. They can apply the methods and interpret their results.		
Teaching staff and contact email	Prof. Dr. Thorsten Reemtsma: thorsten.reemtsma@ufz.de		
Examination			