Module Description of the International Master Study „Structural Chemistry and Spectroscopy”

Academic degree	**Modul Number**	**Module Type**
Master of Science	***13-122-0311***	***Obligatory***
Module Title	Medicinal Chemistry	
Module Responsibility	Professorship of Organic Chemistry	
Module Duration	One term	
Turnaround	Annually in winter term	
Educational Structure	Lecture (3h), Seminar/Excercise (1h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: To provide the student with important basic principles as well as new developments of medicinal chemistry. After completing this unit the student should be able to cope with: Knowledge of antibiotics, anti cancer drugs, enzyme inhibitors and understanding of the relationship between structure and biological activity	
Course Description	Structure and biological activity, design of biologically active molecules; Structure-activity relationships; case studies in medicinal chemistry; Antibiotics, Anticancer agents, Signaltransduction therapy (RTK, GPCR), Enzyme-inhibitors, Receptor blocker; Structure-based design in drug discovery	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written Examination	
Examination date	End of module	
Literature	Richard B. Silverman: The Organic Chemistry of Drug Design and Drug Action, Review Articles; http://www.uni-leipzig.de/~organik/.	

Academic degree	**Modul Number**	**Module Type**
Master of Science	***13-122-0411***	***Obligatory***
Module Title	Time-resolved and Surface Spectroscopy	
Module Responsibility	Professorship for Physical Chemistry	
Module Duration	One term	
Turnaround	Annually in summer term	
Educational Structure	Lecture (3h), Seminar (1h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy; Choice module in MSc. Mineralogy and material sciences and in Internat. MSc. in Physics	
Aims	The aims of this unit are: Basic knowledge of the methods of time-resolved and surface spectroscopy After completing this unit the student should be able to cope with: modern methods of time-resolved und surface spectroscopy application of these methods to physical chemical problems	
Course Description	Usage of time-resolved spectroscopy (laser flash photolysis, electron pulse radiolysis) for the investigation of reactions of radicals, radical ions and electronically excited states in various systems. Different types of electron spectroscopy (XPS, UPS, MIES, EELS, AES), ion spectroskopy (ICISS, NICISS, ARISS) and methodsn of non linear optics for the investigation of solid and liquid interfaces	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written Examination	
Examination date	End of module	
Literature	N. J. Turro „Modern Molecular Photochemistry“, Wiley, 1991;A.W.Adamson, Physical Chemistry of Surfaces, Wiley; H. Lüth, Surface and Interfaces of Solids, Springer, 3-540-42331-1;	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0121***	***Obligatory***
Module Title	NMR on Biosystems	
Module Responsibility	Professorship of Structural Analytics	
Module Duration	One term	
Turnaround	Annually in winter term	
Educational Structure	Lecture (2 h), Seminar (1 h) Practical Course (1 h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: To build upon and extend the theoretical and instrumental concepts of Magnetic Resonance introduced during the bachelor degree programme. To develop the competence and confidence of the students applying Magnetic Resonance towards structural elucidation After completing this unit the student should be able to cope with: Understand in a comprehensive way the pulse programs for 2D NMR spectroscopy Identify and apply methods for structural elucidation in bioorganic chemistry Interpret 2D NMR spectral data and present the conclusions drawn in written and oral form	
Course Description	After a repetition of the basics of 1D NMR spectroscopy the principles of 2D NMR will be explained and in part described mathematically. The main part of the lecture course is the description of different 2D NMR methods for structural elucidation, such as *J*-resolved spectroscopy, COSY, H,C correlation (HMQC, HMBC) as well as NOESY, TOCSY and ROESY. The theoretical lectures of the course are accompanied by practical demonstrations and accompanied by a homework assignment. The practical demonstrations yield a set of spectra for a somewhat more difficult compound. This structure has to be elucidated and a written protocol is required. A final written test will be performed at the end of the lecture course.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written protocol with the correct structural elucidation for the given sample (33%), Written Examination (67%)	
Examination date	End of module	
Literature	1. Jeremy K. Sanders, Brian K. Hunter: ”Modern NMR Spectroscopy, a guide for Chemists”, Oxford University Press 1993 2. Stefan Berger, Siegmar Braun: ”200 and More NMR Experiments”, Wiley-VCH, 2004 3. Timothy D. W. Claridge: ”High Resolution NMR Techniques in Organic Chemistry”, Pergamon 1999 http://www.uni-leipzig.de/~nmr/ANALYTIK/studium	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0221***	***Obligatory***
Module Title	Structure Analysis in Inorganic Chemistry	
Module Responsibility	Professorship of Structural Analytics	
Module Duration	One term	
Turnaround	Annually in summer term	
Educational Structure	Lecture (4 h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: The students know modern methods of structure analysis for characterization of inorganic compounds. After completing this unit the student should be able to cope with: Understanding the principles of IR, NMR and ESR spectroscopy and apply these techniques to problems of inorganic chemistry	
Course Description	X-ray structure analysis: Basics in crystallography, diffraction, symmetry (point groups and space symmetry), structure factors, Fourier synthesis, experimental methods, phase problem, structure solution and refinement, results and interpretation of a single crystal X-ray structure analysis, databases and program systems. IR spectroscopy: Basics, prediction of IR spectra, selected examples. NMR spectroscopy, Basics, hetero nuclei (e.g., ^{19}F, 31P, 207Pb, 119Sn), selected examples. Magnetochemistry: Molecular magnetism, magnetic susceptibility, magnetic properties of coordination compounds, „spin-only“ magnetism, magnetic exchange interactions, single molecule magnets. EPR methods: Basic principles, anisotropic interactions/spectral parameters; systems with S > ½, exchange-coupled systems, relaxation processes and EPR spectrum, sample preparation, ENDOR, pulse techniques.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written Examination	
Examination date	End of module	
Literature	http://www.uni-leipzig.de/chemie/inorg/index.html	

Choice obligatory modules

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0111***	***Choice-Obligatory***
Module Title	Mass Spectrometry	
Module Responsibility	Professorship for Bioanalytics	
Module Duration	One term	
Turnaround	Annually in winter term	
Educational Structure	Lecture (2 h), Seminar (1 h), Exercise (1 h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Knowledge of theory and praxis of mass spectrometry After completing this unit the student should be able to cope with: Important ionization techniques, such as EI, CI, FAB, ESI, and MALDI, as well as mass analyzers (single-/double-focusing, quadrupole, ion trap and time-of-flight instruments) and he shall be able to interpret the corresponding mass spectra.	
Course Description	The historical development of mass spectrometers to current instrumentation and ionization techniques, such as EI, CI, FAB, ESI, and MALDI, are presented. The principles of the most commonly used mass analyzer, that is, sector field, quadrupole, time-of flight (TOF), ion trap and ion-cyclotron resonance- MS, are explained including the theoretical principals. Typical applications as well as limitations of the different techniques are discussed for samples from different areas in chemistry and biochemistry. The focus is in the field of bioanalytics, especially peptide and protein analytics. Mass spectra and tandem mass spectra of organic and inorganic compounds are discussed. Furthermore, MALDI-PSD (PSD, postsource decay) and tandem-mass spectra from ESI triple quadrupole and quadrupole/TOF hybrid mass spectrometers are used to sequence peptides de novo, to identify proteins and to characterize posttranslational modifications, such as phosphorylation sites. Current software packages for automatic data analysis and identification of proteins using genome or protein data basis are used.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written Examination	
Examination date	End of module	
Literature	1. H. Budzikiewicz: Massenspektrometrie, VCH 2. J. H. Gross: Mass Spectrometry, Springer 3. http://www.uni-leipzig.de/~bioanaly/lehre.html	

Academic degree	**Modul Number**	**Module Type**
Master of Science	***13-122-0211***	***Choice-Obligatory***
Module Title	Solid State Chemistry	
Module Responsibility	Professorship of Inorganic Chemistry	
Module Duration	One term	
Turnaround	Winter term every two years	
Educational Structure	Lecture (4 h),	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Knowledge of structural principles in solid state chemistry, properties of semiconductors and modern methods of synthesis and characterization of these materials. After completing this unit the student should be able to cope with: Inorganic crystal structures, Synthesis and characterization of inorganic solids	
Course Description	The first part starts with a detailed discussion of the the structures of the elements and treats polyanionic and polycationic compounds, intermetallic phases, the systematic occupation of holes in closest packings of spheres and finally clusters in solid state structures. The relationship between structure, geometric factors and electronic properties will be demonstrated. The second part (semiconductor chemistry) discusses structure-property relationships, preparative methods of solid state chemistry, crystal growth und modern techniques for epitactic growth of thin layers. Semicon-ductor materials are the main emphasis of this part.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Oral Examination	
Examination date	End of module	
Literature	U. Müller: Structural Inorganic Chemistry; www.uni-leipzig.de/chemie/inorg/index.html	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0412***	***Choice-Obligatory***
Module Title	Spectroscopy of Liquid Interfaces	
Module Responsibility	Professorship of Physical Chemistry I	
Module Duration	One term	
Turnaround	Biannually in winter term	
Educational Structure	Lecture (3 h),	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Knowledge of spectroscopic methods for the characterization of liquid interfaces, introduction to different models for the description of liquid interfaces After completing this unit the student should have developed an understanding the physics of liquid interfaces and gained knowledge on the methods of their characterization. Further, he should be able to probe heterogeneous systems with sensor molecules.	
Course Description	Methods of surface analysis suited for fluid interfaces (XPS, ARXPS, MIES, UPS, NICISS, ARISS). Discussion of practical experimental problems handling vapors generated by liquid samples. Special problems of data evaluation due to the presence of vapors. Comparison with conventional methods such as surface tension. Investigation of interfaces in micro heterogeneous systems by photochemical and photophysical sampling with sensor molecules. Light induced reactions in amphphilic solutions	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written Examination	
Examination date	End of module	
Literature	A.W.Adamson, Physical Chemistry of Surfaces, Wiley; G.Andersson et al, Surface Science 445 (2000) 89-99	

Academic degree	**Modul Number**	**Module Type**
Master of Science	***13-122-0413***	***Choice-Obligatory***
Module Title	Surface Analysis of Solids	
Module Responsibility	Professorship for Physical Chemistry of Surfaces	
Module Duration	One term	
Turnaround	Biannually in winter term	
Educational Structure	Lecture (3 h),	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy; Choice module in MSc. Mineralogy and material sciences and in Internat. MSc. Physics	
Aims	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	
Course Description	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). Mass spectrometry: Secondary ion MS (SIMS, SNMS). scanning microscopies: STM, AFM, scanning electrochemical microscopy (SECM)	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written Examination	
Examination date	End of module	
Literature	H. Bubert and H. Jenett, Surface and Thin Film Analysis, Wiley-VCH, 3-527-30458-4; H. Lüth, Surface and Interfaces of Solids, Springer, 3-540-42331-1	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0511***	***Choice-Obligatory***
Module Title	Nano Structured Catalytic Systems	
Module Responsibility	Professorship for Physical Chemistry of Surfaces	
Module Duration	One term	
Turnaround	Annually in winter term	
Educational Structure	Lecture (2 h), Exercise (2 h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Knowledge of catalyst structures After completing this unit the student should be able to cope with: Understanding the influence of the structure of the catalysts in nano dimensions on the properties of catalysts	
Course Description	Catalytic systems (monoliths, random packing, catalytic micro reactor systems), application, importance, modelling of reaction engineering Non destructive 3D Tomography	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Exercises (50%); Written Examination (50%)	
Examination date	End of module	
Literature	Cybulski, Moulijn, Stuctured Catalysts and Reactors, Marcel Dekker, ISBN 0-8247-9921-6 Blacher, S., Léonard, A., Heinrichs, B., Tcherkassova, N., Ferauche, F., Crine, M., Marchot, P., Loukine, E., and Pirard, J.-P., Colloids and Surfaces A: Image analysis of X-ray microtomograms of Pd-Ag/SiO2 xerogel catalysts supported on Al2O3 foams, Physicochemical and Engineering Aspects, 241(1-3), 201-206 (2004).	

Academic degree	**Modul Number**	**Module Type**
Master of Science	***13-122-1111***	***Choice-Obligatory***
Module Title	Protein Crystallography	
Module Responsibility	Professorship for Structural Analytic of biopolymer	
Module Duration	One term	
Turnaround	Annually in winter term	
Educational Structure	Lecture (2h), Exercise (1h), Seminar (1h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	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	
Course Description	With the method of X-ray crystallography the structures of 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 determination of small compounds using the Patterson function and direct methods, structure determination of bio-molecules by molecular replacement, heavy atom replacement und anomalous dispersion, model building and structure visualization, structure refinement, validation und interpretation, comparison with NMR data.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written Examination	
Examination date	End of module	
Literature	unter www.uni-leipzig.de/~straeter/kristallographie.html	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0221***	***Choice-Obligatory***
Module Title	Homogeneous Catalysis in Industry, Synthesis and Nature	
Module Responsibility	Module Professorship of Inorganic Chemistry (Organometallic Chemistry/Photochemistry)	
Module Duration	One term	
Turnaround	Annually in summer term	
Educational Structure	Lecture (4 h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	Explanation of the most important examples of homogeneous catalysis in industrial, synthetic and biological contexts After completing this unit the student should understand basic principles of homogeneous and heterogeneous catalysis, be able to apply catalytic solutions to industrial processes, and have knowledge of biocatalysis and enzyme reactions, and have knowledge of biocatalysis and enzyme reactions	
Course Description	Catalysis: history and development, types of catalysts,activity, selectivity; homogeneous catalysis: elementaryreactions; organometallic compounds, industrial processes/organic synthesis, reactions with CO (Oxosynthesis, Monsanto acetic acid process, Reppe), with alkenes (hydrogenation, metathesis, isomerisation, oligomerisation, polymerisation), oxidation / epoxidation / dihydroxylation of olefines (OsO4); electron transfer reactions; funktionalisation of CC-multiple bonds; alkane activation; photocatalysis; heterogenisation/immobilisation. Metalloenzymes: bioelements, bioligands, physical methods. O2 transport and activation. Iron: uptake, transport, storage, iron proteins. Copper proteins. Cobalamines. ”Early” transition metals: Mo, W (V, Cr), nitrogen fixation, nickel: urease / hydrogenases. Zink. Toxicology of selected elements. Biochemistry of toxic metals. Medicinal aspects (cancerostatika, radionuclides)	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Oral examination	
Examination date	End of module	
Literature	http://www.uni-leipzig.de/chemie/inorg/index.html	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0521***	***Choice-Obligatory***
Module Title	Modern Concepts in Catalysis	
Module Responsibility	Professorship for Technical Chemistry (Heterogeneous Catalysis)	
Module Duration	One term	
Turnaround	Annually in summer term	
Educational Structure	Lecture (2 h), Exercise (2 h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Understanding and applying basic concepts in catalysis After completing this unit the student should be able to cope with: Knowledge of catalyst structures and composition, concepts of catalytic reactions and their kinetics	
Course Description	Kinetics of catalytic reactions, catalyst characterisation, solid state catalysts, surface reactivity, micro kinetic modelling, practical applications	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Exercises (50%) Written examination (50%)	
Examination date	End of module	
Literature	Chorkendorff, Niemantsverdriet, Concepts of Modern Catalysis and Kinetics, Wiley, ISBN 3-527-30574-2	

Academic degree	Modul Number	Module Type
Master of Science	***11-122-1121***	***Choice-Obligatory***
Module Title	Receptor Biochemistry	
Module Responsibility	Professorship of Bioorganic and Biochemistry	
Module Duration	One term	
Turnaround	Annually in summer term	
Educational Structure	Lecture (2 h), Exercise (2 h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy; Module 11-122-1122	
Aims	The aims of this unit are: Understanding structure, function and activation of receptors and their signal transduction mechanisms After completing this unit the student should be able to cope with: Signal transduction, receptor biochemistry, G-proteins, protein ligand interaction	
Course Description	The main classes of receptors, their function and their biologically relevant ligands are discussed and. methods of medicinal chemistry for the development of drugs are shown. The basics of signal transduction in cells and the most relevant test systems to understand binding and function of receptors are explained. Recent high throughput systems are demonstrated The receptor families contain nuclear receptors/steroid receptors, G-protein coupled receptors, ligand gated ion channels, receptor tyrosine kinases and transporter proteins.	
Prerequisites	Basics in biochemistry	
Assessment	Seminar Presentation (50%), Oral examination (50%)	
Examination date	End of module	
Literature	www.biochemie.uni-leipzig.de/col	

Academic degree	Modul Number	Module Type
Master of Science	***12-122-1511***	***Choice-Obligatory***
Module Title	Spectroscopy	
Module Responsibility	Professorship Chemical Physics	
Module Duration	One term	
Turnaround	Annually in summer term	
Educational Structure	Lecture (4 h; with demonstrations)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Broad overview for all relevant spectroscopic methods After completing this unit the student should be able to cope with: Spectroscopic theory, selection of spectroscopic techniques for a given problem, applying spectroscopic techniques for scientific questions	
Course Description	- Introduction and history - Absorption and emission of radiation - Structure and symmetry - Nuclear magnetic resonance - Electron paramagnetic resonance - IR, Raman and UV/VIS spectroscopy - Laser and NLO effects in spectroscopy - X-ray and photoelectron spectroscopy - Moessbauer spectroscopy - Mass spectroscopy	
Prerequisites	Bachelor in Chemistry or Physics	
Assessment	Oral Examination (100%)	
Examination date	End of module	
Literature	H. Haken and H.C. Wolf, The Physics of Atoms and Quanta, 6th rev. and enlarged ed. 2000, H. Haken and H.C. Wolf: Molecular Physics and Elements of Quantum Chemistry, Springer 2004,	

Academic degree	Modul Number	Module Type
Master of Science	***13-121-1416***	***Choice-Obligatory***
Module Title	Recent Trends in Chemistry	
Module Responsibility	Professorship of Physical Chemistry	
Module Duration	One term	
Turnaround	Annually in summer or winter term	
Educational Structure	Colloquium (45h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: The students shall be able to understand, discuss and present science topics from current research fields in chemistry	
Course Description	This module course consisting of independent lectures by different (international) lectures in English.	
Prerequisites	none	
Assessment	Written Examination (100%)	
Examination date	End of module	
Literature	Actual literature	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0321***	***Choice-Obligatory***
Module Title	Highlights in Natural Products Synthesis	
Module Responsibility	Professorship for Organic Chemistry	
Module Duration	One term	
Turnaround	Annually in summer	
Educational Structure	Lecture (45h); Seminar (15h)	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Learning from famous total syntheses of natural products the student shall be able to apply retrosynthetic considerations for syntheses of complex organic molecules. After completing this unit the student should be able to: • cope with theoretical dissection of molecules into retrons • Understanding advanced organic synthetic methods	
Course Description	Natural Products are an inspiring source for organic chemistry. Their unique structure as well as biological acitivity make them ideal targets for synthetic studies. In this course a broad range of different natural products with significant biological activities will be discussed with respect to their structure, biological activity and synthesis (prostaglandins, alkaloids, macrolides, steroids, terpenes). A major focus will be on the retrosynthesis of the target molecule, that is identification of suitable bond disconnections to form smaller compounds which are more easily assembled. The students will learn how to plan a complex total synthesis of a given structure.	
Prerequisites	none	
Assessment	Written Examination (100%)	
Examination date	End of module	
Literature	K. C. Nicolaou, Classics in Total Synthesis 1 und 2, Wiley-VCH; http://www.unileipzig.de/~organik/.	

Academic degree	Modul Number	Module Type
Master of Science	***13-ASC-34LE***	***Choice-Obligatory***
Module Title	Quantitative analytics using separation methods hyphenated to mass spectrometry	
Module Responsibility	Chair of Structural Analysis	
Module Duration	One term	
Turnaround	Annually in summer term	
Educational Structure	Lecture "Quantitative analytics using separation methods hyphenated to mass spectrometry"; 30 h and 50 h student centred learning Colloquia 15 h Practical 3 x 5 h	
Workload/Credits	150h / 5 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	Advanced understanding in analytical method development and quantitative analyses with mass spectrometry	
Course Description	Advanced quantitative analysis: parameter, method development and validation Specifics of mass spectrometry in quantitative analyses and hyphenation with liquid and gas chromatography Multi-selective quantitation of proteins and small biomolecules and its application in clinical diagnostics MS Imaging and data assessment	
Prerequisites	B.Sc. Chemistry or equivalent	
Assessment	Written Examination (100%)	
Examination date	End of module	
Literature	Stavros Kromidas: Handbuch der Validierung in der Analytik; Jürgen H. Gross: Mass Spectrometry; Franz Hillenkamp and Jasna Peter-Katalinic (Ed.): A textbook; MALDI MS - A Practical Guide to Instrumentation, Methods and Applications; Andrew J. Link and Joshua LaBaer: Proteomics: A Cold Spring Harbor Laboratory Course Manual	

Choice obligatory practical courses

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0131***	***Choice-Obligatory***
Module Title	Bioorganic Structural Analytic by NMR	
Module Responsibility	Professorship for Structural Analytic	
Module Duration	One term	
Turnaround	Annually in winter term	
Educational Structure	Practice (10 h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Knowledge and Application of selected NMR- Methods towards bioorganic problems After completing this unit the student should be able to cope with: Understand and work with recent 2D NMR pulse sequences Operate NMR spectrometers including water suppression techniques Prepare biologically relevant samples suitable for NMR use	
Course Description	This course includes a research project either from recent literature or from the research group of the supervisor. The student has to apply recent NMR methods towards the problem oriented bioorganic chemistry	
Prerequisites	Module 13-122-0121	
Assessment	Protocol (67%), Presentation (33%)	
Examination date	End of module	
Literature	1. Stefan Berger, Siegmar Braun: 200 and More NMR Experiments, Wiley-VCH, 2004 2. http://www.uni-leipzig.de/~nmr/ANALYTIK/Studium	

Academic degree	Modul Number	Module Type
Master of Science	***13-121-0215***	***Choice-Obligatory***
Module Title	Research Practical Course in Inorganic Chemistry	
Module Responsibility	Professorship for Inorganic Chemistry	
Module Duration	One term	
Turnaround	Winter or summer term	
Educational Structure	Practice (9 h), Seminar (1 h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Research praxis within a current field of inorganic chemistry After completing this unit the student should be able to cope with: Research methods in inorganic chemistry	
Course Description	Practical course: Taking part within a current research project; synthesis and characterisation of polynuclear main group element compounds, transition metal complexes and solid state compounds under inert gas conditions; characterisation by X-ray and spectroscopic (IR, NMR, EPR, MS) methods; generation of semiconductor structures by modern methods of semiconductor chemistry. Seminar: Presentations of topics in inorganic chemistry of current interest	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written report (67 %), oral presentation (33 %)	
Examination date	End of module	
Literature	Current literature related to the research project	

Academic degree	Modul Number	Module Type
Master of Science	***13-121-0216***	***Choice-Obligatory***
Module Title	Research Practical Course in Organometallic Chemistry	
Module Responsibility	Professorship of Inorganic Chemistry (Organometallic Chemistry/Photochemistry)	
Module Duration	One term	
Turnaround	Annually in winter or summer term	
Educational Structure	Practice (9 h), Seminar (1 h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy;	
Aims	Research in a current field of organometallic chemistry. After completing this unit the student should be familiar with research methods in organometallic chemistry.	
Course Description	Practical course in a current research project: a) Development of mono- and polynuclear transition metal complexes for homogeneous (asymmetric) catalysis. b) Synthesis of novel phosphorus-containing compounds by template reaction of complexes with reactive M-E single and multiple bonds (e.g., E = P). c) Electron-deficient (water-soluble) carbaboranylphosphine ligands for use in catalysis und medicine. d) Phosphorus-rich ligands and complexes as precursors for binary metal phosphides MP_x. e) Homo- und heterometallic metallamacrocycles as multifunctional ligands. f) Development of phosphane ligands (chiral, macrocyclic sterically demanding, PH-functionalized, water-soluble). Most reactions are carried out under inert conditions; characterization is carried out by X-ray and spectroscopic (IR, NMR, EPR, MS) methods. Seminar: Presentations of current topics in organometallic chemistry	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Written report (67 %), oral presentation (33 %)	
Examination date	End of module	
Literature	Current literature related to the research project	

Academic degree	Modul Number	Module Type
Master of Science	***13-121-0217***	***Choice-Obligatory***
Module Title	Research Practical Course in Coordination Chemistry	
Module Responsibility	Professorship of Structural Chemistry	
Module Duration	One term	
Turnaround	Annually in winter or summer term	
Educational Structure	Lab Course (10h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy;	
Aims	The aims of this unit are: Knowledge of synthetic techniques for coordination compounds as well as their structural and spectroscopic characterization with magnetic resonance methods (EPR/NMR) After completing this unit the student should be able to cope with: Practice of ESR and NMR spectroscopy with respect to inorganic problems	
Course Description	Synthesis of ligands and coordination compounds which are closely related to cuurent research projects including paramagnetic compounds as well as ferro-/antiferromagnetically coupled systems formed by molecular self-organisation processes. Besides of standard analytical techniques the compounds will be investigated by EPR and solid-state NMR spectroscopy. The spectra and X ray diffraction studies (single-crystal, powders) are used to draw conclusions about the structure and the chemical bonding. Intermolecular interactions will be analysed.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Practical work and report (67 %), Presentation (33 %)	
Examination date	End of module	
Literature	Current literature related to the research project	

Academic degree	Modul Number	Module Type
Master of Science	***13-121-0218***	***Choice-Obligatory***
Module Title	Research Practical Course in Supramolecular Coordination Chemistry	
Module Responsibility	Professorship for Coordination Chemistry	
Module Duration	One term	
Turnaround	Annually in winter and summer term	
Educational Structure	Practice (10 h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Research praxis within an actual field of supramolecular chemistry After completing this unit the student should be able to cope with: Application of non covalent synthesis, understanding the principles of supramolecular chemistry, characterization of molecular interactions	
Course Description	Taking part within an actual research project the experimental methods of supramolecular chemistry are trained. Non covalent synthesis and the principles of supramolecular chemistry, molecular recognition, and intermolecular interaction will be applied. Special emphasis will be on chemistry of crown ether and macrocyclic ligands, self association and self replication, molecular imprinting, molecular machines und functional units, supramolecular catalysis, nano-chemistry, design and synthesis of nano-structured materials.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Protocol (67 %), Presentation (33 %)	
Examination date	End of module	
Literature	J.W.Steed, J.L.Atwood, Supramolecular Chemistry, Wiley-VCH, 2000; Actual literature with respect to the research project	

Academic degree	**Modul Number**	**Module Type**
Master of Science	***13-122-0314***	***Choice-Obligatory***
Module Title	Laboratory Course Advanced Synthetic Organic Chemistry	
Module Responsibility	Professorship of Organic Chemistry	
Module Duration	One term	
Turnaround	Each term	
Educational Structure	Practical Course (10h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Training in experimental organic chemistry After completing this unit the student should be able to cope with: Multiple step organic synthesis and spectroscopic characterization of the synthesized compounds	
Course Description	In this practical course the student will learn to assemble complex organic structures with defined constitution and configuration from simple precursors through a diverse range of organic reactions. The reactions to be conducted will include multistep-syntheses of complex heterocycles, biologically active compounds, the syntheses of fine chemicals with chiral auxiliaries, catalysts and enzymes and metal-catalyzed reactions. The products have to be carefully analyzed with modern GC- and HPLC-techniques and characterized by NMR-, IR-, and MS-spectroscopy.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Short thesis (67%) and presentation (33%)	
Examination date	End of module	
Literature	Special references for each research project; http://www.uni-leipzig.de/~organik	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0415***	***Choice-Obligatory***
Module Title	Laboratory Course for the characterization of fluid and solid surfaces	
Module Responsibility	Professorship for Physical Chemistry I	
Module Duration	One term	
Turnaround	Annually in winter term or summer term	
Educational Structure	Practical Course (10h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Research Practical Course on interfaces After completing this unit the student should be able to cope with: Use of different spectroscopic techniques for the investigation of surfaces, in particular of the molecular structure of liquid surfaces	
Course Description	Research Practical Course for selected topics of liquid and solid interfaces, particle spectroscopy on inhomogenous solid state surfaces, electron spectroscopy and ion spectroscopy on selected liquid surfaces, comparison with conventional methods such as tensiometry.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Protocol (67%), Presentation (33%)	
Examination date	End of module	
Literature	A.W.Adamson, Physical Chemistry of Surfaces, Wiley; G.Andersson et al, Surface Science 445 (2000) 89-99	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0416***	***Choice-Obligatory***
Module Title	Laboratory Course in Computer Simulation for Investigation of Fluid Interfaces	
Module Responsibility	Professorship for Physical Chemistry I	
Module Duration	One term	
Turnaround	Annually in winter term or summer term	
Educational Structure	Practical Course (10h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Knowledge and practical experience of computer simulation After completing this unit the student should be able to cope with: Use of computer simulation (MD und TMD) for the investigation of structure and dynamics on liquid interfaces	
Course Description	Research Practical Course in Computer Simulation for Investigation of Liquid Interfaces. Simulations will be performed on selected tenside/solvent systems using PC's and main frames.	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Protocol (67%), Presentation (33%)	
Examination date	End of module	
Literature	J. M. Haile, Molecular dynamics simulation: elementary methods, Wiley-Interscience; H.Morgner, Computer simulation of the adsorption of alkanethiols on Au(111) from the gas phase. I. Methanethiol, Langmuir 13 (1997) 3990-4002	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0417***	***Choice-Obligatory***
Module Title	Laboratory Course in Reaction Kinetics and Structure Identification	
Module Responsibility	Professorship for Physical Chemistry/ Short Time Spectroscopy	
Module Duration	One term	
Turnaround	Annually in winter term or summer term	
Educational Structure	Practical Course (10h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Research praxis within an actual field of time resolved spectroscopy After completing this unit the student should be able to cope with: Use of time resolved spectroscopy for the investigation of elementary reactions Use of ESR-spectroscopy for the investigation of paramagnetic transient compounds	
Course Description	Research Practical Course for selected topics in time-resolved spectroscopy by pulse radiolysis or laser photolysis and optical detection of absorption and emission in solvents. Application of ESR for kinetic and structural investigations of organic or biochemical molecules after photolytic excitation	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Protocol (67%), Report (33%)	
Examination date	End of module	
Literature	A. Henglein, W. Schnabel, J. Wenedenburg „Einführung in die Strahlenchemie“, Akademieverlag, Berlin, 1969, N. J. Turro „Modern Molecular Photochemistry“, Wiley, 1991; F. Gerson, W. Huber „Electron Spin Resonance Spectroscopy of Organic Radicals”, Wiley-VCH, 2003	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0418***	***Choice-Obligatory***
Module Title	Research Practical Course in Thin Film Growth, Phenomena and Analysis of Solid Interfaces	
Module Responsibility	Professorship for Physical Chemistry	
Module Duration	One term	
Turnaround	Annually in winter term or summer term	
Educational Structure	Practical Course (10h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Research praxis within an actual field of time resolved spectroscopy After completing this unit the student should be able to cope with: Use of time resolved spectroscopy for the investigation of elementary reactions Use of ESR-spectroscopy for the investigation of paramagnetic transient compounds	
Course Description	Research Practical Course for selected topics in time-resolved spectroscopy by pulse radiolysis or laser photolysis and optical detection of absorption and emission in solvents. Application of ESR for kinetic and structural investigations of organic or biochemical molecules after photolytic excitation	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Protocol (67%), Report (33%)	
Examination date	End of module	
Literature	A. Henglein, W. Schnabel, J. Wenedenburg „Einführung in die Strahlenchemie“, Akademieverlag, Berlin, 1969, N. J. Turro „Modern Molecular Photochemistry“, Wiley, 1991; F. Gerson, W. Huber „Electron Spin Resonance Spectroscopy of Organic Radicals”, Wiley-VCH, 2003	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0531***	***Choice-Obligatory***
Module Title	Laboratory Course for Structural Characterisation of Solid State Catalysts	
Module Responsibility	Professorship for Technical Chemistry (Heterogeneous Catalysis)	
Module Duration	One term	
Turnaround	Annually in winter term	
Educational Structure	Practice (10h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Research praxis within an actual field of catalysis compounds After completing this unit the student should be able to cope with: Self dependent research work for structural characterisation of solid state catalysts	
Course Description	Integration into an actual research project of the supervisor, synthesis of catalysts, characterisation with respect to texture, volume- and surface structure, correlation with catalytic properties	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Protocol (67%), Presentation (33%)	
Examination date	End of module	
Literature	Actual literature with respect to the research project	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-0532***	***Choice-Obligatory***
Module Title	Reaction Engineering of Heterogeneous Catalysis	
Module Responsibility	Professorship for Technical Chemistry (Chemical Reaction Engineering)	
Module Duration	One term	
Turnaround	Annually in winter term	
Educational Structure	Practice (10h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Knowledge of chemical reaction engineering in catalysis After completing this unit the student should be able to cope with: Independent research work in the field of chemical reaction engineering in differently structured catalytic reactors	
Course Description	Collaboration in a running research project of the chemical reaction engineering group, synthesis of catalysts, investigation of the influence of differently structured reactors on catalytic performance, chemical reaction engineering modelling	
Prerequisites	Eurobachelor in chemistry or equivalent	
Assessment	Protocol (67%), Presentation (33%)	
Examination date	End of module	
Literature	Actual literature with respect to the research project	

Academic degree	Modul Number	Module Type
Master of Science	***13-122-1112***	***Choice-Obligatory***
Module Title	Laboratory Course in Mass Spectrometry	
Module Responsibility	Professorship for Bioanalytics	
Module Duration	2 to 6 months, depending on agreement	
Turnaround	Each term	
Educational Structure	Seminar (1 h), Practice (9 h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Application of bioanalytical techniques on a specific research project. After completing this unit the student should be able to cope with: Research in the field of mass spectrometry	
Course Description	Independent research work in the field in mass spectrometry and protein analytics. Therefore, all methods and techniques, such as liquid chromatography, gel electrophoresis, ESI- und MALDI-mass spectrometry, in-gel digests, immunoblots, ELISA, UV/VIS- and fluorescence spectroscopy, as well as fluorescence polarization can be used.	
Prerequisites	Module 13-122-0111	
Assessment	Protocol (67%), Presentation (33%)	
Examination date	End of module	
Literature	http://www.uni-leipzig.de/~bioanaly/lehre.html	

Academic degree	Modul Number	Module Type
Master of Science	***11-122-1122***	***Choice-Obligatory***
Module Title	Laboratory Course in Receptor Biochemistry	
Module Responsibility	Professorship of Bioorganic and Biochemistry	
Module Duration	One term	
Turnaround	Annually in summer or winter term	
Educational Structure	Practice (10 h)	
Workload/Credits	300h / 10 credits	
Usability	M.Sc. Structural Chemistry and Spectroscopy	
Aims	The aims of this unit are: Principles of manual techniques in cell biochemistry After completing this unit the student should be able to cope with: Understand and work with recent preparative methods of biochemistry; Prepare biologically relevant samples suitable for biochemical investigations	
Course Description	Methods to test chemical compounds at receptors expressed by mammalian cells, e. g. binding and signal transduction at G-protein coupled receptors	
Prerequisites	Module 11-122-1121	
Assessment	Protocol (67%), Presentation (33%)	
Examination date	End of module	
Literature	www.biochemie.uni-leipzig.de/col	