Teaching Portfolio

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Experience with Teaching, supervision, and Examination

My teaching experience at the Faculty of Natural Sciences at SDU comprises courses for students in natural sciences at all levels, from bachelor to master and to PhD. Students are typically enrolled in either physics or chemistry, or related (nano)biosciences.
Below I am presenting examples of courses I was invovled in / responsible for; more details may be found under "Teaching and Supervision".

Teaching and supervision

1. **Biology at the interface**

Descriptions

The aim of the course is to enable the student to

- characterize the most important physical techniques, concepts, and models used to describe biological systems and to account for their strong and weak points
- account for the importance of interfaces in relation to key biomedical systems, problems, and technological applications
- compose and present a talk on a topic within the broad area covered by the course

These aims are all of importance in all fields of natural sciences and pharmacy.

Description

The course builds on the knowledge acquired in the courses in the first, possibly the second year of study of natural sciences, including pharmacy, and gives an academic basis for studying the topics […], that are part of the degree.

In relation to the competence profile of the degree it is the explicit focus of the course to:

- know some the most important physical and physico-chemical techniques and concepts to characterize interfaces in biological systems.
- know selected, specific applications of these techniques and concepts within biophysics, biochemistry, pharmacy, nanotechnology and biomedicine.

Information

Period	05/02/2007 → 06/02/2017
Target group	Other
ECTS credits	5,0 ECTS
Subject Director	Mouritsen, O. G. Bagatolli, L. Brewer, J. R., Department of Biochemistry and Molecular Biology Hansen, P. L. Klösgen, B., Department of Physics, Chemistry and Pharmacy Simonsen, A. C., Department of Physics, Chemistry and Pharmacy
Managing organisational unit	Department of Physics, Chemistry and Pharmacy

2. **Applied Optics for the Biosciences**

Descriptions

Description	The course focuses on selected subjects and their potential to study systems of biological relevance. An obvious topic of the biosciences is the investigation of structures, and the biological function covered by them, from tissue to cells, from molecular aggregates to single molecules. Another issue is trafficking, which is related to dynamics, i.e. changes of concentrations and/or structures. An introduction to basic aspects will be given together with an outline of modern experimental approaches: • Imaging microscopy techniques (optical-, electron-, and x-ray microscopy) and the related questions of resolution and contrast, probe selection and sample preparation will be discussed together with structures of interest. • Periodic configurations (crystalline structures) can be investigated to finest details by diffraction and reflectometry methods, whereas techniques like atomic force microscopy (AFM) probe localized features down to single molecules – and can be envisaged as optical only in a generalized way of thinking. These methods will be introduced and discussed. • Biological systems are typically soft, and frequently fluid. Nature makes use of their mechanical features, performing e.g. shape adjustments, domain formation and decomposition, and fast response on concentration gradients. Advanced spectroscopy and microscopy techniques, including image analysis, micromanipulation, and (laser) fluorescence methods will be presented.

Information

Period	03/02/2003 → 07/02/2005
Target group	Bachelor
ECTS credits	Other
Subject Director	Klösgen, B., Department of Physics, Chemistry and Pharmacy
Managing organisational unit	Department of Physics, Chemistry and Pharmacy

3. **Cross Institutional Molecular Biophysics**

Descriptions

Description	The course is linked to Århus University and is being conducted with contributions from all Danish universities. The Cross Institutional Molecular Biophysics course is interdisciplinary and cross-institutional and will be given by a series of lecturers who are experts within each their subfield of biophysics. The coherence of the course is assured by emphasizing the molecular basis of modern biophysics. The course will take place at different institutions in order to expose the students to different research groups, their researchers and experimental research facilities. The course will thus give the student a unique opportunity of orienting him or herself within an active and diverse field of interdisciplinary science. The course is relevant for biophysically oriented PhD students within physics, chemistry, biochemistry, molecular biology, nano-bioscience, pharmaceutical sciences, agricultural science or biology. The emphasis of the course is a molecular description of biophysical systems and phenomena and it covers experimental methods, theoretical concepts, as well as molecular modeling.

Information

Period	07/02/2006 → …
Target group	Ph.D
ECTS credits	10 ECTS
Subject Director	Klösgen, B., Department of Physics, Chemistry and Pharmacy
Managing organisational unit	Department of Physics, Chemistry and Pharmacy

4. **Electromagnetisme for biologists**

Descriptions

Description	This introductory course into electromagnetism is especially designed for the needs of future scientists in the area of the biosciences. The basic physical phenomena associated with charges and currents will be introduced, including the concepts of electric and magnetic fields. Lectures will be accomplished by a set of exercises that especially address relevant examples from biology / biochemistry / general laboratory techniques. This includes ions in aqueous surroundings and the related currents, electric potentials across semipermeable interfaces as membranes, nerve conduction, … but also basic measuring techniques as the function of ammeters, voltmeters, oscilloscopes, … and electrophoresis, mass spectrometry, … . Working on the exercises will require some basics of calculus. Therefore the lectures will briefly resume the math essentials as needed (fractions, power calculations, vectors, logarithmic and trigonometric functions, trigonometry, …) and the exercise assignments will train these calculus basics in the context of selected problems.

Information

Period	06/09/2004 → …
Target group	Bachelor
ECTS credits	Other
Subject Director	Klösgen, B., Department of Physics, Chemistry and Pharmacy
Managing organisational unit	Department of Physics, Chemistry and Pharmacy

5. **Experimental biophysics**

Descriptions

Description	he course introduces a series of modern experimental methods for studying soft materials and biophysical model systems. The following topics are covered: Surface sensitive techniques for characterizing biomolecular interfaces including atomic force microscopy (AFM), imaging ellipsometry and Brewster angle microscopy (BAM). Examples of systems studies are: Supported bilayers and monolayers (Simonsen). Micromechanical methods for fabrication, manipulation and characterization of micro and nanoparticles (Needham). Fabrication of Langmuir monolayers of surfactant molecules and characterization of these with X-ray and neutron reflectometry (Klösgen). Confocal fluorescence microscopy and fluorescence correlation spectroscopy (FCS) for studying membranes and cells (Bagatolli).

Information

Period	03/02/2014 → 05/09/2016
Target group	Master
ECTS credits	5,0 ECTS
Subject Director	Simonsen, A. C., Department of Physics, Chemistry and Pharmacy Klösgen, B., Department of Physics, Chemistry and Pharmacy Needham, D. Brewer, J. R., Department of Biochemistry and Molecular Biology Kinoshita, K.
Managing organisational unit	Department of Physics, Chemistry and Pharmacy

6. **Experimental Physics: Surface Physics**

Descriptions

Description	The course is an introduction to advanced experimental equipment and methods to analyse surfaces of solid materials and soft organic films. Ultra high vacuum techniques are used to study solid state surfaces, reaction of gas phase molecules at surfaces, and new materials which can be created on surfaces, such as thin films for coatings and electronic materials. The instruments used for surface analysis include electron microscopes, electron spectrometers, mass spectrometers, scanning probes (STM, AFM), and equipment for studying low energy electron diffraction. The course will also give an introduction into modern techniques to analyse the formation of thin organic films by self-aggregation, e.g. the formation of mono- and bi-layers of lipid films in contact with water. The techniques presented in this context are X-ray diffraction, neutron reflectometry, Langmuir-Blodgett technology, AFM, and FCS. Experiments: 1. Electron spectroscopy and microscopy (AES, XPS, SEM+EDX, ELS). 2. Surface structure, morpholgy, and and mechanical state of deposited thin layers on solid and liquid supports (Langmuir compression, reflextometry; LEED, STM, AFM, ELS). 3. Thermodynamic studies of lipid shells: fluid-solid transition, behaviour of mixtures.

Information

Period	06/02/2006 → 02/02/2009
Target group	Other
ECTS credits	5,0 ECTS
Subject Director	Baurichter, A. Morgen, P., Department of Physics, Chemistry and Pharmacy Klösgen, B., Department of Physics, Chemistry and Pharmacy
Managing organisational unit	Department of Physics, Chemistry and Pharmacy

7. **Experimental surface physics**

Descriptions

Description	The following topics are covered: 1. Surface sensitive techniques for characterizing biomolecular interfaces including atomic force microscopy (AFM), imaging ellipsometry and Brewster angle microscopy (BAM). Examples of systems studies are: Supported bilayers and monolayers (Simonsen). 2. Micromechanical methods for fabrication, manipulation and characterization of micro and nanoparticles (Needham). 3. Fabrication of Langmuir monolayers of surfactant molecules and characterization of these with X-ray and neutron reflectometry (Klösgen). 4. Confocal fluorescence microscopy and fluorescence correlation spectroscopy (FCS) for studying membranes and cells (Bagatolli).

Information

Period	02/02/2009 → 04/02/2013
Target group	Master
ECTS credits	5,0 ECTS
Subject Director	Simonsen, A. C., Department of Physics, Chemistry and Pharmacy Klösgen, B., Department of Physics, Chemistry and Pharmacy Needham, D. Bagatolli, L.
Managing organisational unit	Department of Physics, Chemistry and Pharmacy

8. <h2 class="title">Nanostructure characterisation</h2><h3 class="subheader">Descriptions</h3><table class="properties"><tbody><tr> <th scope="row">Description</th> <td>In this course the students learn how structures can be formally described and how they can be studied. The investigation of nanoscopic phenomena will be especially addressed. The students get acquainted with some of the currently most important experimental techniques available for (nano)structure characterization. The course provides lectures on experimental methods and includes two hands-on experimental activities. Throughout the course, exercises train basic mathematical tools and serve to elucidate details related to the experimental methods by problem solving. The course will also use, as part of the instruction, material available on the Internet. Finally, each student will write a scientific text about a chosen example of structure characterization as individual in –depth project. Working on the individual project will base on class teaching about how to implement the project subject by literature search and identification of terms and topics followed by an assembly through reading. Tools as spider maps and project flow charts will be introduced, aiming at scientific presentation and, finally, scientific writing.
The course builds on the knowledge acquired in the courses of the first two years of the bachelor education, and gives an academic basis for applying and expanding the previous knowledge towards complex methods. Focus is on techniques to study and characterize structures, as part of the degree's preparation for professional applications.
</td></tr> </tbody></table><h3 class="subheader">Information</h3><table class="properties"><tbody><tr class="period"><th scope="row">Period</th><td>01/02/2006 → 01/02/2016</td></tr><tr><th scope="row">Target group</th><td>Bachelor</td></tr><tr><th scope="row">ECTS credits</th><td>5,0 ECTS</td></tr><h3 class="subheader">Subject Director</h3><tr><th scope="row">Subject Director</th><td> Klösgen, B., Department of Physics, Chemistry and Pharmacy </td></tr><tr><th scope="row">Managing organisational unit</th><td>Department of Physics, Chemistry and Pharmacy</td></tr><h3 class="subheader">Teaching and supervision occurrences</h3><ul class="relations">
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9. **Neutron scattering in theory, simulation, and practice**

Descriptions

Description	Neutron scattering is one of the most important experimental methods for the study of the atomic-scale structure and dynamics of condensed matter. Neutron scattering complements the well-known technique of X-ray diffraction by being well suited for the study of light elements (hydrogen in particular), magnetic structures, and collective excitations like phonons and spin waves. This course will present an introduction to neutron scattering and its applications, strengths, and weaknesses. furthermore, the students will become proficient in design and simulation of neutron scattering instruments. Topics include: - Scattering from atoms, crystals, and nanostructures. Magnetic scattering. - Elastic and inelastic scattering - Scattering from lattice vibrations, spin waves, diffusion, surface layers, macromolecules, and soft condensed matter. - Design of neutron instruments for different types of science - Hands-on experiments on lattice vibrations, biophysics, soft condensed matter, nanoparticles, and magnetic materials.

Information

Period	06/09/2010 → 03/09/2012
Target group	Further
ECTS credits	7,5 ECTS
Subject Director	Klösgen, B., Department of Physics, Chemistry and Pharmacy
Managing organisational unit	Department of Physics, Chemistry and Pharmacy

10. <h2 class="title">Physical Chemistry B</h2><h3 class="subheader">Descriptions</h3><table class="properties"><tbody><tr> <th scope="row">Description</th> <td>The course aims to deepen the insight of the students about the basic concepts of physical chemistry, and to use them in a more advanced framework and extend them towards non-ideal behavior, both in the theoretical and also in the experimental part of the course. The students will get more familiar with the dependence of systems on temperature, pressure and composition. Concepts and phenomena of previous courses (KE523 and KE528) will be addressed and clarified. A full written report shall be carried out in scientific format. The course offers a training for the work on bachelor projects and for future professional case. In relation to the competence profile of the degree it is the explicit focus of the course to: provide knowledge about the physico-chemical characteristics of chemical systems, develop skills to gather new knowledge and combine it with a specific experimental task, provide skills to break down the task into its specific aspects and establish formal plans and documentation about the activity (on sample making, on data acquisition, making tables, graphing data, etc.) practicing collaboration and communication skills, establish expertise in scientific documentation throughout all elements of the course and report writing in the thesis format.</td></tr> </tbody></table><h3 class="subheader">Information</h3><table class="properties"><tbody><tr class="period"><th scope="row">Period</th><td>02/09/2008 → 02/11/2020</td></tr><tr><th scope="row">Target group</th><td>Bachelor</td></tr><tr><th scope="row">ECTS credits</th><td>5,0 ECTS</td></tr><h3 class="subheader">Subject Director</h3><tr><th scope="row">Subject Director</th><td> Klösgen, B., Department of Physics, Chemistry and Pharmacy </td></tr><tr><th scope="row">Managing organisational unit</th><td>Department of Physics, Chemistry and Pharmacy</td></tr><h3 class="subheader">Teaching and supervision occurrences</h3><ul class="relations">
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11. **Project in methods of experimental physics and biophysics**

Descriptions

Description	The students will get acquaintance with experimental methods by working with some typical, modern experimental techniques in physics and biophysics, including advanced equipment, coupled to computers for automated data collection and data processing. Part of the activities will deal with measurement uncertainties, the control or elimination of noise, and signal conditioning. Topics and areas of interest will be typical instrumentation, sample preparation techniques and methods of surface treatment, as applied for research using modern methods in physics and biophysics. Possible instrumentation includes optical microscopy, for image acquisition but as well coupled to micromechanical studies, electron microscopy, and as well instrumentation of thermodynamic studies as calorimetry, Langmuir compression, or optical and dielectric spectroscopy. Many of these techniques are useful to characterize materials at the nanoscale and to study nanoscopic-phenomena. The topics will preferentially center on current activities in the research going on at the Institute. The chosen experiments are decided on just before the course starts. Within the norms for this course a maximum of two experimental facilities can be included, for one or two sub-projects.

Information

Period	05/09/2011 → 05/09/2016
Target group	Bachelor
ECTS credits	5,0 ECTS
Subject Director	Klösgen, B., Department of Physics, Chemistry and Pharmacy
Managing organisational unit	Department of Physics, Chemistry and Pharmacy

Formal Educational Training

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Methods, Materials, and Tools

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Reflections on your own Teaching Practice and Future Development including Student Evaluations

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