Module title: Advanced Chemistry

Module summary
Module code: SSTM120
Module coordinator: Prof. Dr. Pinkwart
Credits (ECTS): 6
Semester: 1
Pre-requisites with regard to content: A basic understanding of general chemistry and introductory physics, including fundamental concepts of thermodynamics and chemical bonding, is recommended as a pre-requisite for this module.
Pre-requisites according to the examination regulations: There are no specific pre-requisites defined for this module in the examination regulations.
learning outcomes and competencies: • Students have knowledge of the physical and chemical foundations of sensors and biosensors, including their operating principles. • Students understand key concepts of physical chemistry (e.g. properties of gases, liquids and solutions, thermodynamics, chemical energetics, chemical affinity) and can relate them to sensor systems. • Students are familiar with central topics of general chemistry (e.g. chemical reactions, bonding types, hydrogen bonding, acids and bases, buffer systems, redox reactions, electrochemistry, polymers) and can connect them to sensor materials and functionalities. • Students are able to use theoretical models to understand and analyze sensor principles, enabling a deeper grasp of the underlying physical and chemical mechanisms. • Students can link different chemical and physical phenomena with the help of theoretical models and thus structure the knowledge field of sensor and biosensor technology. • Students are qualified to take on more complex tasks in the development and evaluation of (bio)sensors.
Assessment: Written exam, 120 min

Course: Physical Chemistry
Module code: SSTM121
Lecturer: Dr. C. Cremers
Contact hours: 2
Semester of delivery: yearly, summer semester
Type/mode: Lecture
Language of instruction: English
Content: • Spectroscopy • Properties of ideal and real gases • Properties of liquids and solutions • Chemical energetics • Pellistor sensor • 2nd and 3rd law of thermodynamics • Chemical Affinity

Recommended reading: P. Atkins, L. Jones: Chemical Principles, W.H. Freeman and Company D.C. Harris: Quantitative Chemical Analysis, W.H. Freeman and Company
Comments: This course provides a focused introduction to key concepts of physical chemistry that are directly relevant for understanding and designing sensor systems. It is particularly well suited as a foundation for students who wish to deepen their knowledge of thermodynamics, spectroscopy and gas/liquid properties in the context of advanced (bio)sensing applications.

Course: Chemistry
Module code: SSTM122
Lecturer: Dr. Saadia Ilhem Knipping
Contact hours: 4
Semester of delivery: yearly, summer semester
Type/mode: lecture
Language of instruction: English
Content: • Matter and Properties • Chemical Reactions • Materials, • Type of chemical bonds • Hydrogen bonding • Bonding of models bands • Acids and bases • Buffer • Redox Reactions • Electrochemistry Polymers
Recommended reading: P. Atkins, L. Jones: Chemical Principles, W.H. Freeman and Company D.C. Harris: Quantitative Chemical Analysis, W.H. Freeman and Company
Comments: This course offers a broad overview of general chemistry topics, ranging from bonding and reaction types to acids–bases, electrochemistry and polymers, thereby supporting a systematic understanding of materials and processes used in sensor technologies. It is especially valuable for students who need to consolidate and expand their chemistry background for further studies in sensor systems and related fields.