BIOLOGICAL AND MEDICAL SENSOR TECHNOLOGIES	*Elective module*	*6 CP*

Content:

The continuous innovation in the field of biomedical technologies has led to the rapid development of biomedical science in the 21st century. It drives the design, development, and application of biomedical sensors for disease diagnosis and treatment. Sensing and detecting technology for biomedicine is a key technology to get information of human physiology and pathology, and it is an important branch in biomedical engineering.

Lecture:

1. Introduction of development in sensing technology for biomedicine. Core themes: sensing materials and coating technologies, application of biomedical sensors.
2. Introduction of development of detecting technology for biomedicine. Core themes: the detection of bioelectrical signal, biomagnetic fields, and parameters in physiology and biochemistry.
3. Introduction of physiological information of the human body and their biomedical foundation. Core themes: the types and diagnosis of human physiological information, potential of human cell, physiological information of circulatory system, physiological information of respiratory system, physiological information of nervous system, physiological information of digestive system, physiological information of sensory organs, and other physiological parameters and their measurements.
4. Introduction of basis of molecular biomedicine. Core themes: cells, genes, receptors, ion channels, antibodies, and enzymes.
5. Introduction of chemical sensors and their detection technologies. Core themes: fundamental concept and theory of chemical sensors, basic type and their characteristics of chemical sensors. Here, electrochemical sensors, gas sensors, humidity sensors, electrical nose, and electrical tongue will be highlighted.
6. Introduction of biological quantity sensors and their detection technologies. Core themes: i) fundamental concepts, principles and characteristics of biological sensors, ii) constructions and features of biological sensors, iii) classification of bio-recognition elements and biological sensors, iv) biomolecular sensors, containing enzymes-biological sensors, immunity-biological sensors, DNA sensors, receptor and ion-channel sensors, v) cells and tissue sensors, containing microbial cell sensors, cell metabolism sensors, cell resistance sensors, cell electrophysiological sensors, vi) nano-biological sensors.

Seminar:

Fundamentals and applications of biomedicine sensors and their detection technologies will be introduced through some typical themes. The themes include:

1. The principles of sensors (adsorption and absorption of chemical material, selective molecular receptors, membrane permeation, ion-selective membranes, and photochemical-sensitive effects will be highlighted).
2. The technologies for manufacture (single chip integrated semiconductor technology, ceramic preparation technology, thin film and thick film preparation technology, multi-polymer technology).
3. The application of chemical sensors (the application of electrochemical sensors, metal oxide semiconductor sensors, solid electrolyte sensors, and surface acoustic wave sensors in gas detection, the application electrical nose in food, environment and medical detection).
4. The quantitative biological sensors and their application (the introduction of biological sensing elements and physico-chemical transducers; highlighting of preparation technologies, such as membrane entrapment, physical adsorption, matrix entrapment and covalent bonding; introduction of the application of enzyme biosensors, immune sensors, cell electrophysiology sensors, gene and protein chips, and nano-biological sensors)

Educational Objectives / Competences:

The aim is to provide students with an inspirational background that will allow them to 1) understand the key biosynthetic and metabolic processes in nature, ii) translate structural and functional data on biomolecules into mechanistic models, iii) design biomimetic processes and biocomplexes, and iv) understand and develop strategies for the treatment of diseases and disorders.

Frequency of module:	Once a year (winter semester)
Duration of module::	1 semester (8 weeks block)
Requirements for participation:	Basic knowledge in English
Organizational Information:	The module will be held in English.
Proof of Study (Proof of Participation / Certificate of Performance):	Regular and active attendance at the seminar

Final Module Examination / Form of Examination:	Written exam
Requirements for attaining CP:	Passing the final exam
Applicability to other Course of Study :	Elective module for students in the Master course for Chemistry and Biochemistry

Teaching units	***Typ***	***SWS***	***Semester / CP***			
			1	***2***	***3***	***4***
Lecture Biological and Medicinal Sensor Technologies	V	2,5	4			
Seminar Biological and Medicinal Sensor Technologies	S	1	2			