Course Package

Imaging & In Vitro Diagnostics

Name module	Imaging & In Vitro Dagnostics
Educational programme	MSc Biomedical Engineering
Period	First block of the first semester (block 1A)
Study load	15 ECTS
Coordinator	J. Huttenhuis

Imaging & In Vitro Dagnostics			
block 1A	**block 1B**	**block 2A**	**block 2B**
Biophysical Techniques and Molecular Imaging **193640020** (5 EC)			
In vitro Diagnostics* **201700040** (5 EC)			
Technology for Health **201500222** (5 EC)			

Required preliminary knowledge: Fundamental knowledge and concepts from Cell Biology, Biochemistry, Chemistry, Physics: - Biology/Biochemistry: Cell structure, organelles, DNA, RNA, Proteins, Enzymes, Antibodies; - Chemistry: fundamentals of Inorganic and Organic Chemistry, Standard Techniques; - Physics: Fundamentals of Optics, Thermodynamics; - Math: Statistics, a bachelor degree in Applied Physics, Biomedical Technology or Advanced Nanotechnology, Bachelor BMT or equivalent.

*Mandatory preliminary knowledge: Entry requirements for BME.

193640020 - Biophysical Techniques and Molecular Imaging

Biophysical Techniques & Molecular Imaging (BT&MI) introduces a selection of advanced micro-spectroscopic techniques for molecular and cellular studies. The course treats imaging techniques based on fluorescence spectroscopy and vibrational spectroscopy. The general concepts of contrast, resolution, localization, sensitivity and signal-to-noise ratio will be presented and related to microscopic properties of molecules. Electro-magnetic properties of the light field, basic to contrast, will be put in the context of microscopic methods. Light distributions in the focus of microscope objectives will be presented to understand the basics of resolution. Micro-spectroscopic techniques are essential to modern biomedical sciences, such as in-vivo imaging, quantitative biology, stem cell research and studies of fundamental cellular processes, for example cell-division, apoptosis, phagocytosis, cell differentiation, carcinogenesis. Concepts will be illustrated with examples from the life and (bio)-material sciences.

The modules are tentative and subject to change. Please check the website regularly.

201700040 - **In Vitro Diagnostics**

In vitro diagnostics (IVD) is the analysis of bodily fluids and tissue samples for the purpose of medical diagnostics. Main aims of the course:

- To understand the requirements an IVD device has to fulfil
- To understand the processes and concepts employed in existing IVD devices
- To apply this understanding to critically assess recent developments and proposed concepts for targeted biomarkers and/or diseases.

After an introduction on the purpose of IVD devices and the requirements they have to fulfil, the lectures will focus on the (bio)-chemical and physical processes and technical concepts employed in these devices:

- Sample preparation techniques
    - enrichment/purification/separation
    - amplification
    - labelling
- Detection techniques:
    - label free
    - fluorescence based
    - electrochemical/electrical
- Microfluidics for IVD
- Point-of-care diagnostics

201500222 - Technology for Health

The aim of Biomedical engineering is to provide technological solutions for health care problems, for example for the support of human functions which are impaired by trauma or disease. As a biomedical engineer, you will be actively involved in technology research for advancing new ideas, concepts or intermediate results on the translation chain towards innovation of clinical practice and commercial exploitation. The overall goal of this course is to provide an overview of key aspects of the process of biomedical engineering and the role of the biomedical engineer. Therefore, this course consists of:

- theoretical lectures on clinical problem analysis, technology research and technology transfer;
- capita selecta lectures in which experts from the field describe a clinical problem and state of the art technical solutions and future developments in technology research;
- assignments in which students individually prepare a final proposal for a research project for development of a technological solution beyond the present state of the art;
- peer groups in which students present and discuss their progress during the preparation and receive feedback from fellow students and a tutor;
- a grant competition in which final proposals are presented to and evaluated by a student jury.