Course Title	Code
Intensive PhD Course (BIO9110): Biological Micro and Nanosystems that perform biological, clinical or molecular work	BIO9110

ECTC credits:	10
Faculty:	**Faculty of Technology and Maritime S**
Location:	**University College in Vestfold**
Technical Language	**English**

Participants: Ph.D. students at VUC and collaborating institutions

Prerequisite knowledge
Introductory electromagnetics and semiconductor devices. Parallell introduction to MEMS

Aim and objectives
Bringing students up to an Advanced Level of Understanding of the combination of Biotechnology Micro and Nanosystems Technology to perform biological, clinical or molecular work

Upon completion of this course the student should:

- Basic knowledge in the main areas of the cell and molecular biology of the living macro and micro world
- Molecular and biological techniques; cell culture, 3D cell cultivation, target and signal amplification and detection, ELISA, Electrophoresis, NASBA, cell concentration, spectroscopy, blotting techniques, absorbance and fluorescence measurements
- demonstrate a good overview of measurement techniques based on microfluidics, mixing systems, polymer behavior, biological composition, pumping, surface chemistry, counting chemistry, molecular, and structural principles
- explain and master the most common characterization techniques for microsystem devises made in silica, glass or plastics used in biological applications
- select the most appropriate techniques for specific measurement problem
- list and compare key techniques and components and their applications and limits
- perform microfluidics, microfluidic calculation and simulations, biological and device characterization.
- be able to write a scientific publication based on Biological Micro and Nanosystem technology

Outline Syllabus

- Characterization techniques such as:
  - Microsystem devices in silica or glass
  - Microsystem techniques used on plastics
  - Simulation and design of devices for biological and biochemical analysis
  - Microfluidics and pumping
  - BioMedical Engineering techniques and sensors
  - Conventional and on chip target and signal amplification and detection
  - Cell cultivation on Chip – The use of microscope
  - Microbiology and Immunoassay technologies
  - Conventional sample preparation
  - Sample preparation, concentration, lysis, manipulation on Chip
  - Conventional and on Chip DNA/RNA purification

Work Methods/Teaching: Laboratory work including 10 short scientific reports and One Scientific Review
Assessment Method(s): Laboratory 30% Written examination, 5 hours, 70 %.
Compulsory Work / Excercises : Laboratory work and Presentation of Scientific Review

Coordinator (Professional responsible): Professor Frank Karlsen

More detailed reading list

- Six of the chapters from: Fundamentals of BioMEMS and Medical Microdevices (SPIE Press Monograph Vol. PM153) Steven S. Saliterman.
    1. “Soft” Fabrication Techniques
    2. Polymer Materials
    3. Sensor Principles and Microsensors
    4. Micro-Total-Analysis System (MicroTAS)
    5. Detection and Measurment Methods
    6. Emerging BioMEMs Technology
- Nine chapters in DNA and Biotechnology, Molly Fitz Gerald-Hayes Ten chapters in DNA and Biotechnology, Molly Fitz Gerald-Hayes
    1. The DNA Double Helix
    2. DNA in Action
    3. Tools of the DNA Trade
    4. Working with DNA
    5. Human Genomics
    6. Bioinformatics
    7. DNA Forensics
    8. Stem Cell Resrach
    9. Animal Biotechnology
- Different scientific articles: Gulliksen et al., 2007, Zhang et al., 2006, DiBernardo et al., 2007, Toner and Irimia., 2005, Fiorini et al., 2005.