Course Number: 28188

Course Name: Fundamentals and Applications of Lab on a Chip Technology

Course Type:	Type & Max Unit: 3
Prerequisite: Basic BSc courses	Corequisite:
Level: MSc	First Presentation: Spring 2018
Group: Energy Conversion	Last Edition:

Objectives:

Diverse applications of lab-on-a-chip systems in different fields have caused an increasing demand of a better understanding of the microfluidic phenomena behind the final applications. This course aims to provide a theoretical background as well as the state of the art applications in this field. The course covers the entire field of lab-on-a-chip technology, including micro-nano-fluidic principles and microfabrication approaches. It presents concrete examples of lab-on-a-chip applications that have been published recently.

Topics:

Introduction to lab-on-a-chip technology, origins, scaling laws, applications

Microfluidic principles: Fluid dynamic models, Hydraulic circuit analysis, Stokes' flow

Small-scale diffusion: Random walk model, convection diffusion equation; etc.

Small-scale Mixing: Taylor dispersion, chaotic mixing

Capillary effects: Surface tension, Marangoni effect, Tunning of capillary effect,

Microfluidic Components and platforms: Actuation; pumps; mixers; valves; etc.

Introduction to fabrication techniques: Silicon and glass, Polymer materials

Elctrokinetics: Electrostatics and electrodynamics, Electroosmosis, Zetta potential etc.

Electrochemistry: Electrode modeling, Surface chemistry, Kinetics of reactions, Physical modeling of cells

Nanofluidics: Governing equations, Platforms and Fabrication techniques, Applications

Acustofluidics: Basics and novel applications

Optofluidics: Basics and novel applications

References:

J, Kirby, ''Micro- and Nanoscale Fluid Mechanics: Transport in Microfluidic Devices''
H Bruus, ''Theoretical Microfluidics''
M Madou, ''Fundamentals of Microfabrication: The Science of Miniaturization''
Kovacs, ''Micromachined transducers handbook / Kovacs''
Articles that will be introduced during the course.