



BIOMICROFLUIDICS

PROF. TAPAS KUMAR MAITI

Department of Biotechnology
IIT Kharagpur

PROF. SUMAN CHAKRABORTY

Department of Mechanical Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
INTENDED AUDIENCE : Any engineering/Biology discipline

COURSE DURATION : 4 weeks (23 Aug'21 - 17 Sep'21)
EXAM DATE : 24 Oct 2021

COURSE OUTLINE :

Biomicrofluidics is an interdisciplinary domain that fuses microfluidics/ nanofluidics with the science of living systems, having outstanding applications in multifarious domain ranging from medical diagnostics to targeted drug delivery. It is an emerging field of research which today, is not only helping in the understanding of diseases from an engineering perspective, but also aiding in the development of inexpensive, portable, diagnostic platforms that can predict whether a person is carrying a disease, even from a small drop of body fluid, at the remotest of locations. Biomicrofluidics, primarily rests on the pillars of cellular and molecular biology and microscale fluid mechanics. The understanding of any subject in its entirety is often incomplete without knowledge and tools derived from other disciplines. This course is thus intended to give engineers an overview of the biology of the cell and at the same time, biologists, a lucid understanding of fluidic transport processes at the microscale. Eventually, this course aims to demonstrate how the amalgamation of Biology and Engineering is leading to a growing body of knowledge about progression of diseases and the development of simpler replacements of tedious biological assay procedures including affordable point-of-care diagnostic kits.

ABOUT INSTRUCTOR :

Prof. Tapas Kumar Maiti is an Biochemist working for more than two decades on natural anti-cancer lectins, immunomodulatory mushroom glucans, tissue engineering, biomicrofluidics-based understanding of cancer progression, as well as development of microfluidic chip-based cancer-screening devices and drug-testing models.

Prof. Suman Chakraborty is an expert in fluid mechanics with specialization in microfluidics, presently working towards exploiting microscale transport phenomena for the development of inexpensive chip-based extreme point-of-care diagnostic kits.

COURSE PLAN :

Week 1 : Introduction to Biomicrofluidics

Engineers' guide to the cell
Fluidics in living systems and mechanobiology
Pressure driven flows

Week 2 : Surface tension driven flows

Modulating surface tension
Lab on a CD
Introduction to Electrokinetics

Week 3 : Microfluidic cell culture

On-chip cellular assay techniques
Microfluidics for understanding biology

Week 4 : Organ-on-a-chip

Lab-on-a-chip for genetic analysis
Microfluidic technology for monoclonal antibody production