MICRO/NANOFLUIDICS - DESIGN & MODELLING (3-1-0) 3 Cr

Module I (8 hours)
Physics of fluids at the micrometer and nanometer scale, laminar flow, fabrication of microfluidics and nanofluidic devices, applications of nanofluidics for bionanotechnology.

Module II (12 hours)
Micro/nanofluidic computing, Micro-fluidic system assembly. Fundamental aspects of fluid mechanics, scaling laws, flow transport at small length scales. Capillary-driven, pressure-driven, and electro-kinetic based microfluidics, multi-phase flow, droplet-based microfluidics and complex fluids flow, micro-mixing and pumping systems and cell based microfluidics.

Module III (10 hours)
Nanofluidics and surfaces: liquid structure near solid-liquid interfaces: simple liquids; layering electrolytes: Poisson-Boltzmann equation; Debye Hückel approx., nanofluidic transistors, nanofluidic memory.

Module IV (12 hours)
Hydrodynamics at small scales (laminar flow, slip versus no-slip, mixing), electro kinetic effects, solid-liquid interfaces (interactions, adsorption/desorption), 3-phase systems (capillary forces, wetting, superhydrophobicity), electrokinetic effects (electroosmotic pumping, electroviscous effect), electrophoresis and separation techniques, colloids, surface reconstruction, dangling bonds and surface states.

Text Books

1. Nanotechnology Understanding Small Systems, Rogers Pennathur Adams, CRC Press, Taylor & Francis Group.
2. Fundamentals and Applications of Microfluidics by Nam-Trung Nguyen and Steve Wereley

Reference Books

1. Introduction to Solid State Physics : Kittel
2. Introduction to Theory of Solids : H.M. Rosenberg
3. Theoretical Microfluidics by Henrik Bruus, Oxford
4. Introduction to Microfluidics by Tabeling, Oxford
5. Microdrops and digital microfluidics by Jean Berthier
6. The Structure and Rheology of Complex Fluids by R. Larson