20VL025 - MICRO/NANO FLUIDICS

Objectives:

1. Understanding some advanced fluid mechanics relevant to micro scale device.

2. Design and analyze microfluidic devices

3. Demonstrate a basic understanding of principle and processes of microfluidic device fabrication, testing and characterization

4. Understanding lab-on-a-chip and the impact of microfluidics device for application in life science

5. Make reasonable decisions about the microfluidic device, selection, options and performance

Course Outcomes:

CO1. Develop a broad and deep understanding of transport phenomena at the micro/nanoscale

CO2. Understand major applications of micro/nanofluidics

CO3. Understand major methods to fabricate micro/nanofluidic devices

CO4. Be able to design and test new micro/nanofluidic devices for certain applications

UNIT-1

Introduction of microlfuidics and applications in life science. Content: Fundamentals and engineering concept: Introduction of basic principle of fluid mechanics, Navier-Stokes equation, non-slip condition, capillary, drop and micro/nanoparticle, electrokinetics

UNIT-2

Introduction to microfabrication: soft-lithography, self-assembled monolayers; Microfluidic components and sample preparation: micro- pump, filter, valve, dispenser, mixer, reactor, preconcentrator, separation based on electrokinetics, microactuator and particle manipulator

UNIT-3

Experimental measurements: microscopy, fluorescence and laser-induced fluorescence, measurement of flow velocity, temperature and concentration

UNIT-4

Applications in chemistry and life science: s Course Objectives: At the conclusion of this course, students will be able to: ensors for pressure, velocity, concentration, temperature

UNIT-5

Biosensor in environmental monitoring and biodefence, clinical diagnostics, drug discovery and delivery.

Text Book and Reference:

1.“ Micro- and Nanoscale Fluid Mechanics for Engineers: Transport in Microfluidic Devices By Brian J. Kirby. 2009.

2. Tabeling, P. Introduction to Microfluidics, Oxford, 2005.

3. Probstein, R.F. Physicochemical Hydrodynamics, 2nd Ed., Wiley, 1994