

UNIT I: Introduction - Basics of fluid mechanics - flow solutions - Navier-Stokes equation - Flow physics at micrometer scale - Continuum assumption - Scaling laws and dimensionless numbers - Flow in rectangular channels - Hele-Shaw flows.

UNIT II: Fabrication techniques - Photolithography, Additive techniques, Subtractive techniques, Pattern transfer techniques - Silicon based micromachining - Polymer based micromachining - Assembly and packaging of microfluidic devices - Biocompatibility.

UNIT III: Experimental flow characterization - Point wise methods, Full-field methods, Particle image velocimetry - Examples of micro particle image velocimetry.

UNIT IV: Diffusion - Taylor-Aris diffusion - Electrohydrodynamics and Electrokinetics - Electroosmotic flow – Electrophoresis - Capillary electrophoresis - Capillarity and surface tension - Droplet microfluidics.

UNIT V: External Flow and Internal flow control components - microvalves, micropumps, microflow sensors, microneedles, micromixers, microdispensers, microfilters and microseparators, microreactors.

**TEXT BOOKS/ REFERENCES:**

1. Nam-Trung Nguyen and Steven T. Wereley, “Fundamentals and Applications of Microfluidics”, Artech House, 2006
2. Albert Folch “Introduction to BioMEMS”, CRC Press, 2013
3. Patrick Tabeling “Introduction to Microfluidics”, Oxford University Press, 2005