

Examination topics for Fluid dynamics and Microfluidics

1. Basic properties of liquids. Viscosity. Surface tension and capillary forces. Droplets. Pressure inside of droplets. Digital microfluidics.
2. Fluid statics. Pressure on a wall. Buoyancy.
3. Bernoulli equation. Static, stagnation, dynamic and total pressure.
4. Eulerian description of flow: velocity field, acceleration field, streamlines. Material derivatives. Reynolds transport theorem. Control volume. Conservation of mass, momentum and energy.
5. Rotation and deformation in fluids. Viscous flow: Navier-Stokes equation. Solution for pressure driven flow and Couette flow.
6. Dimensional analysis. Buckingham Pi-theorem. Common dimensionless numbers.
7. Flow in pipes. Turbulent flow. Hydraulic resistance and compliance.
8. Flow over immersed layers. Boundary layer.
9. Flow and diffusion. Characteristic times for flow, diffusion and sedimentation.