

## **Momentum, Heat and Mass Transfer**

Introduction to fluids, Fluid statics, Description of flows, Reynolds' transport theorem, Conservation of mass, stream function, Linear Momentum balance, Navier-Stokes' (NS) equation, Bernoulli equation and applications including flow measurement, Pipe flows and losses in fittings, Similitude and modeling, High Re flow: Prandtl's approximation, basic inviscid flow, need for boundary layer, Magnus effect, Boundary layers- elementary results for flat plates, Separation, flow past immersed bodies; Introduction to heat transfer, rate law and conservation law, Conduction equation, Steady state conduction- concept of resistances in series and of critical thickness of insulation, Unsteady conduction: Biot and Fourier numbers, Heissler charts, penetration depth, Convection, energy equation without dissipation and pressure terms, non-dimensionalization, Nusselt number and correlations; Simple ideas of mass transfer, similarity with heat transfer, Use of steady 'conduction' concepts to solve simple steady cases in dilute solutions as well as in stationary solids.