

SYLLABUS :-

Introduction: Fundamentals of kinetic theory-molecular models, micro and macroscopic properties, binary collisions, distribution functions, Boltzmann equation and Maxwellian distribution functions, continuum hypothesis and deviations from the same, scaling laws for micro-domains, Microscale gas flows: Wall slip effects and accommodation coefficients, flow and heat transfer analysis of microscale Couette flows, Pressure driven gas micro-flows with wall slip effects, heat transfer in micro-Poiseuille flows, effects of compressibility, introductory concepts on gas flows in transitional and free molecular regimes, some representative applications of micro-scale gas flows in accelerometers, micro-propulsion and micro-nozzles, Microscale liquid flows: Pressure driven liquid microflow, apparent slip effects, physics of near-wall microscale liquid flows, capillary flows, electro-kinetically driven liquid micro-flows and electric double layer (EDL) effects, concepts of electro-osmosis, electrophoresis and dielectrophoresis, analysis of hydro-dynamically and thermally fully developed electro-osmotic flows, ac electro-osmosis, an introduction to fluid dynamics over nano scales (nanofluidics), concepts of nano-fluids and their augmented transport characteristics, An introduction to bio-microfluidics and some illustrative applications (drug delivery, DNA hybridization, leukocyte rolling etc.), An introduction to special computational modelling of micro-flows: MD and DSMC methods.