Advanced Fluid Mechanics

Description of fluid flow: with reference to translation, rotation and deformation concept of continuum, control mass & control volume approach, Reynolds transport theorem. Steady flow and uniform flow.

Velocity field, one & two-dimensional flow analysis, circulation and vorticity, stream function and velocity potential function, potential flow, standard flow patterns, combination of flow patterns, flow net.

Dimensional Analysis as a tool in design of experiments, identification of non-dimensional numbers and their significance, dimensional analysis methods.

Equations of motion for laminar flow of a Newtonian fluid - Viscous flow – Navier-Stoke's equations, simple exact solutions.

Boundary Layer Theory-Formation, growth and separation of boundary layer-Integral momentum principles to compute drag and lift forces-Mathematical models for boundary layer flows.

Turbulence, Origen of turbulence universal velocity distribution laws of turbulence, smooth rough and transitional turbulent flow in pipes, pipe resistance equation for pipes design of pipe networks.

Diffusion and dispersion of pollutants in natural streams.

References:

1. Som S. K and Biswas G "Introduction to Fluid Mechanics and Fluid Machines",TMH
2. Schlichting: "Boundary Layer theory", International Text – Butterworth
3. Fox R.W., Pitchard P.J, and Mcdonald A "Fluid Mechanics" Wiley India.
4. Rouse, H. "Advanced Fluid Mechanics", John Wiley & Sons, N York
5. White, F.M. "Viscous Fluid Flow", McGraw Hill Pub. Co, N York
6. Yalin, M.S. "Theory of Hydraulic Models", McMillan Co.
7. Mohanty A.K. "Fluid Mechanics", Prentice Hall of India, N Delhi.