SUBJECT NO-ME61003, SUBJECT NAME- ADVANCED FLUID MECHANICS

LTP- 3-1-0,CRD- 4

SYLLABUS :-

Concept of continuum and definition of a fluid. Body and surface forces, stress tensor. Scalar and vector fields, Eulerian and Lagrangian description of flow. Motion of fluid element ; translation, rotation and vorticity; strain rate tensor, continuity equation, stream function and velocity potential. Constitutive equations, derivation of Navier;Stokes equations. Exact solutions of Navier;Stokes equations: plane Poiseuille flow and Couette flow, Hagen;Poiseuille flow, flow between two concertic rotating cylinders, Stokes first and second problem, Hiemenz flow, flow near a rotating disk, flow in convergent-divergent channels. Slow viscous flow: Stokes and Oseen s approximation, theory of hydrodynamic lubrication. Thin-film equations. Boundary layer: derivation, exact solutions, Blasius, Falkner Skan, series solution and numerical solutions. Approximate methods. Momentum integral method. Two dimensional and axisymmetric jets. Introduction to Hydrodynamic stability: linear stability of plane Poiseuille flow, Orr;Sommerfeld equation. Description of turbulent flow, velocity correlations, Reynolds stresses, Prandtl s Mixing Length Theory, Karman s velocity defect law, universal velocity distribution. Concepts of closure model, eddy viscosity models of turbulence- zero equation, one equation and two-equation models.