

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 3 Chemical Engineering

Subject Code 130502
Subject Name Fluid Flow Operation

Sr.No	Course contents
1	Fluid static and its application: Nature of fluids, Pressure concept, Hydro static equilibrium, decanters like continuous gravity, centrifugal.
2	Fluid Flow Phenomena: Velocity fluid, Velocity gradient and rate of shear, Newtonian and Non-Newtonian fluids, Viscosity and momentum flux, Reynolds number and its significance, laminar and turbulent flow; Turbulence, Reynolds stresses, Eddy viscosity, Laminar and Turbulent flow in boundary layers, boundary layer formation in straight tubes, boundary separation and wake formation.
3	Basic equations of Fluid Flow: Mass velocity; average velocity; potential flow; streamlines, stream tubes, macroscopic momentum balance, momentum correction factor, Equation of continuity, Bernoulli's equation, corrections for fluid friction, pump work in Bernoulli's equations, angular momentum equations,
4	Flow of incompressible fluids in Conduits and Thin Layers: Flow of incompressible fluids in Conduits and Thin Layers in pipes, relation between skin friction and wall shear, friction factor laminar flow in pipes, kinetic energy factor and momentum correction factor for laminar flow of Newtonian fluids, Hagen-Poiseuille equation, effect of roughness, friction factor chart, friction factor inflow through channels of non-circular cross section, equivalent diameter, hydraulic radius, friction from changes in velocity or direction, flow through sudden enlargement of cross section, flow through sudden contraction of cross section, effect of fittings and valves, form friction losses in Bernoulli's equations, separation of boundary layers in diverging channel.
5	Flow of Compressible fluids: Mach number, continuity equation total energy balance equation, velocity of sound, processes of compressible of flow like isentropic expansion, adiabatic frictional flow, isothermal frictional flow, velocity in nozzles.
6	Flow past immersed bodies: Drag, drag coefficient, form drag, and stream lining, friction in fluids through bed of solids, fluidization, condition of fluidization, types of fluidization application of fluidization, continues fluidization, slurry and pneumatic transport.

7	Transportation and Metering of fluid: Pipe and tubing, joint and fittings selection of pipe sizes, prevention of leakage around moving parts, stuffing boxes, mechanical seals, valves like Gate, Globe, Plug cocks, Ball, Check valves.
8	Fluid moving machinery: Pumps its characteristics like developed head power requirement suction lift and cavitations; positive displacement pumps like reciprocating, rotary pumps, centrifugal pumps and its theory, characteristic of head capacity relation pump priming, fans blowers like positive displacement, centrifugal, compressor efficiency, vacuum pumps , jet ejectors, comparison of devises for moving fluids.
9	Measurement of flowing fluids: Full bore meter like venturimeter, orifice meter, coefficient of discharge of venturimeter, orifice meter, area meters like Rotameter, target meters, vortex-shedding meters, coriolis meters, magnetic meters etc., insertion meters like pitot tubes etc. Recent advancement in different pumps, valves and measuring devices.
10	Dimensional Analysis: Different methods of dimensional analysis applied to fluid flow problems.

Reference Books:

1. McCabe W L, Smith J C, Harriott P, "Unit Operations of Chemical Engineering", 7th Ed. McGraw Hill, 2005
2. Coulson, Richardson "Chemical Engineering " Vol. I.
3. Knudson and Katz. "Fluid Dynamics and Heat Transfer"