CH 487 FLUID FLOW OPERATION

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Time : 3 hrs
Theory : 100 marks
Sessional : 50 marks
Practicals 50 Marks

1. **INTRODUCTION** :Properties of fluids, compressible and incompressible fluids, Normal forces on fluids, Dimensional analysis.

2. FLUID STATICS : Principle of hydrostatic equilibrium, barometric equation, pressure management manometer.

3. FLUID FLOW PHENOMENA : Velocity field, laminar flow, velocity gradient and rate of shear, Eddie viscosity, viscosity and momentum flux, shear stress field, Newtonian and non- Newtonian fluids, Binghham model, Ostwald-de Waele model of non-Newtonian fluid, turbulent flow, Reynold's experiments, flow in boundary layer, laminar and turbulent flow in boundary layer, transition from laminar to turbulent flow – Reynold's number, boundary layer separation and wake formation.

4. BASIC EQUATION OF FLUID FLOW :Stream lines and stream tubes, average velocity, mass velocity, integral equation of flow – Euler's equation of motion, momentum equation for one dimensional flow under steady state condition, the Bernoulli's equation, its application to pumps, blowers, turbines etc.

5. FLOW OF INCOMPRESSIBLE FLUID IN CONDUITS :Flow of incompressible fluids in pipes, boundary layer formation in straight tube, laminar flow of Newtonian fluids, Hagen- Poisseuille equation, laminar flow of non-Newtonian fluids, velocity distribution for turbulent flow, average velocity, relation between maximum and average velocity, application of dimensional analysis to fluid flow problems – friction factor, pipe roughness, loss of head due to friction, bends, fittings etc.

6. FLOW PAST IMMERSED BODIES : Drag, Drag-co-efficient , turbulence, friction in flow through bed of solids – Kozeny-Carman equation, Blake-Plummer equation, motion of particles through fluids, equation for one dimensional motion of particle through fluid.

7. FLUIDIZATION : Mechanism of fluidization, batch fluidization, minimum porosity, maximum bed density, bed height, pressure drop in fluidized bed, uses of fluidization.

8. TRANSPORTATION AND METERING OF FLUIDS : Orifice meter, Venturimeter, Pitot tube, Rotameter and Weir-its principle, theory and application. Classification and performance of pump, compressor, blower, selection and specification.

9. COMPRESSIBLE FLUIDS : Continuity equation, total energy balance, mechanical energy balance, ideal gas equation, process compressible fluids.

Practicals:
1. Experiment on Reynold's apparatus
2. Experiment on turbulent flow apparatus
3. Flow characteristics through venture meter, orifice meter
4. Verification of Bernoulle's equation.
5. Determination of friction factor at different floe rates for SS aluminum, copper pipe
6. Frictions losses in pipes, bends, fittings etc.

BOOKS:
Unit Operation of Chemical Engg. by – Mccabe and Smith.
Chemical Engg. Vol-I by – Coulson and Richardson.
Introduction to Chemical Engg. by – Badger and Banchero.