MOMENTUM TRANSFER

Course Code :15CH1103

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Course Outcomes:

On successful completion of the course, the student should be able to

CO 1 Calculate dimensional consistency of a given equation. Identify different flow patterns.

CO 2 Analyze incompressible flow in pipes and channels.

CO 3 Analyze compressible fluids.

CO 4 Explain flow past immersed bodies and two phase flow.

CO 5 Identify different equipment for transportation and metering of fluids.

UNIT-I **(10 Lectures)**

Unit operations, unit systems, dimensional analysis, basic concepts, Fluid statics and its applications-hydrostatic equilibrium, applications of fluid statics. Fluid flow phenomena - laminar flow, shear rate, shear stress, rheological properties of fluids, turbulence, boundary layers, Basic equation of fluid flow – mass balance in a flowing fluid, differential momentum balance and mechanical energy equations.

UNIT-II **(10 Lectures)**

Incompressible flow in pipes and channels- shear stress and skin friction in pipes, laminar flow in pipes and channels, turbulent flow in pipes and channels, friction from changes in velocity or direction.

UNIT-III **(10 Lectures)**

Flow of compressible fluids - definitions and basic equations, processes of compressible flow, isentropic flow through nozzles, adiabatic frictional flow, and isothermal frictional flow.

UNIT-IV (10 Lectures)

Flow past immersed bodies, drag and drag coefficient, flow through bed of solids, motion of particles through fluids, fluidization. Two phase flow: Applications of Gas-Liquid, Gas-Solid, Solid-Liquid flows in Chemical engineering.

UNIT-V (10 Lectures)

Transportation and metering of fluids- pipes, fittings and valves, pumps: positive displacement pumps and centrifugal pumps. Fans, blowers, and compressors, measurement of flowing fluids- full bore meters, insertion meters.

TEXT BOOKS:

1. McCabe W.L., Smith J.C. and Harriot P., *"Unit Operations of Chemical Engineering"*, 7th Edition, McGraw-Hill, 2005.
2. De Nevers, N., *"Fluid Mechanics for Chemical Engineers"*, 3rd Edition, McGraw Hill, 2005.

REFERENCE:

1. James O Wilkes., *"Fluid Mechanics for Chemical Engineers"*, 2nd Edition, Prentice Hall, New Jersey, 2006.