TOPIC:FLUID FLOW

Disclaimer

All the content material provided here is only for teaching purpose

Fluid flow

- Mention fluid **properties** such as viscosity, compressibility and surface tension of fluids.
- Hydrostatics (**Fluidststics**) influencing fluid flow.
- **Fluid dynamics**- Bernoulli's theorem, flow of fluids in pipes, laminar and turbulent flow.

THE PROPERTIES OF FLUIDS

- u VISCOSITY
- u SURFACE TENSION
- u COMPRESSIBILITY

Viscosity is a measure of a fluid's resistance to flow.

It describes the internal friction of a moving fluid.

A fluid with large viscosity resists motion because its molecular makeup gives it a lot of **internal friction**.
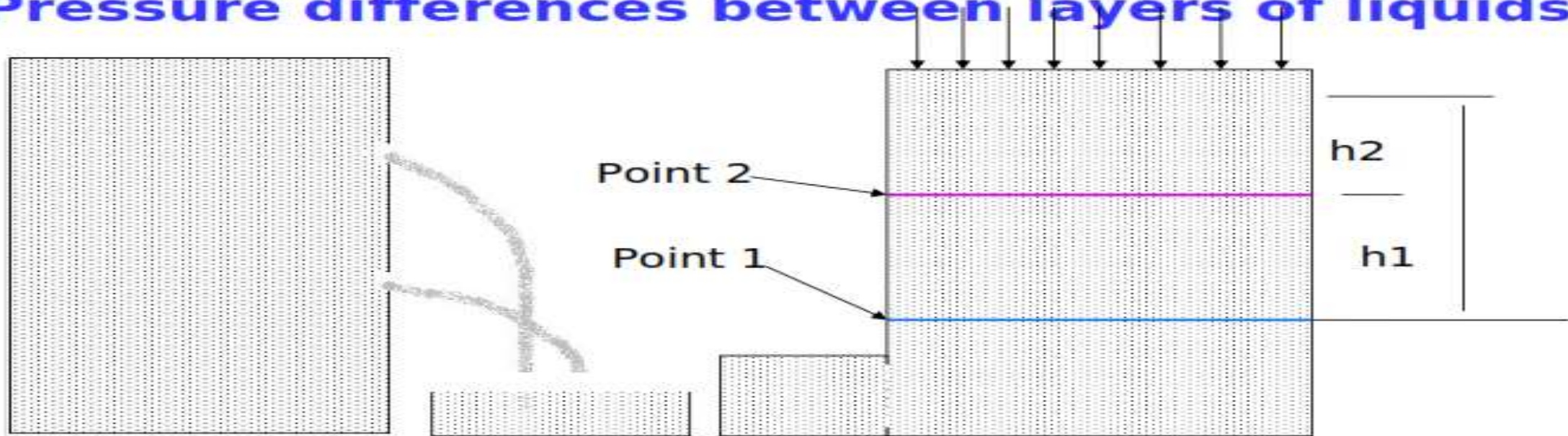
A fluid with **low** viscosity **flows easily** because its molecular makeup results in very little friction when it is in motion.

FLUID STATICS

- Ø **Fluid static's deals with the fluids at rest in equilibrium**
- Ø **Behavior of liquid at rest**
- Ø **Nature of pressure it exerts and the variation of pressure at different layers**

Pressure differences between layers of liquids

FLUID DYNAMICS

Ø **Fluid dynamics deals with the study of fluids in motion**

Ø **This knowledge is important for liquids, gels, ointments which will change their flow behavior when exposed to different stress conditions**

MIXING

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FLOW THROUGH PIPES

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FILLED IN CONTAINER

Reynolds Experiment

Glass tube is connected to reservoir of water, rate of flow of water is adjusted by a valve,

A reservoir of colored solution is connected to one end of the glass tube with help of nozzle.
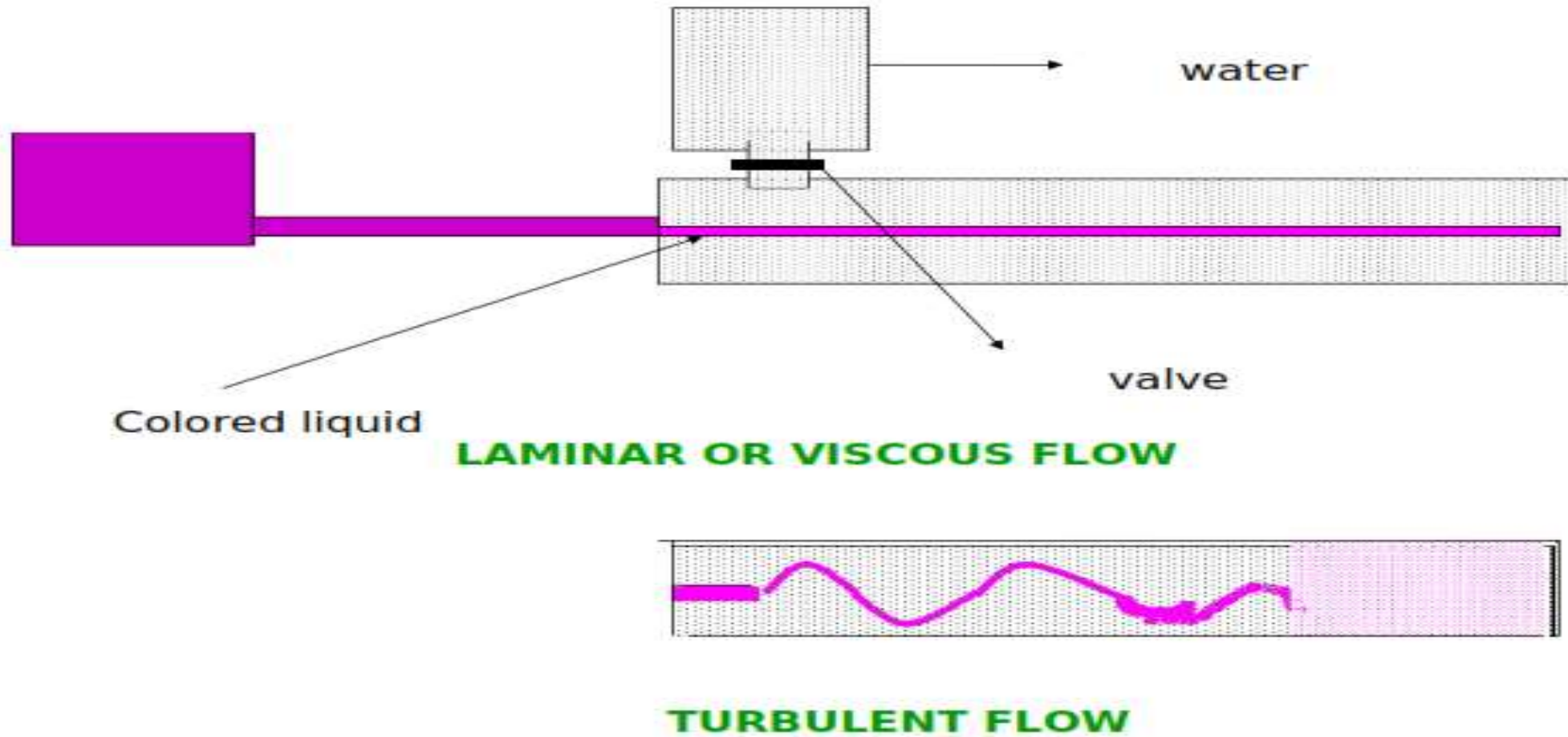
Colored solution is introduced into the nozzle as fine stream through jet tube.

water

valve

Colored liquid

LAMINAR OR VISCOUS FLOW

TURBULENT FLOW

REYNOLDS NUMBER

In Reynolds experiment the flow conditions are affected by
- Ø Diameter of pipe
- Ø Average velocity
- Ø Density of liquid
- Ø Viscosity of the fluid

This four factors are combined in one way as Reynolds number

$$Re = \frac{D \, u \, \rho}{\eta} = \frac{\text{INERTIAL FORCES}}{\text{VISCOUS FORCES}}$$

- Ø **Inertial forces** are due to mass and the velocity of the fluid particles trying to diffuse the fluid particles
- Ø **viscous force** if the frictional force due to the viscosity of the fluid which make the motion of the fluid in parallel.

References

1: H., K AWAM UR A, H . & MATSUO, Y. 2001 Direct numerical simulation of a fully developed turbulent channel flow with respect to the Reynolds number dependence. J. Fluid. Eng. - T. 123, 382–393

2: R. A., KIM, J. & BROW NE, L. W. B. 1991 Some characteristics of small-scale turbulence in a turbulent duct flow. J. Fluid Mech. 233, 369–388

3:https://studylib.net/doc/8164236/ppt---manometer