UNIT-III
VISCOSITY

BY

BHANUDAS NARWADE

DEPT. OF PHYSICS

DEGLOOR COLLEGE,DEGLOOR

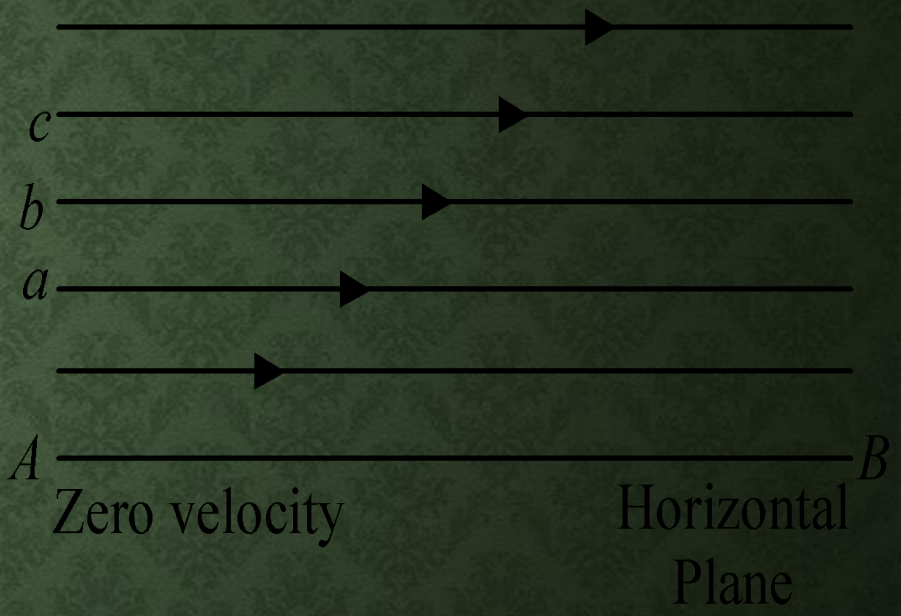
INTRODUCTION:

When liquid flows slowly and steadily over a fixed horizontal surface , its layer in contact with surface is stationary

Velocity of other layer increases from distance from fixed surface ie velocity gradient

Greater the distance of layer from fixed surface, greater its velocity

Such a flow is called Laminar flow

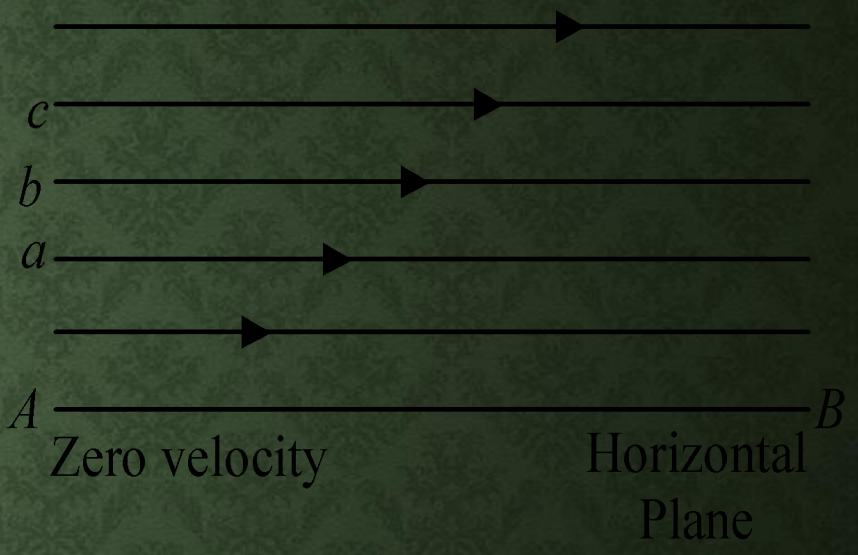


INTRODUCTION:

Two adjacent layers with velocity gradient will tend to destroy their relative motion just like backward dragging force acting tangentially on the layers.

The relative velocity between two layers is to be maintained an external force must be applied to overcome dragging force

If not, relative motion destroyed and flow ceases



VISCOSITY:

Viscosity: property of liquid by virtue of which it opposes relative motion between its different layers is called viscosity

OR

Internal friction of liquid

COEFFICIENT OF VISCOSITY:

Newton showed that viscous force acting tangentially on any liquid layer is directly proportional to

1) Surface area A
2) Velocity v

And inversely proportional to

Distance x from stationary layer

$F \propto A$ $F \propto -v$ $F \propto \frac{1}{x}$

$$F \propto -\frac{Av}{x}$$

$$F = -\eta . \frac{Av}{x}$$

COEFFICIENT OF VISCOSITY:

$F = -\eta . \frac{Av}{x}$

Negative sign indicates viscous force is opposite to velocity

η is constant depending upon nature of liquid called coefficient of viscosity

Putting *v/x* in the form of *dv/dx* rate of change of velocity with distance or velocity gradiaent

$F = -\eta . A \frac{dv}{dx}$ This is Newtons law of viscous flow in streamline flow

If A=1 and $\frac{dv}{dx}$=1 then

$F = \eta$

COEFFICIENT OF VISCOSITY:

Coefficient of viscosity of liquid:

Tangential force required per unit area to maintain unit relative velocity between two layers unit distance apart

Or

Tangential force acting on unit area of layer of liquid per unit velocity gradient

MKS unit :N.s/m^2

CGS unit: poise