TYPES of FLUIDS

The fluids may be classified in to the following five types.

1. Ideal fluid
2. Real fluid
3. Newtonian fluid
4. Non-Newtonian fluid
5. Ideal plastic fluid

1. **Ideal fluid**: A fluid which is compressible and is having no viscosity is known as ideal fluid. It is only an imaginary fluid as all fluids have some viscosity.

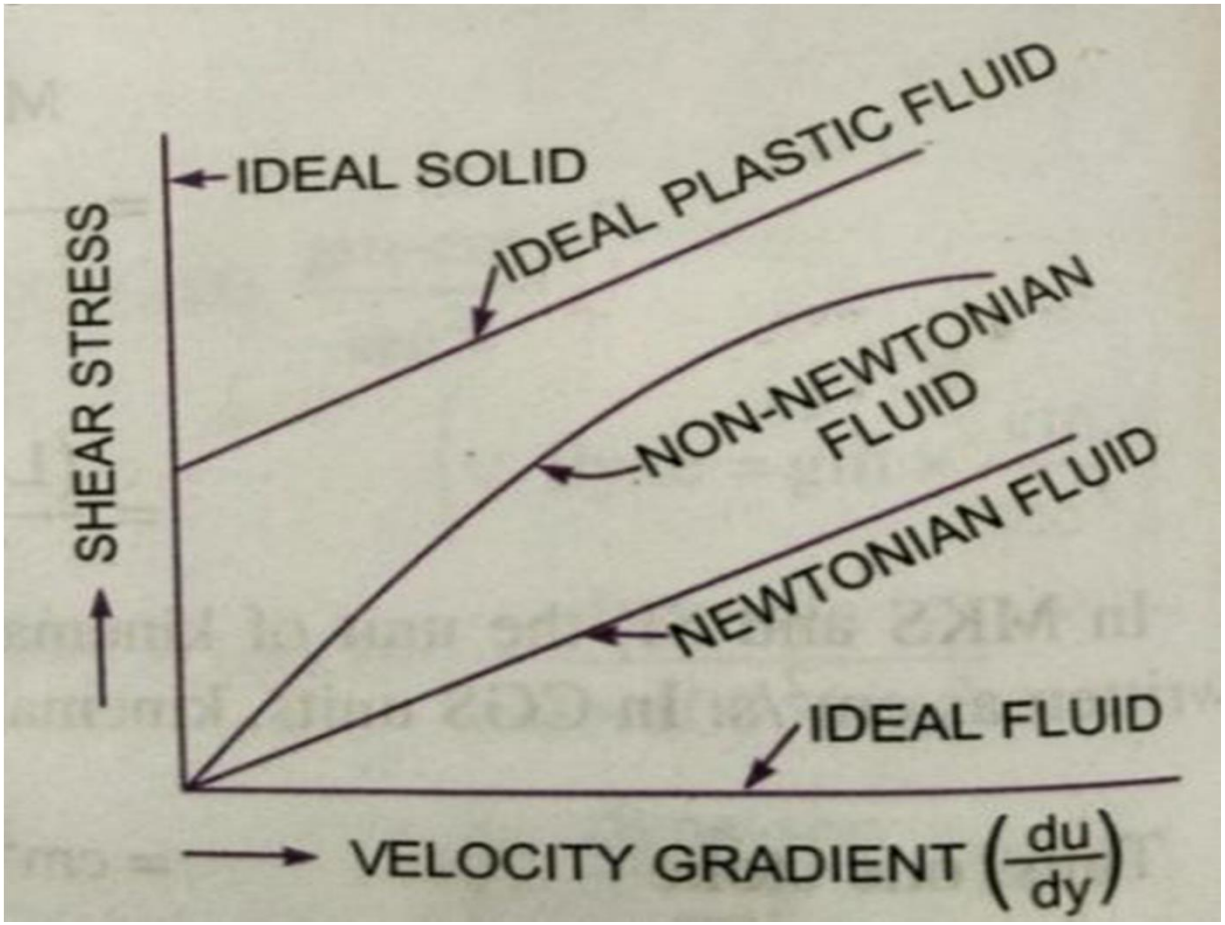
2. **Real fluid**: A fluid possessing a viscosity is known as real fluid. All fluids in actual practice are real fluids.

3. **Newtonian fluid**: A real fluid, in which the stress is directly proportional to the rate of shear strain, is known as Newtonian fluid.

4. **Non-Newtonian fluid**: A real fluid in which shear stress is not Proportional to the rate of shear strain is known as Non- Newtonian fluid.

5. **Ideal plastic fluid:** A fluid, in which shear stress is more than the yield value and shear stress is proportional to the rate of shear strain is known as ideal plastic fluid.

Conti…


IDEAL SOLID
IDEAL PLASTIC FLUID
NON-NEWTONIAN FLUID
NEWTONIAN FLUID
IDEAL FLUID
SHEAR STRESS
VELOCITY GRADIENT (du/dy)

Non-Newtonian Fluids $\left(\tau \neq \mu \frac{du}{dy}\right)$

Purely Viscous Fluids

Time - Independent

1. Pseudo plastic Fluids

$$\tau = \mu\left(\frac{du}{dy}\right)^n ; n < 1$$

Example: Blood, milk

2. Dilatant Fluids

$$\tau = \mu\left(\frac{du}{dy}\right)^n ; n > 1$$

Example: Butter

3. Bingham or Ideal Plastic Fluid

$$\tau = \tau_o + \mu\left(\frac{du}{dy}\right)^n$$

Example: Water suspensions of clay and flyash

Time - Dependent

1.Thixotropic Fluids

$$\tau = \mu\left(\frac{du}{dy}\right)^n + f(t)$$

f(t)is decreasing

Example: Printer ink; crude oil

2. Rheopectic Fluids

$$\tau = \mu\left(\frac{du}{dy}\right)^n + f(t)$$

f(t)is increasing

Example: Rare liquid solid suspension

Visco-elastic Fluids

Visco- elastic Fluids

$$\tau = \mu\frac{du}{dy} + \alpha E$$

Example: Liquid-solid combinations in pipe flow.