

1. INTRODUCTION OF FLUID MECHANICS

FLUID: It's a substance which capable of flowing.

FLUID MECHANICS: It's science which deals with static and dynamic condition of fluid on action of force and interaction of fluid with respect of another fluid or solid on the boundary.

SOLID	LIQUID
Solid does not deform continuously under the action of same shear stress.	Fluid deform continuously under the action of same shear stress.
Solid may regain shape after removal of shear stress.	Fluid deformation is permanent.
For solids shear stress is directly proportional to shear strain with elastic limit. E.g. Hook's Law	In fluids absolute value of shear strain is not important but rate of shear strain is important. E.g. Newtons law of viscosity
Solids are elastic in nature.	Fluids are viscous in nature.

Solids: Elastic	Liquids: Viscous	Fluid: Elastic + Viscous E.g. Blood clot, earth's mantle, etc...
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	LIQUID	GAS
Space Between Molecules	Small comparison	Larger comparison
Force of Attraction Between the Molecules	Enough to keep the liquid molecules together.	Minimum attraction between molecules allowing greater freedom of movement
Volume Comparison	Definite Volume	No definite Volume, occupies the volume of the container in which it's kept
Compressibility	Low or Incompressible	Compressible

CONTINUUM CONCEPT:

- The continuum assumption is an idealization of continuum mechanics under which fluids can be treated as continuous, even though, on a microscopic scale, they are composed of molecules. The continuum hypothesis can lead to inaccurate results in applications like supersonic speed flows, or molecular flows on nano scale.
- Continuum concept validation.

$K_n = \lambda/L$	λ = Mean Free Path=Avg. distance just before collision	L = Characteristic Dimension
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Knudsen No.: K_n	Type of Flow
≤ 0.01	Continuum is valid
$0.01 < K_n \leq 0.1$	Slip Flow
$0.1 < K_n \leq 10$	Transition Flow
$K_n > 10$	Free Molecular Flow

- Continuous mass function of molecules/ Space & time.
- It's valid for highly Compressed Gases, Liquids, etc...
- If continuum concept is not valid, Rarefied Gas theory is used. E.g. Low Dense gas, Vacuum flow, etc...

CLASSIFICATION OF FLUID MECHANICS		
FLUID STATICS	FLUID KINEMATICS	FLUID DYNAMICS
Fluids @ rest	Fluids are in motion without referring to the force acting on it.	Fluids are in motion with referring to the force acting on it.
Fluids in equilibrium Under the action of external forces		

MEASUREMENT UNITS				
	SI SYSTEM	MKS		FPS SYSTEM
	Everywhere It's used	Absolute	Gravitational	
MASS	kg	kg	$m. slug$	g
FORCE	N	N	kgf	
PRESSURE	Pa		$1kgf = 9.81N$	