**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.

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| **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. |

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| 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.

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|  | Mean Free Path=Avg. distance just before collision | Characteristic Dimension |

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|  | Type of Flow |
|  | Continuum is valid |
|  | Slip Flow |
|  | Transition Flow |
|  | 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…

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| **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 |

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| **MEASUREMENT UNITS** | | | | |
|  | **SI SYSTEM** | **MKS** | | **FPS SYSTEM** |
|  | Everywhere It’s used | Absolute | Gravitational |  |
| MASS |  |  |  |  |
| FORCE |  |  |  |  |
| PRESSURE |  |  |  |  |