

INTRODUCTION TO FLUID MECHANICS

Fluid Mechanics

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Anything which is tangible, occupies space and posses mass is called matter or substance.

The matter which can flow is called fluid

Flow is a phenomenon in which matter goes under continuous deformation under the influence of applied shear stress

***FLUID MECHANICS** is the branch of science which deals with the behavior of the fluids (liquids or gases) at rest as well as in motion. Thus this branch of science deals with the static, kinematics and dynamic aspects of fluids*

FLUID MECHANICS

FLUID

- *any substance which can flow which can flow*
- *cannot resist any shear force*
- *Continuous deformation*
- *Relative change of position of particles with respect to time*
- *Does not have certain shape*

FLUID MECHANICS

- *MECHANICS: Science that deals with the forces and the effects of the forces*

FLUID MECHANICS

- *Solids can resist the shear under the static equilibrium condition with finite deformation . In some cases if the stress is released solids may regain their original shape*
- *Fluids go on continuous deformation when experience shear stress fluids don't get their or regain their original shape after the stress is released*

FLUID MECHANICS

- The study of fluid at rest is called **FLUID STATICS**
 - The study of fluid in motion, where pressure forces are not considered is called **FLUID KINEMATICS**
 - The study of fluid in motion where pressure forces are considered is called **FLUID DYNAMICS**
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- *INTRODUCTION: fluid, properties of fluid, types of fluid*
- *FLUID STATICS: pressure , pressure measurements, manometry hydrostatic pressure on surfaces*

SYLLABUS

- *FLUID KINEMATICS: Eulerian lagranian approaches , continuity equation , velocity, acceleration, rotation, circulation,*
- *FLUID DYNAMICS: motion with force, Euler equation, Bernoulli equation, applications of these equations, pitot tube, venturi meter, orifice meter, impulse momentum theorem*

SYLLABUS

- *FLUID FLOW: Ideal fluid flow, viscous flow, pipe flow , boundary layer theorem , drag and lift, flow in open channels.*
- *DIMENSIONAL ANALYSIS*

SYLLABUS

- *MACROSCOPIC: fluid as a whole*
- *MICROSCOPIC : avg: molecular behavior*

APPROACHES OF FLUID MECHANIS STUDY

MACROSCOPIC

- *fluid as a whole*
- *Void space is negligible in comparison to total volume*
- *Continuous distribution of mass*

MACROSCOPIC APPROACH OF FLUID MECHANIS

$$Ku = \lambda / L$$

Where

L = characteristic length

λ = mean free path

Knudsen number

If Ku less than 0.01
(continuum/ no slip condition)

If Ku between 0.01 and 0.1
(slip flow condition)

If Ku between 0.1 and 10
(Transition flow condition)

If Ku greater than 10
(free molecular flow)

Knudsen number

SURFACE FORCES

BODY FORCE (*gravitational force*)

FORCES ON A FLUID
