INTRODUCTION TO FLUID MECANICS

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

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

- *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**

SYLLABUS CLO – 01

- ***CLO-01 INTRODUCTION TO FLUID MECHANICS****: fluid, properties of fluid, types of fluid*
- ***CLO-01 FLUID STATICS:*** *pressure intensity , pressure measurements, manometry hydrostatic pressure on surfaces*
- ***CLO-01 FLUID KINEMATICS:*** *Eularian lagranian approaches , continuity equation , velocity, acceleration, rotation, circulation,*

SYLLABUS CLO - 02

- ***CLO-02 FLUID DYNAMICS****: motion with force, Euler equation, Bernoulli equation, applications of these equations, pitot tube, venturi meter, orifice meter, impulse momentum theorem*

- ***CLO-02 STEAD FLOW THROUGH PIPES:*** *ideal flow, viscous flow, pipe networks, boundry layer theory , drag and lift force, flow in open chanel*

SYLLABUS

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

APPROACHES OF FLUID MECHANIS STUDY

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

MACROSCOPIC

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

MACROSCOPIC APPROACH OF FLUID MECHANIS

Knudsen number

$$Ku = \lambda / L$$

Where

L = *characteristic length*

λ = *mean free path*

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 then 10
(free molecular flow)

Knudsen number

SURFACE FORCES

BODY FORCE *(gravitational force)*

FORCES ON A FLUID