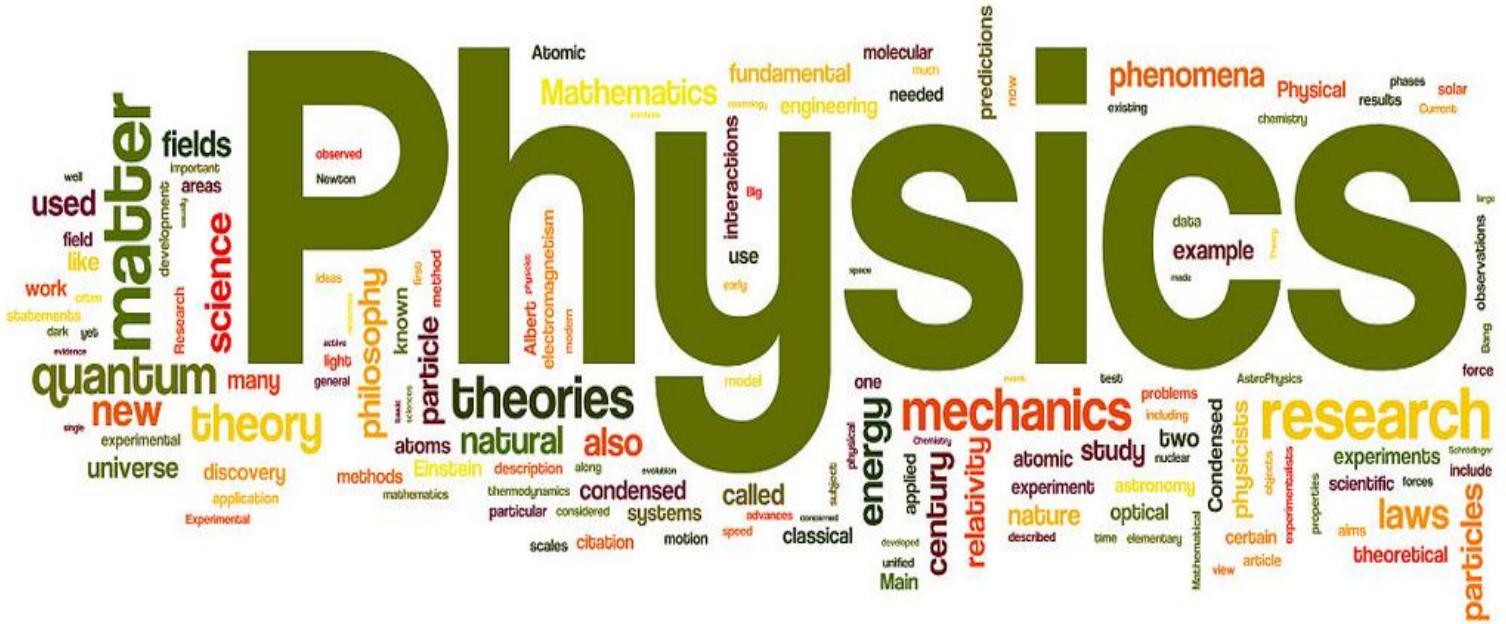
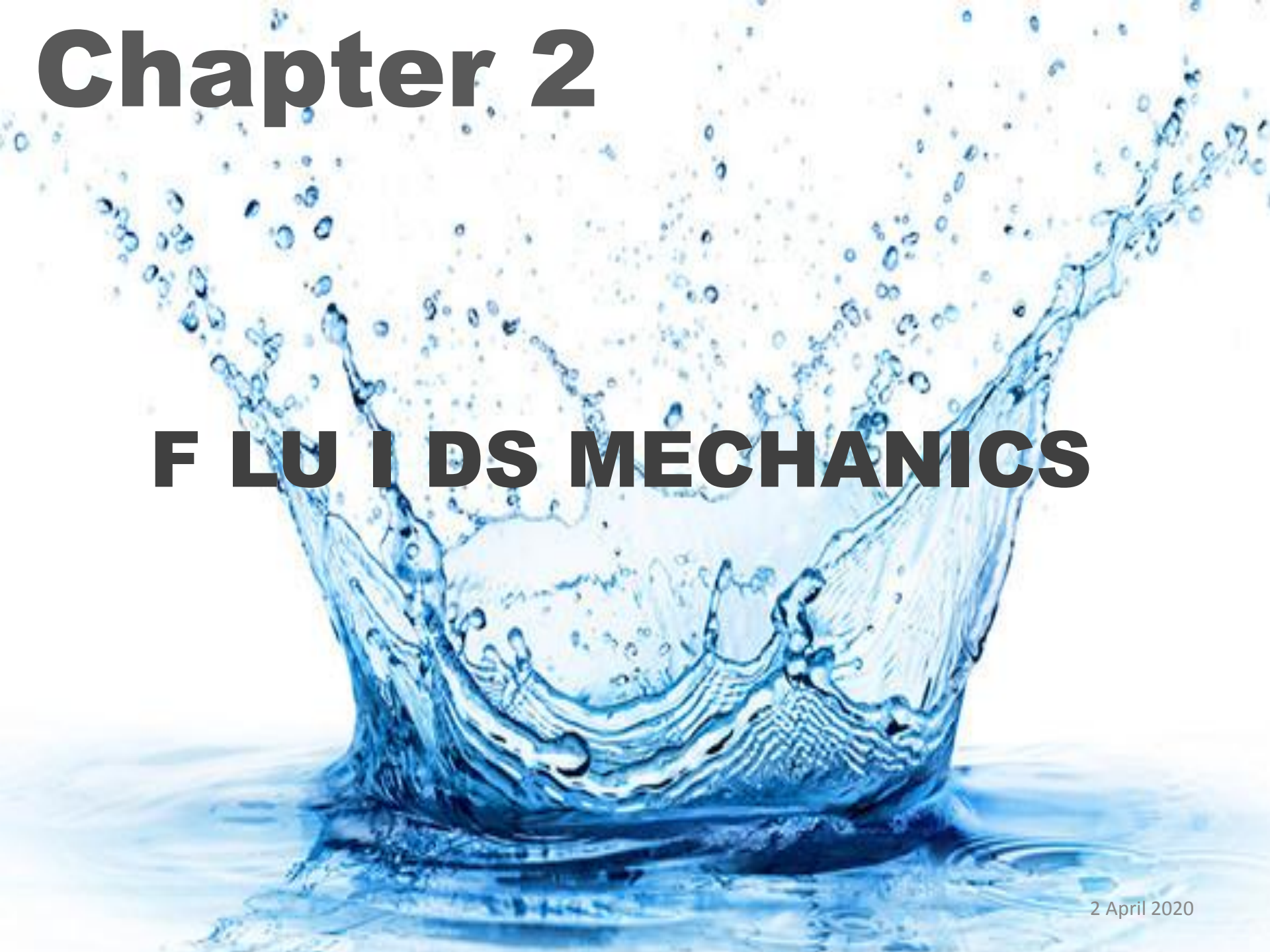


(PHY 101)

Dr. Hossam Bay El-Din

2 April 2020

Chapter 2



F LU I DS MECHANICS

2 April 2020

Chapter 2

FLUID DYNAMICS

Fluid dynamics:- is the study of fluid in motion

Typing of fluids

Ideal fluids

which is simpler to handle mathematically and yet provides useful results.

Real fluids

is very complicated and not yet fully understood

Chapter 2

FLOWING TYPES

1. Laminar flew

السريان الهادى

او المنتظم

2. Turbulent flow

السريان المضطرب

FLUID DYNAMICS

Here are three assumptions that we make about our ideal fluid; they all are concerned with *flow:*

The fluid is non-viscous

The flow is steady or irrotational

The flow is incompressible

Chapter 2

THE CONTINUITY EQUATION

Consider an ideal fluid as shown in fig represents a portion of tube of flow

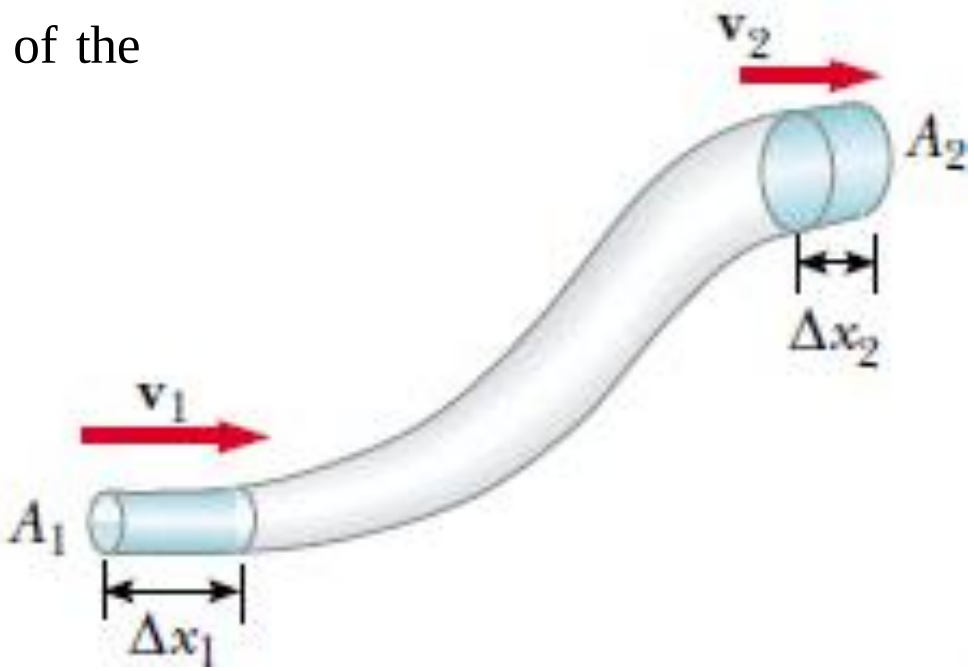
Between two fixed cross section areas ***A1 and A2***.

let *v1 and v2* be the speeds in these section

In a time *t*, the fluid at the bottom end of the pipe moves a distance.

$$\Delta x_1 = v_1 \Delta t$$

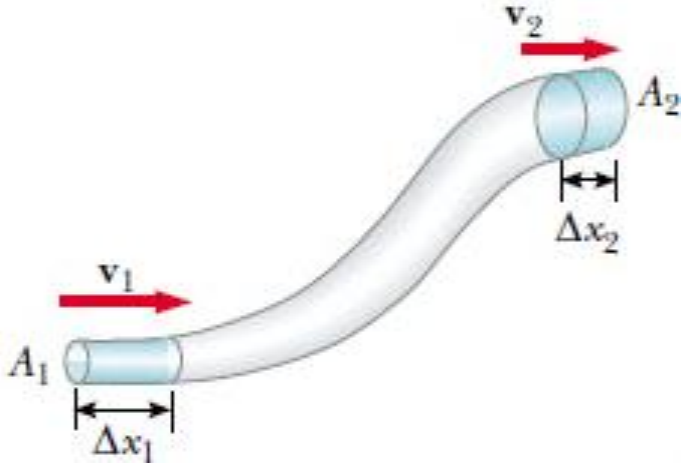
$$\Delta x_2 = v_2 \Delta t$$



THE CONTINUITY EQUATION

the mass ***m*** of fluid contained in the left

$$m = \rho V$$



$$m_1 = \rho A_1 \Delta x_1 = \rho A_1 v_1 t$$

$$m_2 = \rho A_2 \Delta x_2 = \rho A_2 v_2 t$$

However, because *mass is conserved* and because the flow is steady,

the mass that crosses A_1 in a time t must equal the mass that crosses A_2 in the time t. That is

THE EQUATION OF CONTINUITY

$$m_1 = m_2$$

So

$$\rho A_1 v_1 t = \rho A_2 v_2 t$$

this means that:

$$A_1 v_1 = A_2 v_2 = cons.$$ ***Or Av = constant***

When the cross section *A* of a flow decreases the velocity *V* increases

NOTA :- The unit of Av = $m^2 m/s = m^3/s$

So the quantity of *Av* is called volume flow rate *Q*

$$Q = Av$$

$$M = Q\rho$$ **Mass flow rate *M***

THE EQUATION OF CONTINUITY

NOTA :- The unit of $Av = m^2m/s = m^3/s$

So the quantity of *Av* is called volume flow rate *Q*

$$Q = Av$$

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Thank
You