Week 13

ILLINOIS

TAM 210/211 Introduction of Statics

WEEK 13 – Fluid Pressure

- **Hydrostatic fluid pressure**

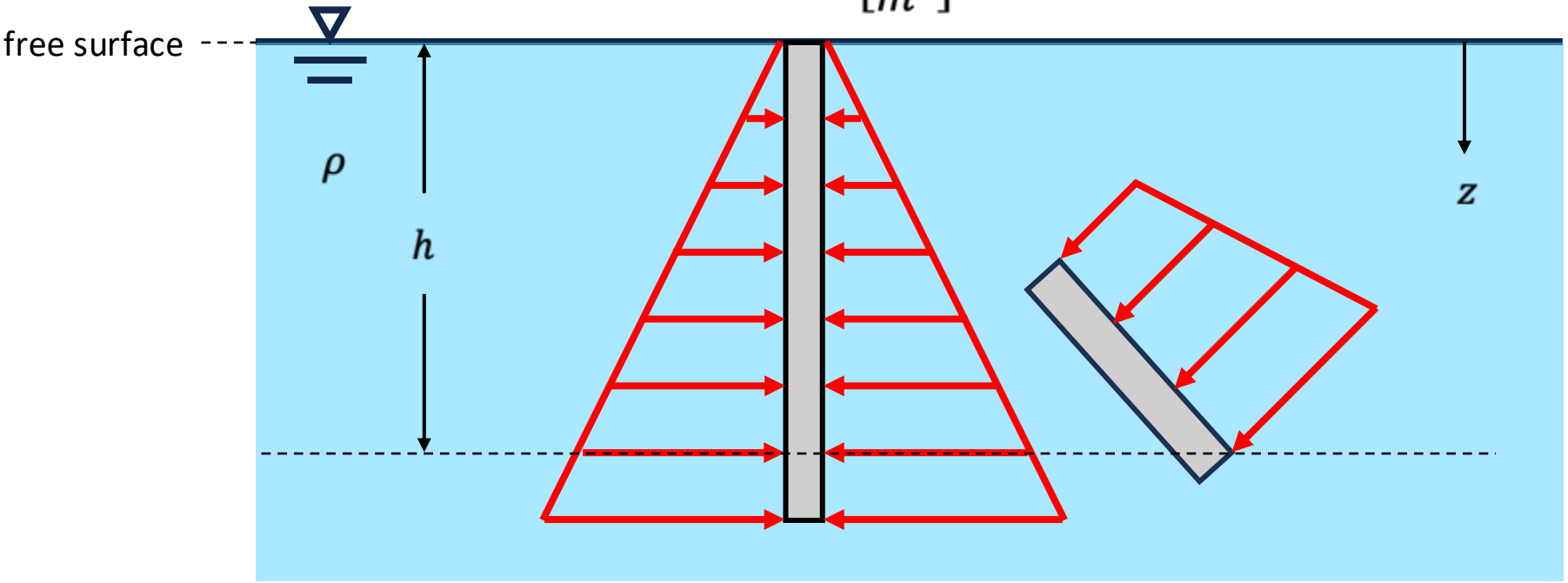
Reference:
https://www.youtube.com/watch?v=XrZPLF0ezw8

WEEK 13 – Fluid Pressure

- **Hydrostatic fluid pressure**
  - **Hydrostatic** fluid pressure: exerted by a **fluid at rest** due to the gravity
  - Pascal's law: 1) ΔP at any point in a fluid at rest is transmitted equally and undiminished in all directions

    2) the pressure force acts perpendicular to the contact surface

$$P(z) = \rho g z \left[\frac{N}{m^2}\right]$$

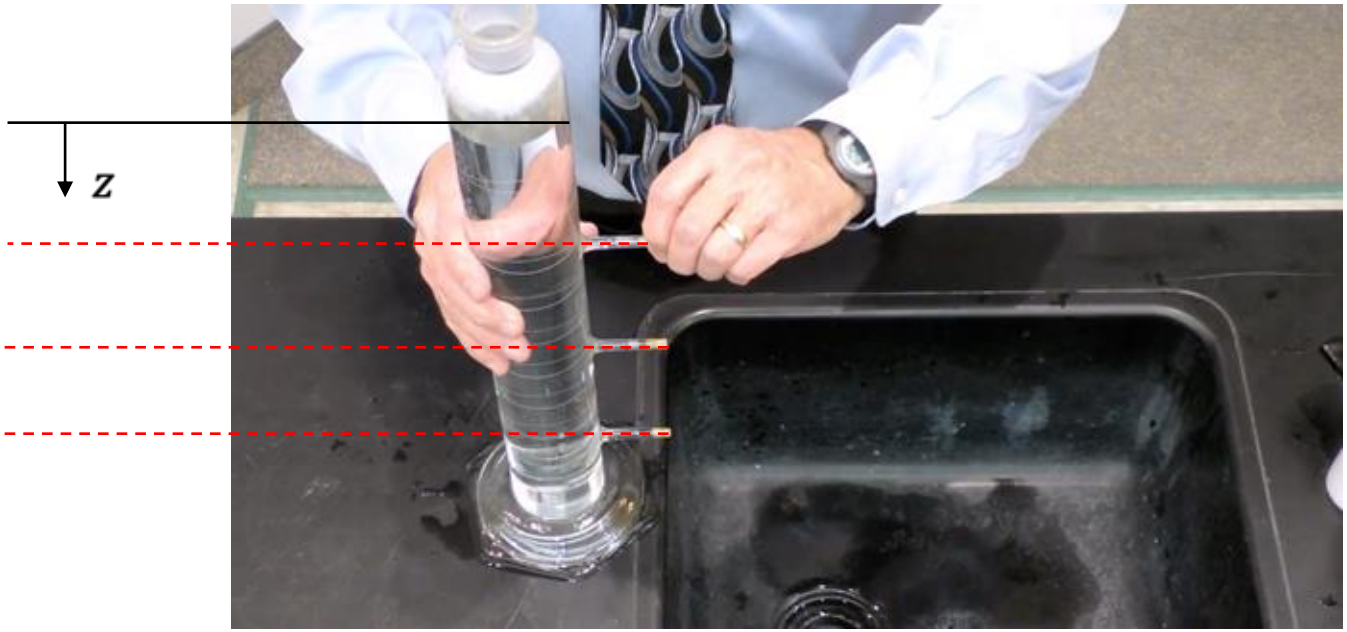


WEEK 13 – Fluid Pressure

- **Hydrostatic fluid pressure**
  - **Hydrostatic** fluid pressure: exerted by a **fluid at rest** due to the gravity
  - Pascal's law: 1) ΔP at any point in a fluid at rest is transmitted equally and undiminished in all directions

    2) the pressure force acts perpendicular to the contact surface

$$P(z) = \rho g z \left[\frac{N}{m^2}\right]$$



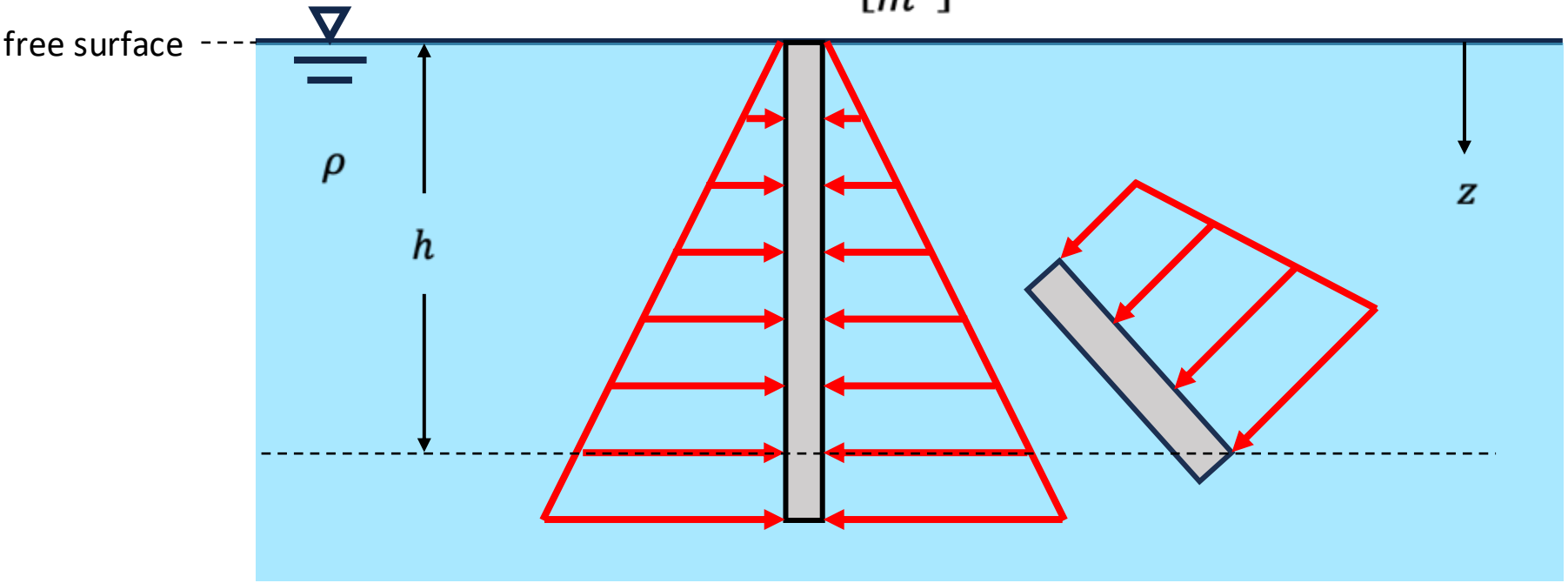
Reference: https://www.youtube.com/watch?v=K5g6P8-GmBg

WEEK 13 – Fluid Pressure

- **Hydrostatic fluid pressure**
  - **Hydrostatic** fluid pressure: exerted by a **fluid at rest** due to the gravity
  - Pascal's law: 1) ΔP at any point in a fluid at rest is transmitted equally and undiminished in all directions

    2) the pressure force acts perpendicular to the contact surface

$$P(z) = \rho g z \left[\frac{N}{m^2}\right]$$



WEEK 13 – Fluid Pressure

- **Pressure ⟷ distributed load**
  - Pressure acts on a surface (**not a force**)

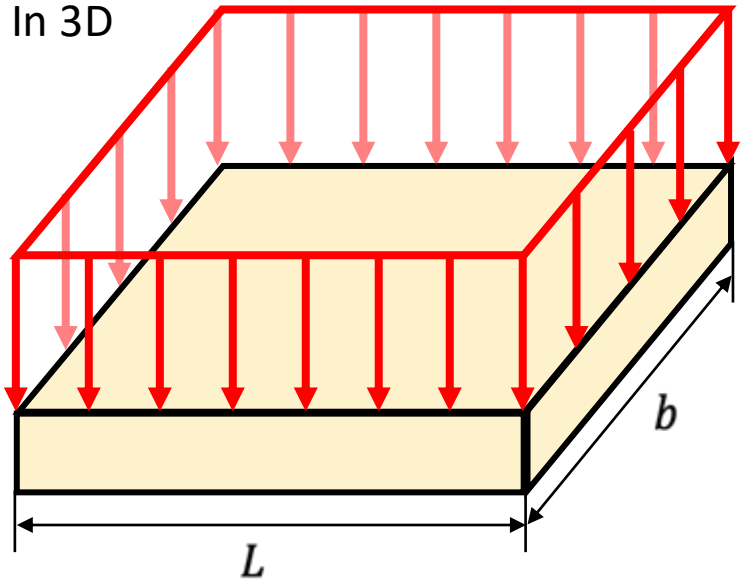
$$P(z) = \rho g z \rightarrow [m]$$

$$\left[\frac{N}{m^2}\right] \quad \left[\frac{kg}{m^3}\right] \quad \left[\frac{m}{s^2}\right]$$

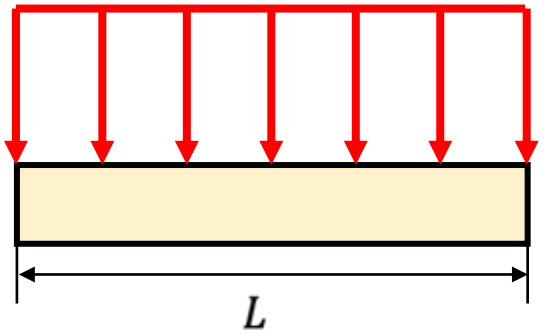
  - Resultant force, F_R

$$F_R = P \times A = \rho g z \, L \, b$$

In 3D



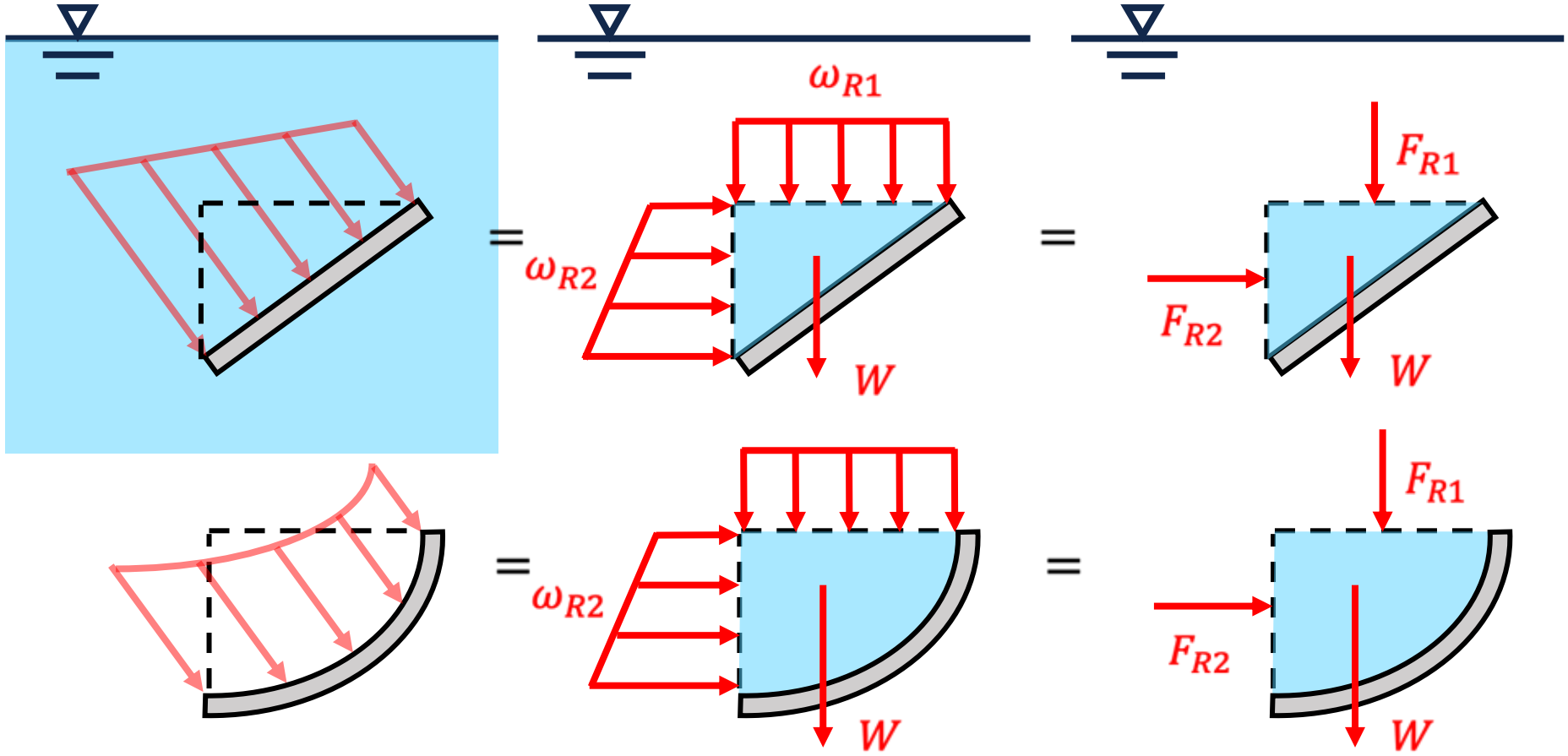
In 2D $\omega\ [N/m] = \rho g z b$



WEEK 13 – Fluid Pressure

- **Fluid pressure with slanted and curved surface**

$$F_R = \sqrt{F_H^2 + F_V^2} = \sqrt{F_{R2}^2 + (F_{R1} + W)^2}$$



WEEK 13 – Fluid Pressure

- **Buoyancy (Archimedes' principle)**
  - Exerted by a fluid opposing the weight of immersed object
  - Equivalent to the weight of the fluid displayed by the object (**force**)

$$F_B = W_{displaced}$$