DEPARTMENT OF ENVIRONMENTAL, WATER RESOURCES, AND COASTAL ENGINEERING

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

FLUID MECHANICS SESSIONAL

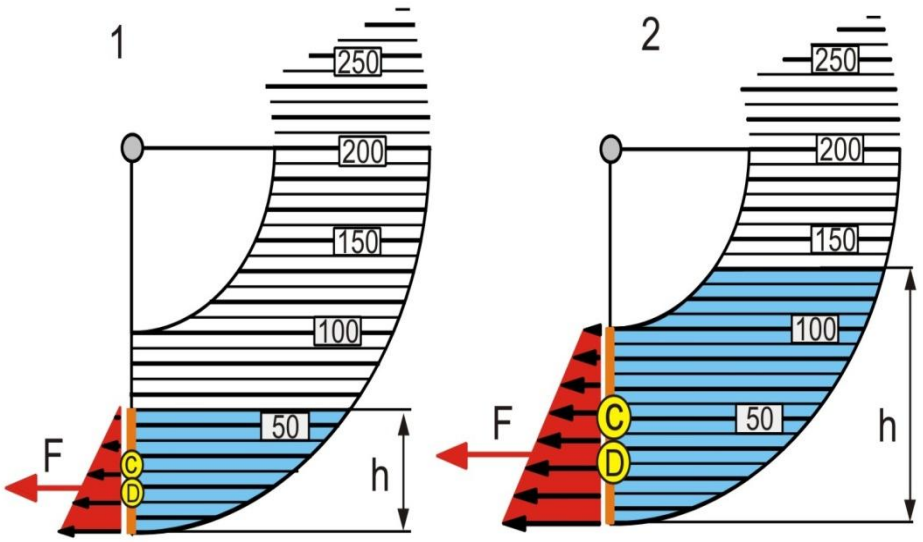
EWCE 262

Experiment No. 2

CENTRE OF PRESSURE

2.1General

The Centre of pressure is a point on the immersed surface at which the resultant of liquid pressure force acts. In case of horizontal area the pressure is uniform and the resultant pressure force passes through the centroid of the area, but for an inclined surface this point lies towards the deeper end for the surface, as the intensity of pressure increases with depth. The objective of this experiment is to locate the Centre of pressure of an immersed rectangular surface and to compare this position with that predicted by theory.



Pressure profiles at different water levels:

1 water level <100mm, 2 water level >100mm; red: pressure profiles, orange: effective area; F force, h= water level, C centre of area of the area, D centre of pressure

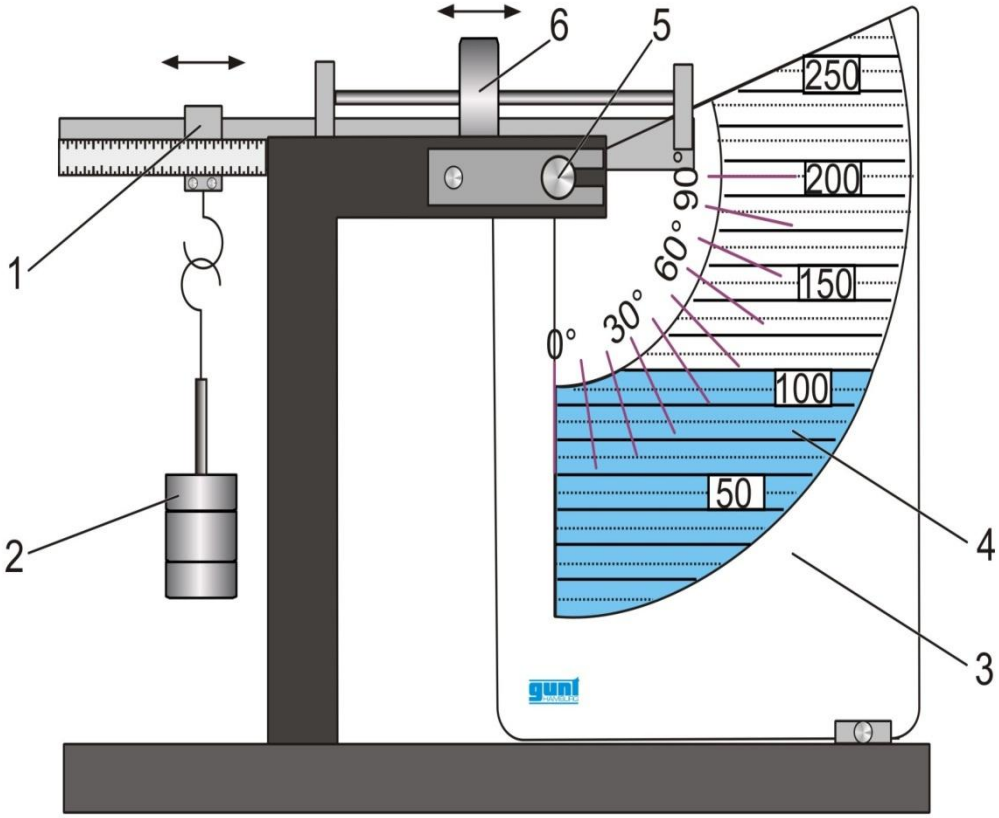
2.2 Practical Application

In designing a hydraulic structure (e.g a dam) we need to know the overturning moment about O created by water pressure on the structure. In this case M_o=Fxd, where F is the force on the dam and d is the distance of the center of the pressure from bottom.



Fig 1 Practical application of Centre of Pressure

2.3 Description of Apparatus



1 hanger with scale, 2 weights, 3 transparent plastic disc with angular and fill level scale, 4 water tank, 5 axis of rotation, 6 movable weight

The weight of fluids at rest causes a pressure that is known as hydrostatic pressure or gravitational pressure. This pressure acts on any area that is in communication with the fluid, exerting a force that is proportional to the size of the area.

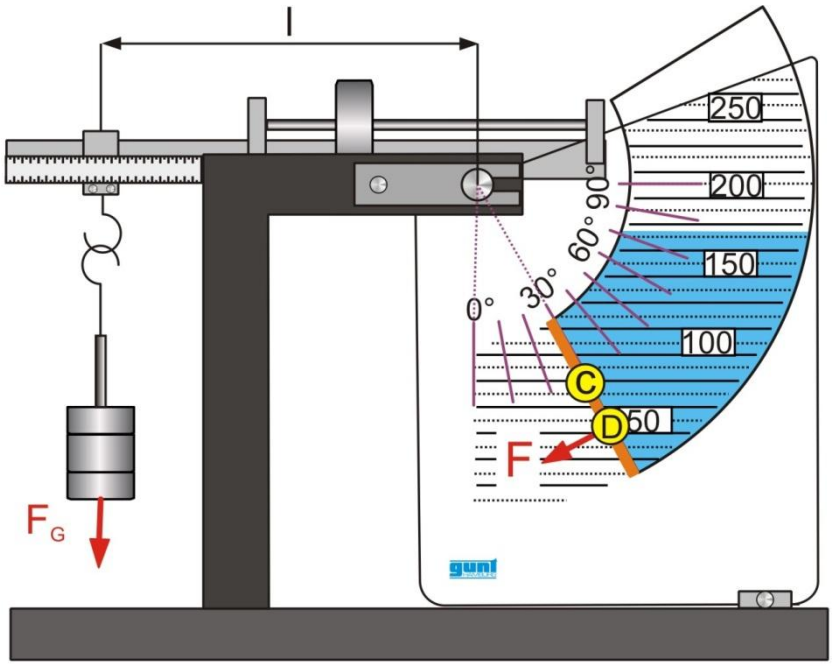
The effect of hydrostatic pressure is highly important in many fields of engineering: in shipbuilding, in hydraulic engineering when designing locks and weirs, in sanitation and building services.

The HM 150.05 experimental unit offers typical experiments to study hydrostatic pressure in liquids at rest. The effect of the hydrostatic pressure of water can be clearly shown at different water levels and angles of inclination.

The experimental unit consists of a transparent, tilting water tank with a scale for measuring volumes. Another scale is used to adjust the angle of inclination of the water tank. The device is balanced by a lever arm using different weights and the compressive force measured.

The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

2.4 Theory



Measuring principle for different inclination angles of the water tank:

blue: water level, orange: effective area; F force, F_G weight, l lever arm of the weight, C Centre of gravity of the area, D centre of pressure

2.6 Objectives

1. To determine the distance of center of pressure from the water surface both theoretically and practically.
2. To plot the Mass on the pan (M) against y_2 in plain graph paper.

2.7 Apparatus

Hydrostatic pressure apparatus, **beaker** with water etc.



Hydrostatic pressure apparatus



beaker

Experiment No. 2

CENTRE OF PRESSURE

Experimental Data Sheet

b = 75 mm,

Angle		**Lowest water level S_l**		**Highest water level S_h**
Lever arm l (mm)	Appended weight F_G (N)	Water level reading s (mm)	Calculated lever arm I_D (mm)	Resultant force F_P (N)

Angle		**Lowest water level S_l**		**Highest water level S_h**
Lever arm l (mm)	Appended weight F_G (N)	Water level reading s (mm)	Calculated lever arm I_D (mm)	Resultant force F_P (N)

Angle		**Lowest water level S_l**		**Highest water level S_h**
Lever arm l (mm)	Appended weight F_G (N)	Water level reading s (mm)	Calculated lever arm I_D (mm)	Resultant force F_P (N)

Level / Term : **Dept. :**
Reg No. : **Section:**
Group No. : **Date :**

Signature of the Teacher

2.9 CALCULATION:

2.10 DISCUSSION:

What are the probable errors in performing the experiment?

Why is y_p (theoretical) greater than y_p (practical)?

2.11 ASSIGNMENT:

1. Discuss why the centre of pressure is below the centre of gravity for an inclined surface.

2. What are the practical applications of the centre of pressure?