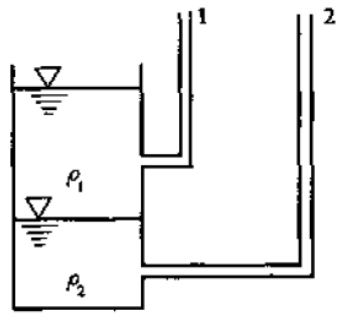
# Introduction to Marine Hydrodynamics (NA235)

(2014-2015, 2nd Semester)

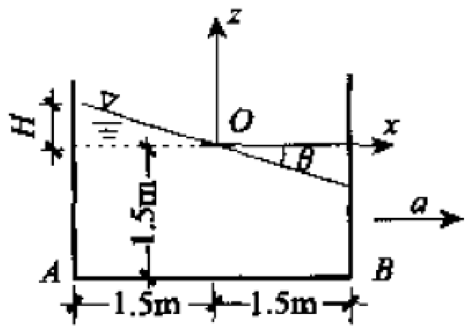
## Assignment No.4

(Seven problems, to be submitted on April 16th, 2015)

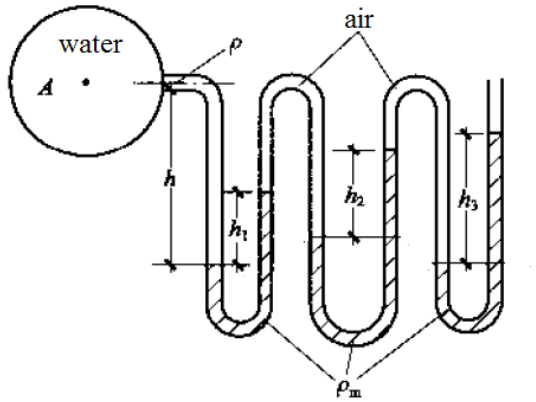
**Problem 1:** An open container is filled with two liquids with $\rho_1 < \rho_2$. The liquid surface in which manometer (1 or 2) is higher? Which liquid surface is the same as the height of the surface in the container?



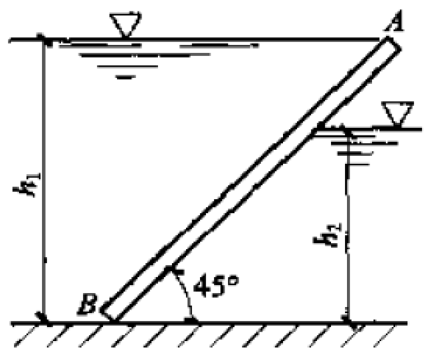

**Problem 2:** A rectangular wooden box is 3m in length. The liquid surface is 1.5m away from the bottom of the box when the liquid is at rest. If the box is moving horizontally with a constant acceleration $3\text{m/s}^2$. Determine the angle between the liquid surface and the horizontal plane, as well as the maximum and minimum pressure on the bottom of the box.



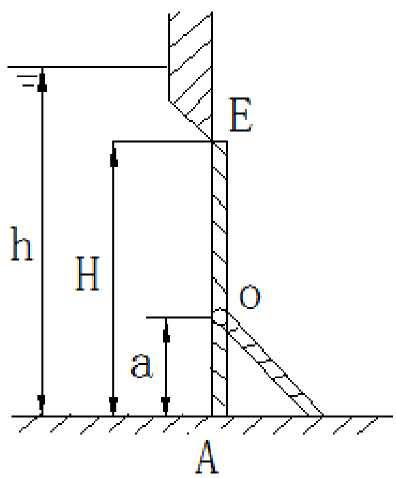

**Problem 3:** Consider that $h_1$=0.1m, $h_2$=0.2m, $h_3$=0.3m, $h$=0.5m, the fluids in the U-tube manometer are mercury and air. Determine the pressure on point A in the water tube.




**Problem 4**: A rectangular gate is 1m in width and AB in length, and is inclined with 45°. The water depth on the left side is $h_1$=3m, the depth on the right side is $h_2$=2m. Determine the hydrostatic pressure on the gate and its acting point.

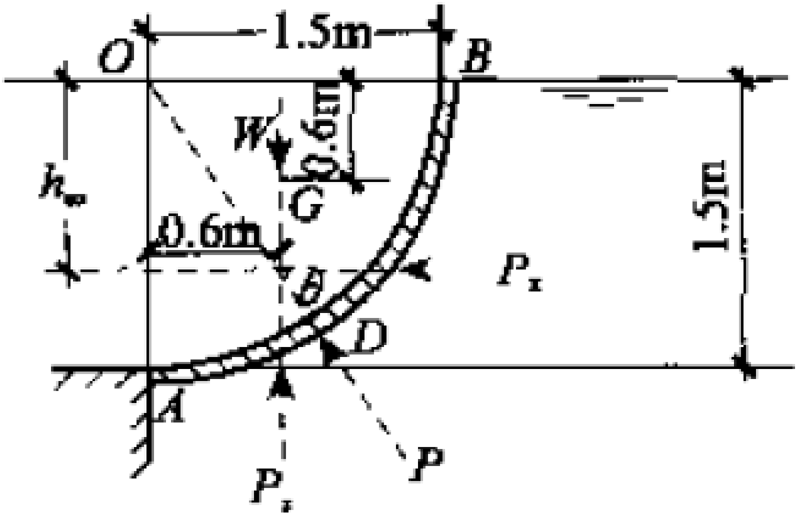



**Problem 5**: A plane gate is shown in the figure. The gate is $H$=1m in height, and the height of the bearing point $O$ from the ground is $a$=0.4m. What is the water depth on the left side when the gate is open around point $O$ automatically?




**Problem 6**: A quarter-circle gate (in 1.5m radius) is shown in the figure. Its center of gravity locates at point $G$. The gate is 3m in width and 6000kg in weight. The hinge is fixed on the axis $O$ of the circle.

Considering the hinge coincides with the water surface, determine the total pressure on the gate and the direction, as well as the required torque to open the gate.




**Problem 7**: A cistern is shown in the figure below. Three hemispherical covers are installed on the cistern wall, with the same diameter $d$=0.5m. Assume $h$=2.0m, $H$=2.5m. Determine the hydrostatic pressures on each hemispherical cover.