National Higher School of Autonomous Systems Technology
Department of Basic Training, 2nd Year
University year: 2025/2026

The Third Tutorial in Fluid Mechanics

Exercise 1:

The inclined surface shown in fig.1, hinged along edge **A**, is **5 m** wide. Determine the resultant force, $\mathbf{F_R}$, and its location of the water and the air on the inclined surface using both methods:

a- Formula method

b- Integration method

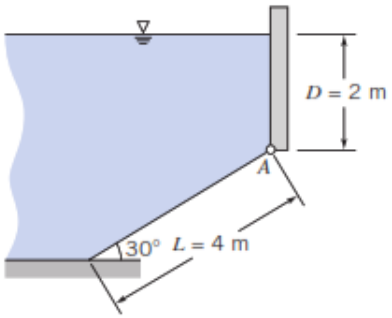

Fig. 1

Exercise 2:

Determine the magnitude and location of the resultant force acting on the triangular end plate of the settling tank in fig.2. The tank contains kerosene ($\boldsymbol{\rho_k}$**=814 kg/m³**) using both methods:

a- Formula method

b- Integration method

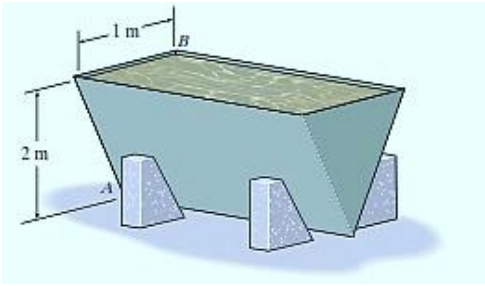

Fig. 2

Exercise 3:

The gate shown in fig.3 is hinged at **O** and has constant width, **w=5 m**. The equation of $\mathbf{x=y^2/a}$, where **a=4 m**. The depth of water to the right of the gate is **D=4 m**. Find the magnitude of the force, **Fa**, applied as shown, required to maintain the gate in equilibrium if the weight of the gate is neglected.

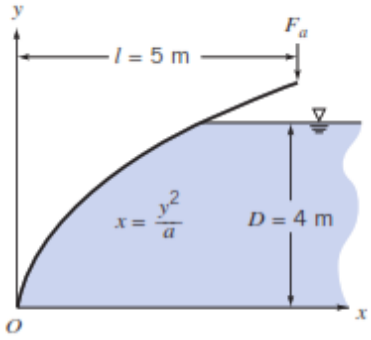

Fig. 3

Exercise 4:

Find the magnitude and direction of the resultant force due to water acting on a roller gate of cylindrical form of diameter **AB=4 m**. Take the length of the gate as **8 m**. See fig.4

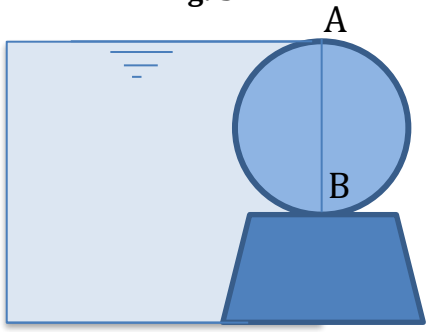

Fig. 4

Exercise 4:

The **500 N** flat-bottom container in Fig.5.a. is **600 mm** wide and **900 mm** long. Determine the depth the container will float in the water (a) when it carries the **200 N** steel block, and (b) when the block is suspended directly beneath the container, Fig. 5.a-b. Take $\mathbf{g_{st} = 77.0\ kN}$

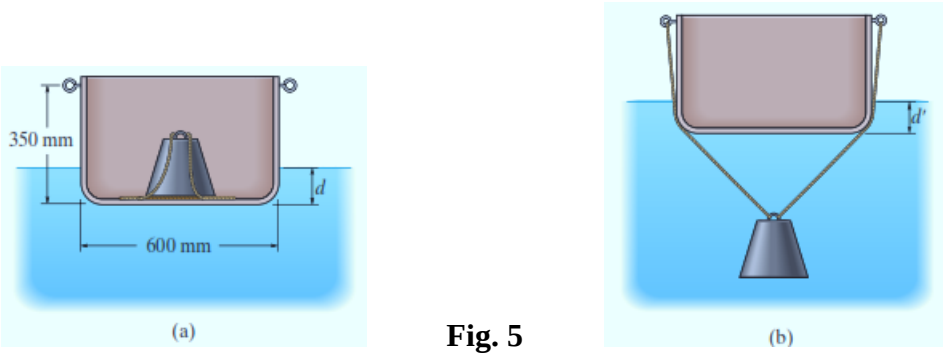

Fig. 5

Exercise 5:

A hydrometer (or densimeter) made of glass consists of a spherical float, weighted, of radius **a=12mm**, topped by a cylindrical tube of radius **r=2mm**, which carries arbitrary, equally spaced graduations.

The hydrometer stem emerges above the water surface at graduation $\mathbf{n_0=0}$ when immersed in pure water. When immersed in dissolvent, it emerges at graduation $\mathbf{n_1=60}$. The densities of water and dissolvent are respectively $\boldsymbol{\rho_0=1g/cm^3}$ and $\boldsymbol{\rho_1=0.72g/cm^3}$. The hydrometer immersed in the benzene levels off at the division **n=28.** Deduce the specific gravity $\boldsymbol{\delta}$ of the benzene as well as the difference $\Delta \boldsymbol{l}$ between two successive graduations on the hydrometer.

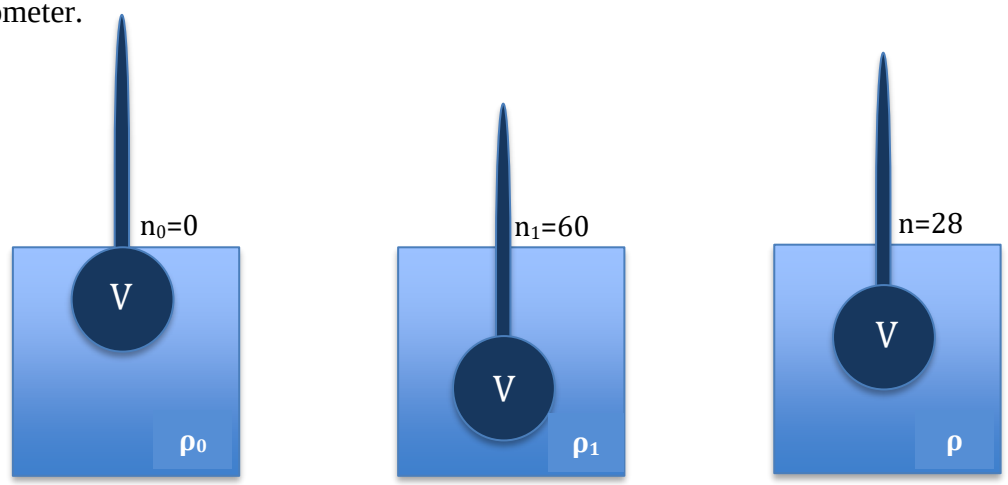

Fig. 5