Fluids Engineering (Group A)   [11:10~12:40]

Question I

Water flows horizontally from left to right in a circular pipe as shown in the right figure. The diameter of the left part of the pipe is D_A. The pipe has a throat whose diameter is D_B ($D_B < D_A$). When a small tube of negligible diameter containing different liquid is connected between the left part and the throat of the pipe, liquid shows the different height of h between the left and right. The densities of water and liquid in the small tube, and the acceleration of gravity are denoted by ρ, ρ_m, and g, respectively ($\rho < \rho_m$). The friction is assumed to be negligible, and the water flow is uniform at each cross-section of the pipe. Express the volumetric flow rate of water Q by D_A, D_B, h, ρ, ρ_m, and g. (25 points)
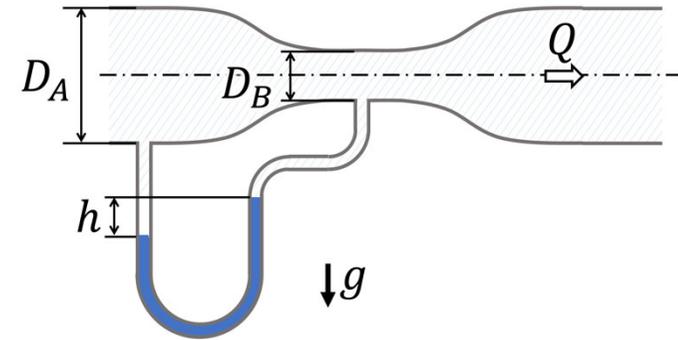
Question II

A circular water jet with the uniform velocity V and the diameter d impinges on a cone with the apex angle θ as shown in the figure. The axis of the jet is idenitical to the cone axis, and the flow around the cone is axi-symmetric and dettaches from the cone at the end. Assuming that the density of water is ρ, and the viscosity of water and the gravity are negligible, answer the following questions. (25 points)

（1） Find the force F exerted by this jet on the cone when it is at rest.

（2） Find the force F' and the power L exerted on this cone by the jet
　　　when it is moving with a velocity u ($<V$) in the same direction as the jet.
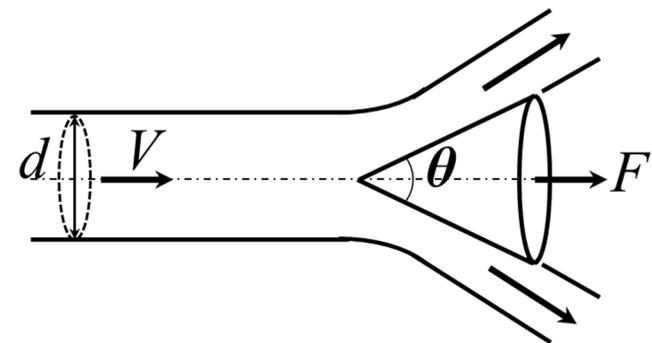
☐Applicant of **INTERNATIONAL MASTER'S PROGRAM** should answer in English.