Coastal and Ocean Wave Hydrodynamics
K.N.T. University of Technology
Assignment 1

1-1.

Using the vector analysis show

$rot(grad\,\phi) = 0$

$div(rot\vec{u}) = 0$

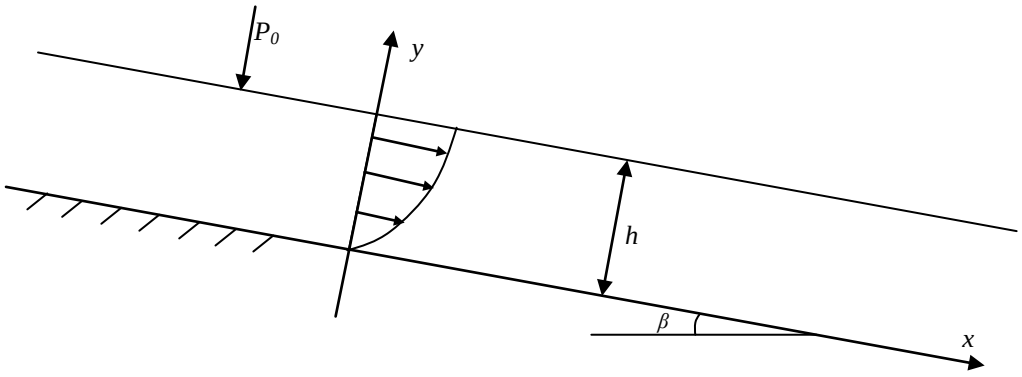
1-2.

Water flows down along a slope as shown in figure below. The flow is laminar and steady.

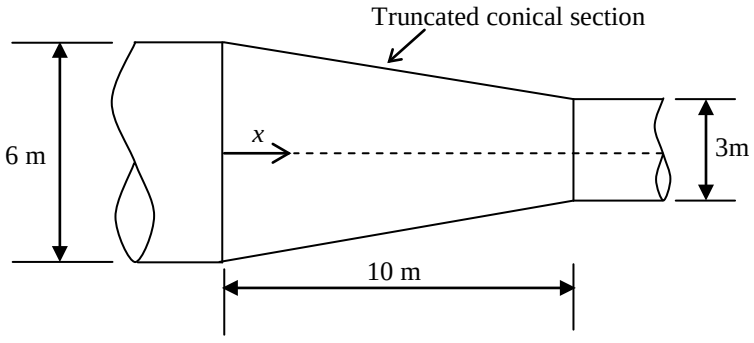
(1) Show momentum conservation equation neglecting unnecessary terms from Navier-Stokes Equation.

(2) Show boundary conditions.

(3) Use above equations and get results for velocity distribution (u) in y direction.



1-3. Consider the following transition section:



(a) The flow from *left* to *right* is constant at $Q = 12\pi$ m^3/s. What is the total acceleration of a water particle in the x direction at $x = 5$ m? Assume that the water is incompressible and that the x component of velocity is uniform across each cross section.
(b) The flow of water from *right* to *left* is given by

$$Q = \pi t^2$$

Calculate the total acceleration at $x = 5$ m for $t = 2.0$ s. Make the same assumptions as in part (a).

1-4.

The water (assumed inviscid) in the U-tube is displaced from its equilibrium position and released to oscillate about this position with its natural period.
(a) Assuming that the total length of water column is L, what is the natural period of oscillation (T)?
(b) If the amplitude A is 10 cm and the natural period T is 8 s, i.e. $\eta(t) = 10\cos(\frac{2\pi}{8}t)$, what will be the pressure at a distance 20 cm below the instantaneous water surface for η = +10 cm, and -10 cm? Assume that g = 980 cm/s^2 and ρ = 1 g/cm^3.