Department of Mechanical Engineering, BUET.
ME 6125: Mechanics of Viscous Fluid

Assignment-2

(**Due Date: 28 July 2013**, **Sunday**. *Submit hard-copy, at class*)

1. A Newtonian fluid with constant density and viscosity flows *steadily* through a two dimensional vertically positioned channel with the width h shown in **Figure 1**. The motion of the fluid is described by the Navier-Stokes equations. The flow is subjected to the gravitational acceleration and a constant pressure gradient ($\frac{\partial p}{\partial y} = -K$) in flow direction y. Assume that velocity components u = w = 0.

a) Determine the solution of the Navier-Stokes equations.

b) Write a computer program, show the velocity distributions for the following cases:

(i) For $K = 0$, (ii) $K > 0$, and (iii) $K < 0$.

c) For which K there is no flow?

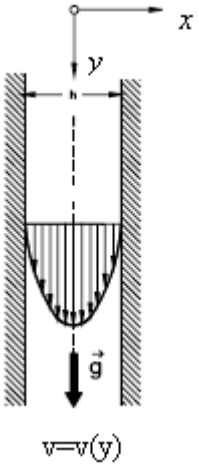

Figure 1

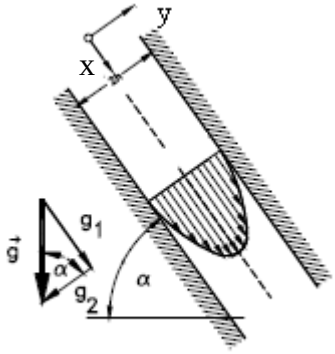

Figure 2

2. Newtonian fluid with constant density and viscosity flows *steadily* through a two dimensional channel positioned at an angle α shown in **Figure 2** with the width 2h. The motion of the fluid is described by the Navier-Stokes equations. The flow is subjected to the gravitational acceleration and a constant pressure gradient ($\frac{\partial p}{\partial y} = -K$) in flow direction x. Assume that velocity components v = w = 0.

a) Determine the solution of the Navier-Stokes equations.

b) Write a computer program and plot the velocity distributions for:

(i) $K = 0$, (ii) $K > 0$, and (iii) $K < 0$.

c) For which K there is no flow?