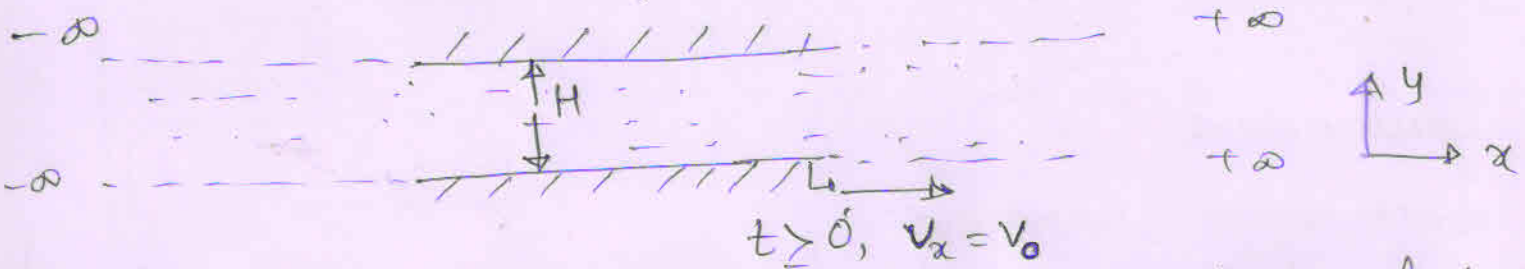
Assignment – 2

Consider a velocity driven flow confined between two infinite plates (with gap H), as shown in figure



$t \geq 0$, $V_x = V_0$

The lower plate has been maintained at velocity $V_x = V_0$ $\forall$ $t \geq 0$. Consider unidirection flow in x-direction.

(a) find out the characteristic/relevant time scale, using the order of magnitude analysis of governing equation (NS equation)

(b) express the governing eqn. in non-dimensionalized form using the characteristic values of different physical parameters (you have to think about the correct length & time scale.)

Hint :- the relevant time scale you already obtained in part (a)

(c) Solve the non-dimensionalised governing eqn. using "Separation of variable" technique.

Hint: split $U_x(y,t)$ in two components

→ $U_x = \hat{u} + U_{ss}$ ↳ steady state solution.

→ find U_{ss}, by solving gov. eqn. for steady state.

→ put $U_x = \hat{u} + U_{ss}$ in gov. eqn.

→ (you will find gov. eqn in terms of $\hat{u}$) solve it using separation of variables technique.

$\hat{u}$ → unsteady part of U_x