Exp.2 Impact of Jet

Instructions:

For submission of this assignment you have to upload one excel sheet and one pdf file. The detailed instructions are given below.

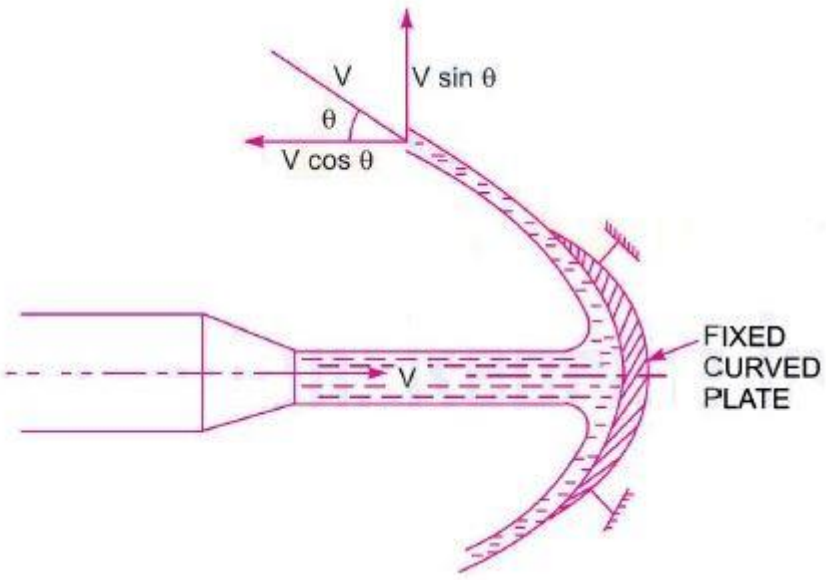
Excel sheet

Fill the columns in the excel sheet provided to you. There are two sheets one each for flat plate and hemispherical plate

- In the excel sheet you have to plot $\boldsymbol{F_{act} vs\ v(jet\ velocity)}$ for both flat plate and hemispherical plate
- Plot also $\boldsymbol{F_{th}}$ in the same sheet
- Properties and formula is provided in the lab manual.

PDF

- In the Pdf you have to write down **at least one** calculation **from each table** as you did in the 1st experiment **but there is slight change. Read "note" given below regarding this**. **Strictly take g as 9.8m/s^2**. You have to justify all the calculations in excel sheet provided by you. There should be **step by step detailed** calculations using all the formulas provided to you.
- You have to attach the screenshot of graphs and calculated table in the pdf which you have drawn in the excel sheet. (copy pasting will be okay)
- You have to write sources of error (**at least two)**.
- Write down your conclusion from the results.
- Answer following questions:
  1) Derive the theoretical force formula for a curves plate having



jet deflection angle theta (θ) as shown in figure using **control volume** analysis. As discussed in theory class you have to derive for both x direction (horizontal) and y direction (vertical) force equation. Make the necessary assumptions and write them down.

2) In the question 1 if the collision is not elastic (actual scenario) what will be the change in formula (both continuity and force equation) that you have derived earlier. For that you can use following: after the collision, velocity magnitude of fluid will be k|v_{jet} | where k is some reduction factor whose value is 0<k<=1. It is equal to 1 for elastic collision. Explain why it can never be zero. (This is somewhat different from classical mechanics)

3) In the derivation of theoretical force if we include friction (in reality there will be friction) of the surface, will the result change in both cases? Why? (hint: you can draw a free body diagram of the plate and visualize in which direction flow is passing on the surface and from that decide friction force direction? (make necessary assumptions)

Note: for the hand written calculation following scheme is to be used.

1st step: take out the last two digits of your roll no. and write down as x1 and x2. Ex. 1831090$\boldsymbol{x_1 x_2}$

2nd step: if your x_1 lies between 0 to 4 ($0 \leq x_1 \leq 4$) , then you have to take reading from **flat plate** having **Sr No.** $\boldsymbol{x_1}$and if your x_1 lies between 5 to 9 ($5 \leq x_1 \leq 9$) you have to subtract "5" from that and do the calculation from flat plate reading having Sr no. $\boldsymbol{x_1 - 5}$ **.**

3rd step: if your x_2 lies between 0 to 4 ($0 \leq x_2 \leq 4$), then you have to take reading from **hemispherical plate** having **Sr No.** $\boldsymbol{x_2}$ and if your x_2 lies between 5 to 9 ($5 \leq x_2 \leq 9$) you have to subtract "5" from that and do the calculation from hemispherical plate reading having Sr no. $\boldsymbol{x_2 - 5}$

Example:

1)183109002:

$\boldsymbol{x_1}$ will be **0** ⟹ take a reading from **flat plate** having **Sr no. 0**

$\boldsymbol{x_2}$ will be **2** ⟹ take reading from **hemispherical plate** having **Sr no. 2**

2)183109068

$\boldsymbol{x_1}$ will be **6** ⟹ take a reading from **flat plate** having **Sr no. 1 (6-5)**

$\boldsymbol{x_2}$ will be **8** ⟹ take reading from **hemispherical plate** having **Sr no. 3 (8-5).**