ME 3455

Computational Fluid Dynamics Lab

Homework 1

Abhishek Ghosh

ME21BTECH11001

Question: Complete the Ansys Fluent tutorial on mixing in an elbow joint.

a)

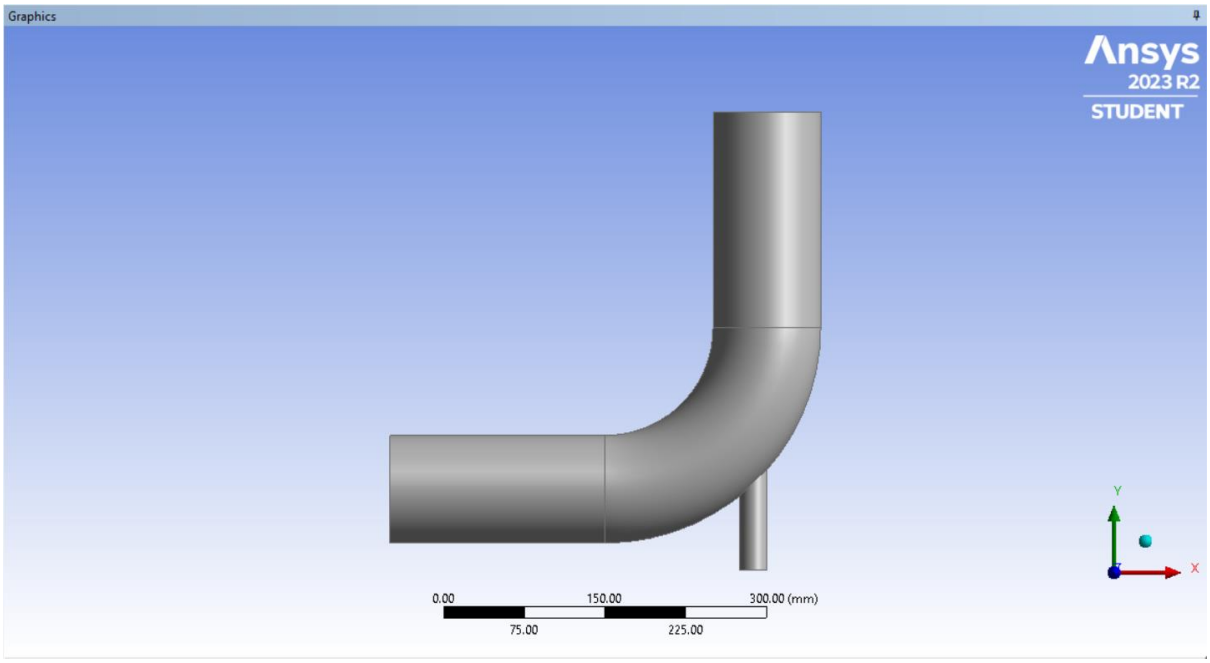


Fig: Geometry in x-y plane

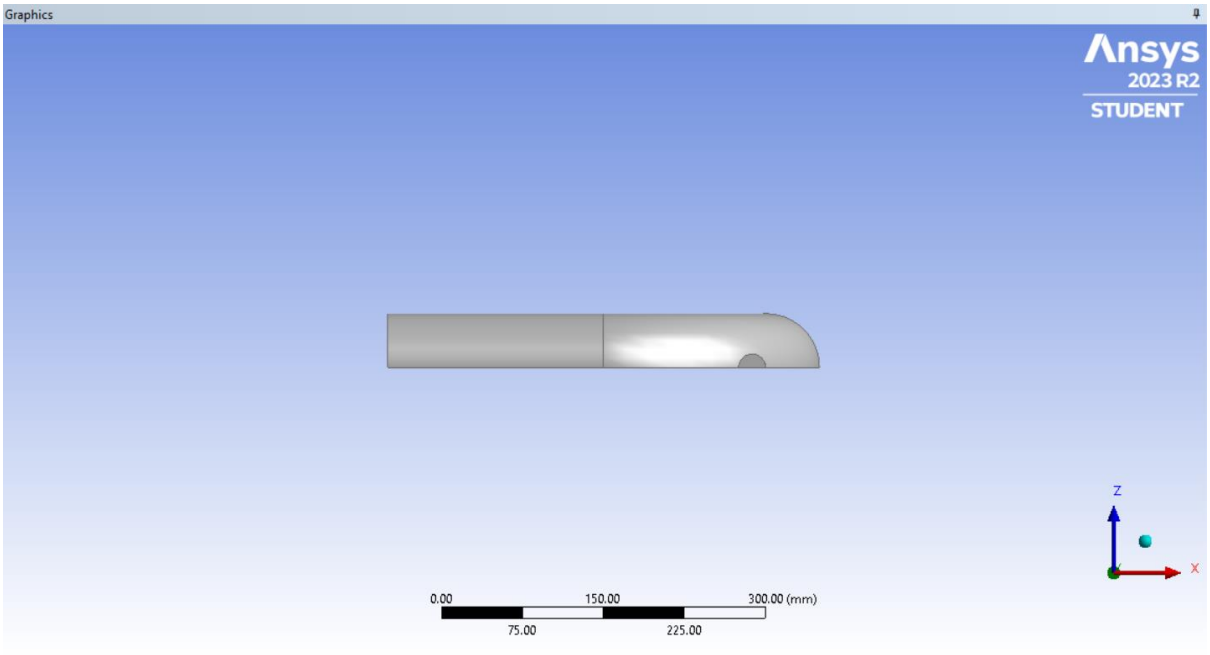


Fig: Geometry in x-z plane

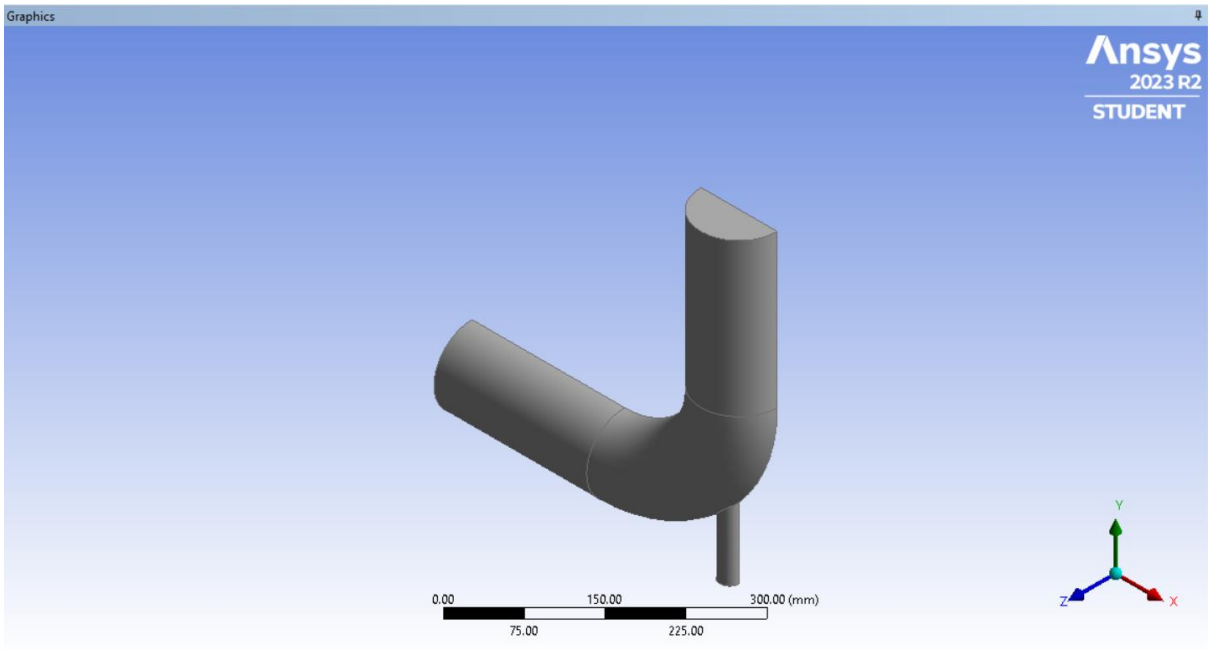


Fig: Geometry in isometric view

b)

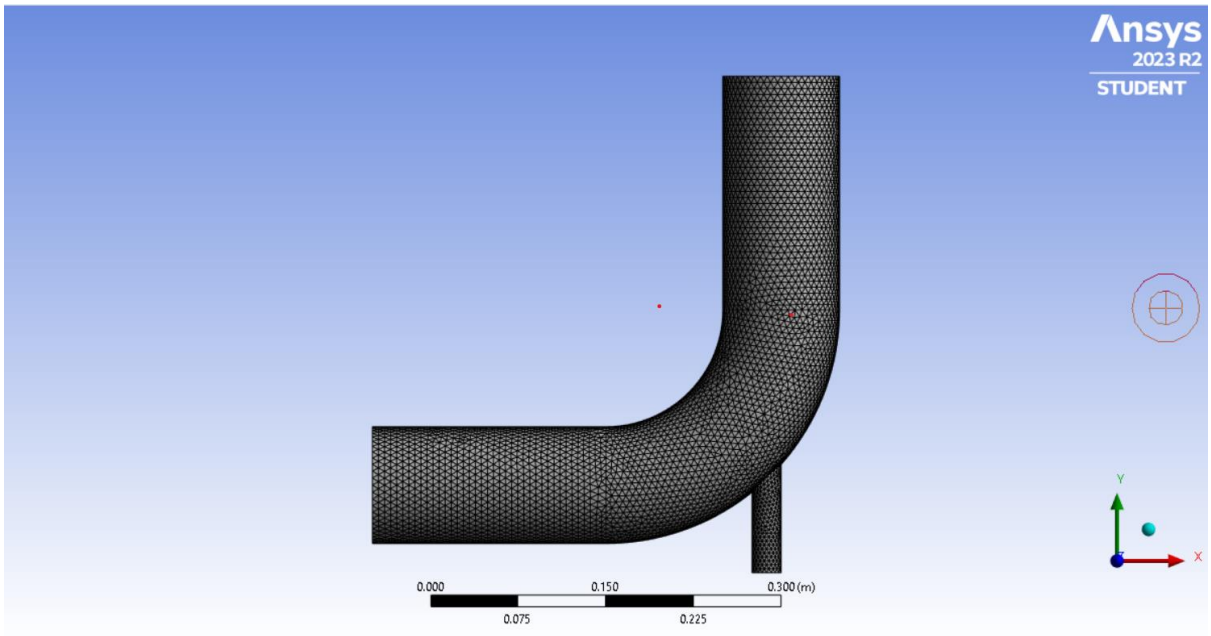


Fig: Mesh in x-y plane

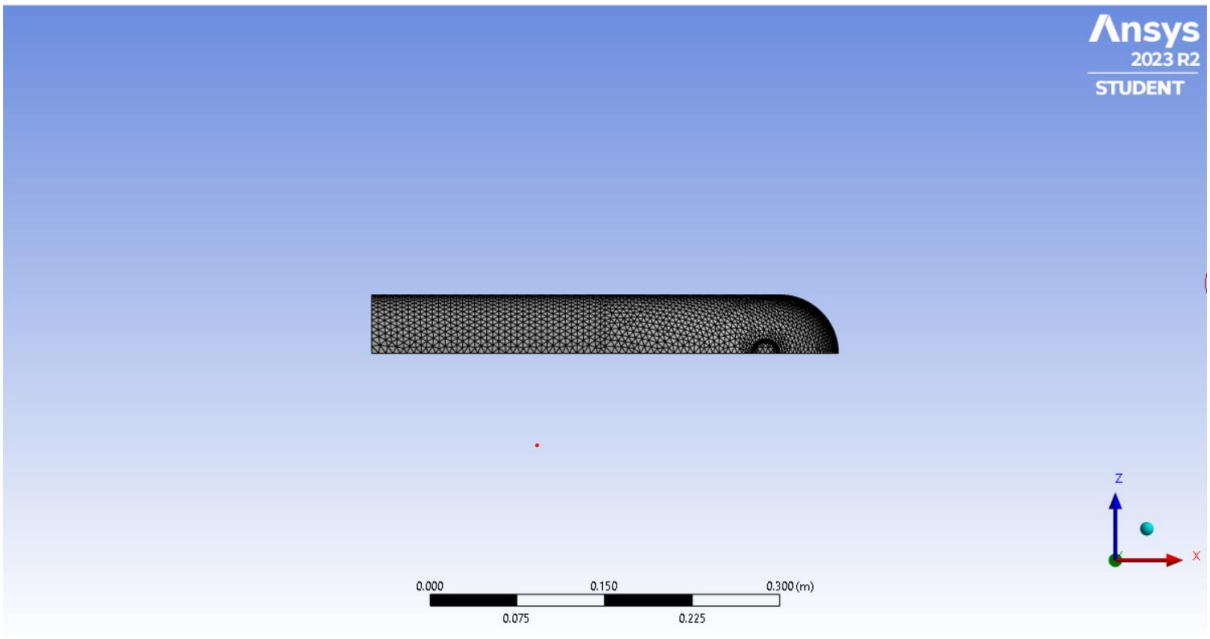


Fig: Mesh in x-z plane

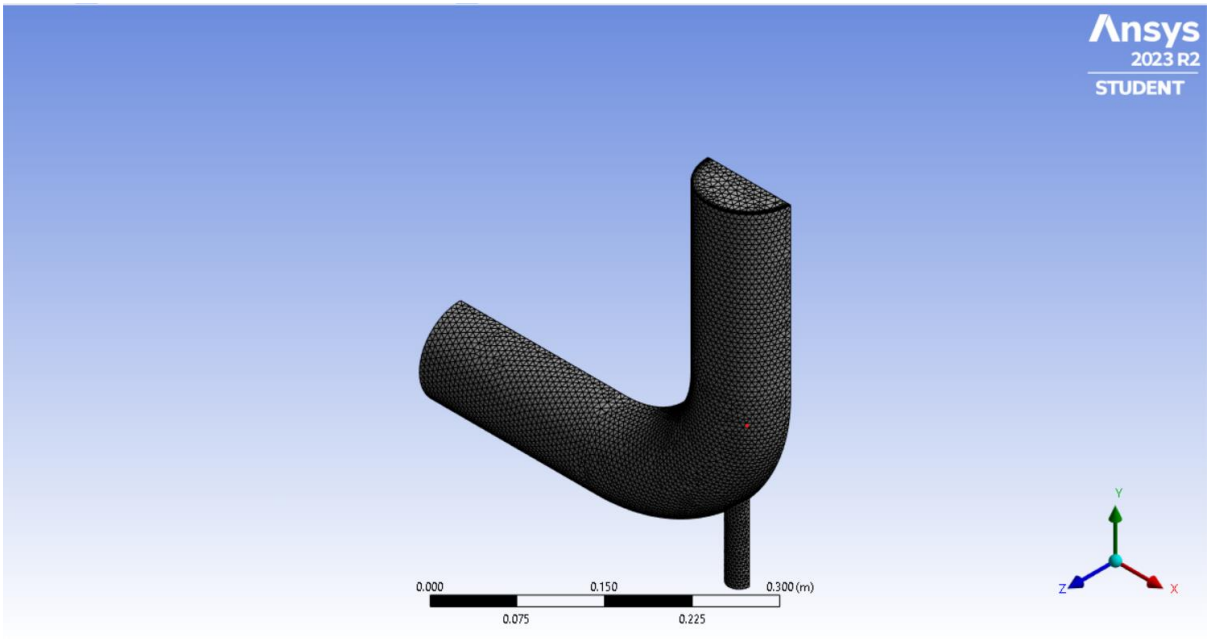
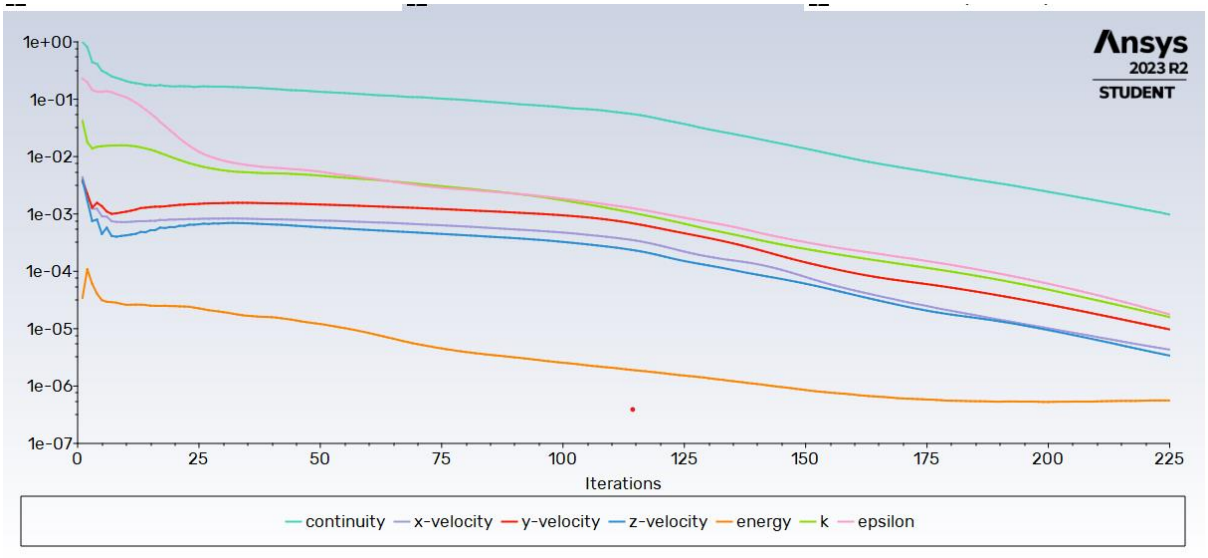
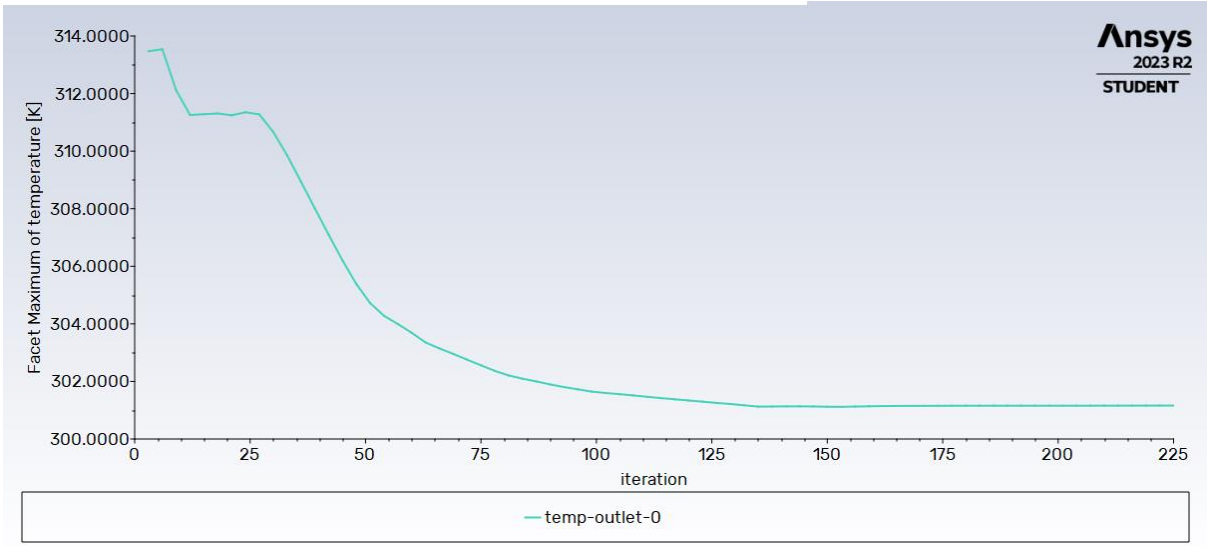


Fig: Mesh in isometric view

c) The below plots show that increase in number of iterations would lead to convergence i.e. reducing the error as we keep on increasing iterations.





d)

From the below plots we can see

- Velocity at the boundary is zero because of the *no slip conditions*.
- Velocity is high at the entry of small inlet.
- There is increase in velocity as the flow encounters small inlet.

- At pressure outlet the velocity varies -> increases from left to right.

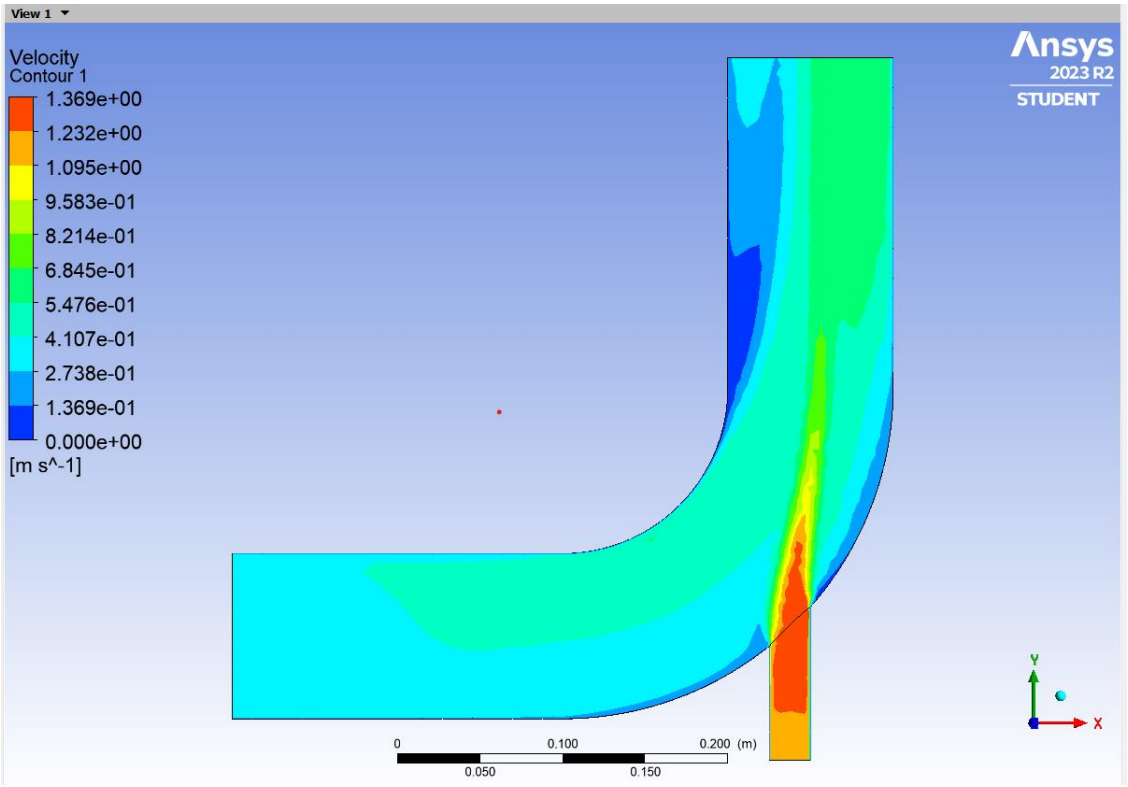


Fig: Contour of velocity magnitude in x-y symmetric plane

- Temperature is high at small inlet and is constant at the entry of large inlet.
- At the pressure outlet the temperature varies i.e., increases from left to right.
- Due to addition of high temperature flow from a small inlet there is change in temperature of the flow.

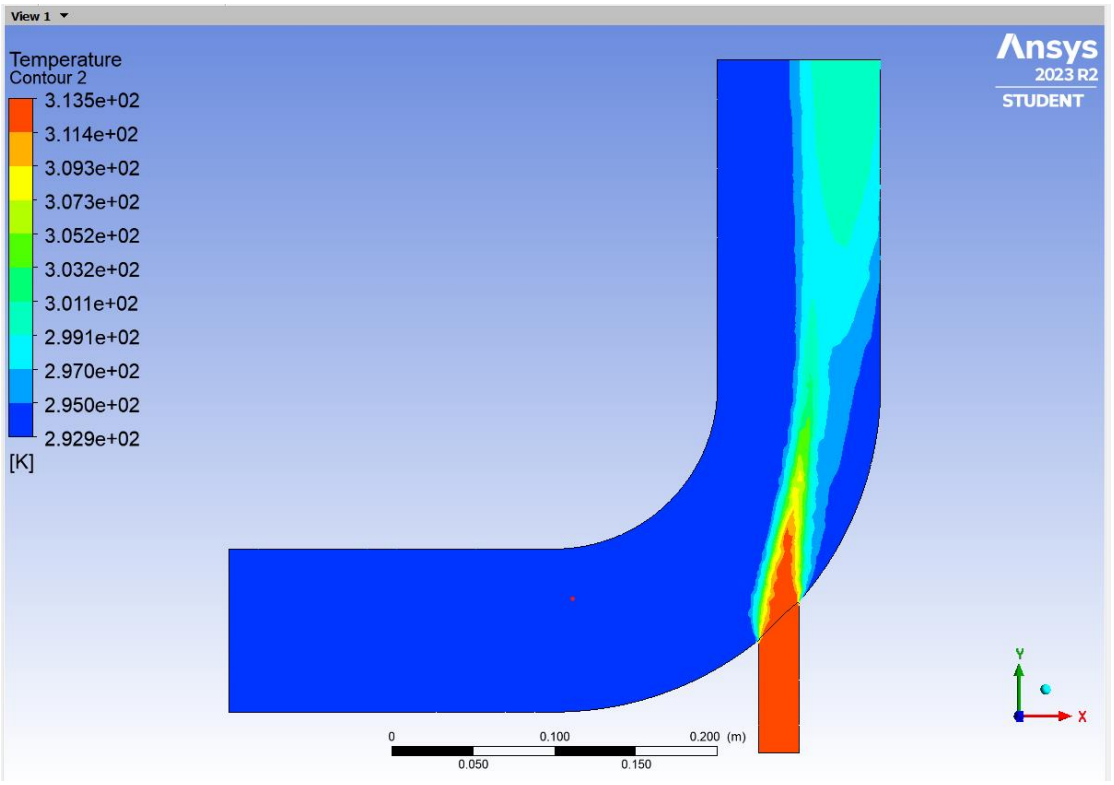


Fig: Contour of temperature in x-y symmetric plane

e)

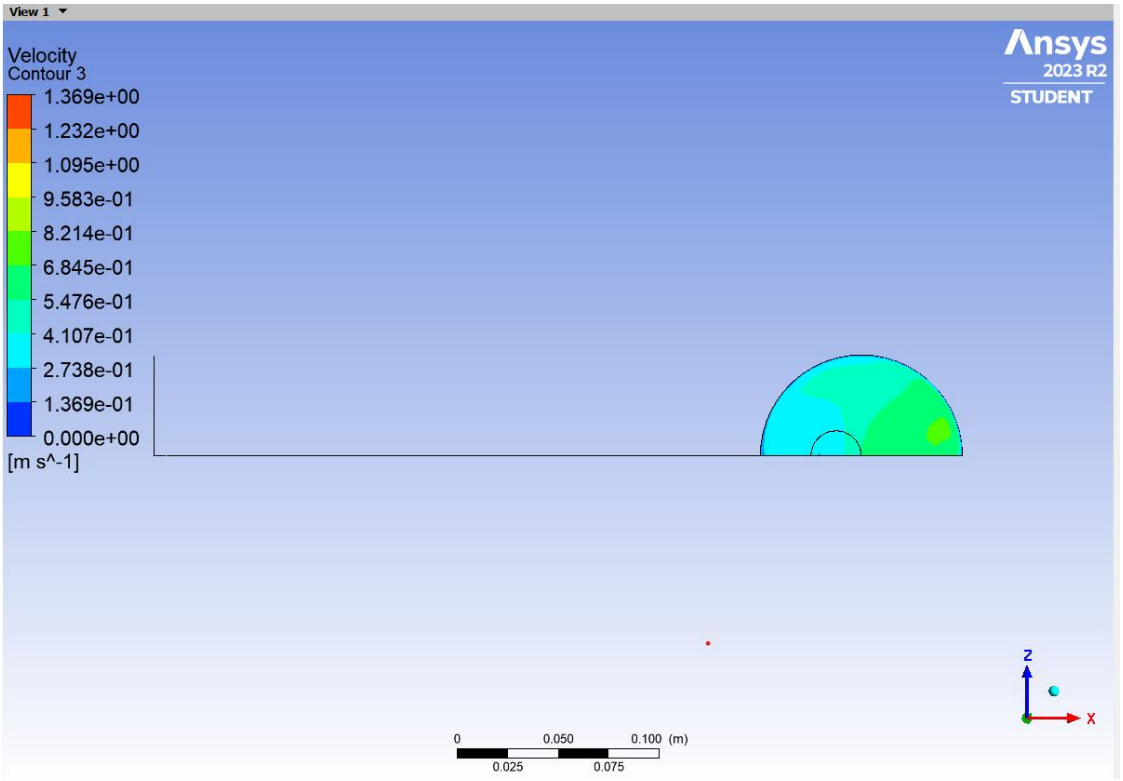


Fig: Contour of velocity magnitude in x-z exit plane

- We could see from the above plot that at the pressure outlet, velocity is higher at the right end that is towards the entry of small inlet when compared to another end.

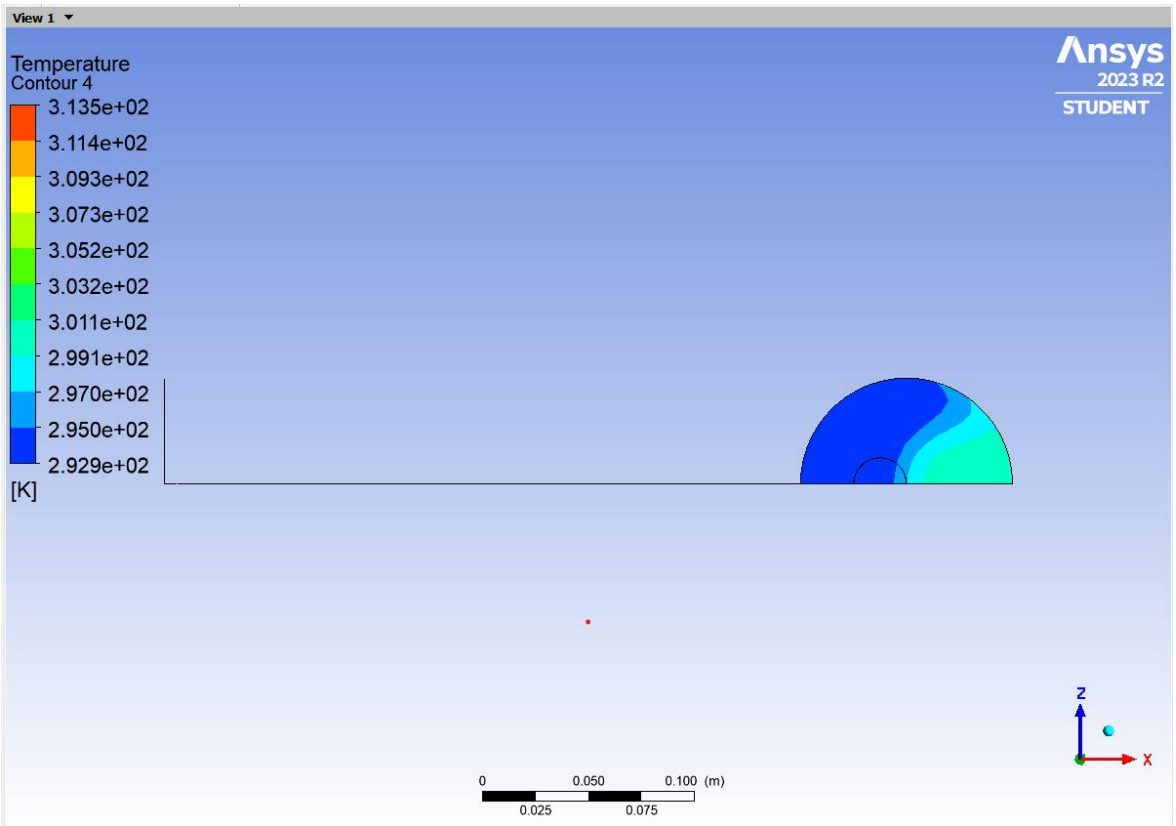


Fig: Contour of temperature in x-z exit plane

- Similarly for the temperature plot we can see that temperature is higher at the right end where the small inlet has an effect (due to high temperature flow) when compared to the right end.

f)

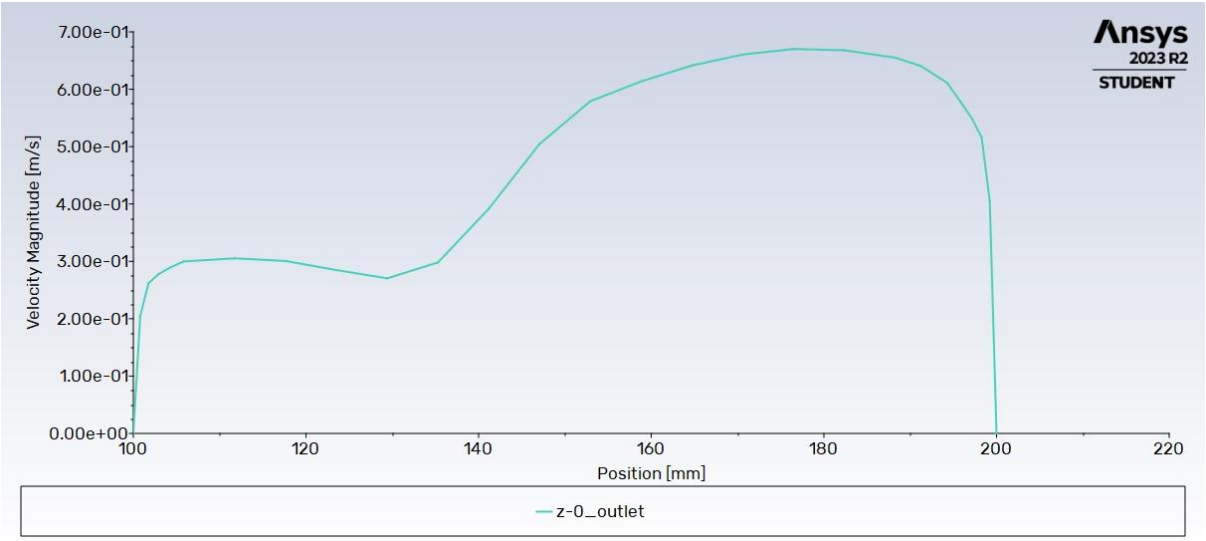


Fig: Profile of velocity magnitude

- Velocity magnitude profile increases due to addition of small inlet flow which causes the velocity profile to rise.
- There is dip initially in the velocity profile due to bend in the pipe.
- Velocity is zero at boundaries due to *no slip condition*.

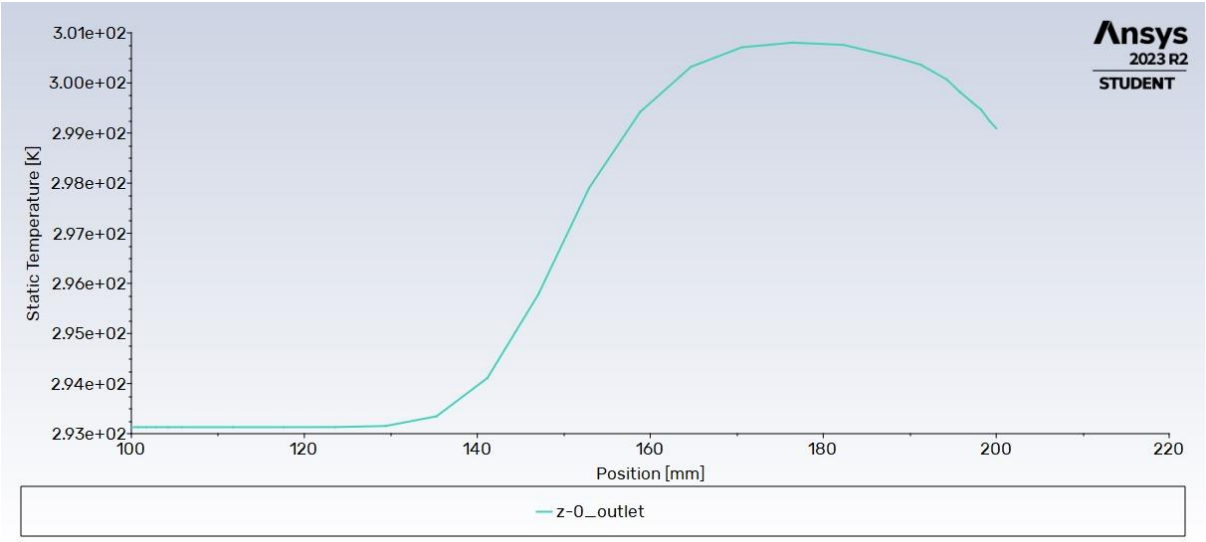


Fig: Profile of temperature

- Temperature profile has a sudden increase due to addition of hot water flow from a small inlet.