

Assignment: 6 VISCOUS AND TURBULENT FLOW

1. State the different observations in Reynolds experiment for various states of flow.
2. Prove that the average velocity is half of the maximum velocity in circular pipe with steady laminar flow.
3. Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe. Using that prove that the ratio of maximum velocity to average velocity is 2.
4. Derive an expression for the Hagen Poiseuille's formula.
5. Derive an expression for power absorbed in foot step bearing.
6. Derive Darcy-Weisbach equation.
7. Explain the term coefficient of friction. On what factors does this coefficient depend?
8. Obtain an expression for the coefficient of friction in the terms of shear stress.
9. Obtain expression for the velocity distribution for turbulent flow in smooth pipes.
10. Show that velocity distribution for turbulent flow through rough pipe is given by

$$\frac{u}{u_*} = 5.75 \log_{10} \left(\frac{y}{k} \right) + 8.5$$

Where u^* = shear velocity, y = distance from pipe wall, k = roughness factor

11. Write a short note on moody diagram for calculating the head loss due to friction.

