Experiment Details

|  |  |
| --- | --- |
| Department Name | Biotechnology engineering |
| Class | SY BTech |
| Semester | 3​rd​ Sem |
| Subject Name | Fluid Mechanics |
| Experiment No. | 7 |
| Experiment Name | Reynold’s Experiment |

Version History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sr. No. | Version Number | Created By | Approved By | Date |
| 1 | v1.0 | Rameshwari Arun Metil | Dr.Mrs Pallavi S.Patil | 12/10/2020 |
|  |  |  |  |  |

AIM:

Determine the Reynold’s Number and hence the Type of Flow

THEORY:

The flow of real fluids can basically occur under two very different regimes namely laminar and turbulent flow. The laminar flow is characterized by fluid particles moving in the form of lamina sliding over each other, such that at any instant the velocity at all the points in particular lamina is the same. The lamina near the flow boundary move at a slower rate as compared to those near the center of the flow passage. This type of flow occurs in viscous fluids, fluids moving at slow velocity and fluids flowing through narrow passages.

The turbulent flow is characterized by constant agitation and intermixing of fluid particles such that their velocity changes from point to point and even at the same point from time to time.

Reynolds conducted an experiment for observation and determination of these regimes of flow. By introducing a fine filament of dye in to the flow of water through the glass tube, at its entrance he studied the different types of flow. At low velocities the dye filament appeared as straight line through the length of the tube and parallel to its axis, characterizing laminar flow. As the velocity is increased the dye filament becomes wavy throughout indicating transition flow. On further increasing the velocity the filament breaks up and diffuses completely in the water in the glass tube indicating the turbulent flow.

After conducting his experiment with pipes different diameters and with water at different temperatures Reynolds concluded that the various parameters on which the regimes of flow depend can be grouped together in a single non dimensional parameter called Reynolds number. Reynolds number is defined as, the ratio of inertia force to the viscous force.

N Re = VDρ/ µ

Where Re-Reynolds number

V - Velocity of flow

D - Characteristic length=diameter in case of pipe flow

Ρ - Mass density of fluid

µ - dynamic viscosity of fluid

Specification of Fluid (Water):

Density (Ρ) :995kg/m 3

Diameter of pipe (D) : 0.006m

Viscocity (μ) : 0.00133Pa-sec

Reynolds observed that in case of flow through pipe for values of Re<2000 the flow is laminar while offer Re>40000 it is turbulent and for 2000<Re<4000 it is transition flow.

|  |  |  |
| --- | --- | --- |
| Type of flow | Reynolds number | |
| Pipe flow | Canal flow |
| Laminar flow | < 2000 | < 500 |
| Transition flow | 2000 to 4000 | 500 to 2000 |
| Turbulent flow | > 4000 | >2000 |

PRE TEST:

1. Unit of renyold’s no is ……..
   * **Dimension less quantity**
   * m
   * kg/m

1. Renyold’s no is define as ………..
   * The ratio of temperature
   * **The ratio of inertia force to the viscous force** ● The ratio of viscous force

1. Unit of Viscocity is ………..
   * + m/s
     + m
     + **pa-sec**

PROCEDURE:

1. Start the experiment and allow the water to flow in to the tank of the apparatus. Water level in the pyrometer is slightly rising along with rise in tank. Control valve of the glass tube should be slightly opened for removing air bubbles.
2. After the tank is filled outlet valve of the glass tube and inlet valve of the tank should be closed, so that water should be at rest.
3. Keeping the velocity of flow is very small and inlet of the die injector is slightly opened, so that the die stream moves at a straight line throughout the tube showing the flow is laminar.
4. Again measure the discharge and increase the velocity of flow.
5. Note the observations till the die stream in the glass tube breaks up and gets diffused in water.
6. Repeat the experiment by decreasing the rate of flow and by changing the temperature and diameter of pipe.

POST TEST:

* 1. Flow to be laminar the Reynolds number should be greater than 2100.
     + True
     + **False**​
  2. For flow to be turbulent the flow should be more than 400.
     + True
     + **False**​
  3. Concept of Reynolds number is used in open channels.
     + True
     + **False**​

4.The behavior of path lines is laminar flow.

* + - True
    - **False**

5. If the Reynolds number is in between 2100 and 4000 then the flow is.

* + - Turbulent
    - **Transition**​
    - Laminar

REFERENCES:

* + - FLUID MECHANICS - RK BANSAL
    - EXPERIMENTS ON FLUID MECHANICS - SARABJIT SINGH
    - WIKIPEDIA
    - The constructor- http://theconstructor.org/