Date

Expt. No. 04

Page No. 10

Aim :-

To determine the Reynold's number by Reynold's apparatus.

Reference :-

Requirement :-

Reynold's apparatus (1)
Pump (1)
Water tank (1)
Coloured solution ($KMnO_4$).

Theory :-

Fluid can flow through a pipe in two different ways. At low flow rates the pressure drop in the field fluid increases directly with the fluid velocity and at high rates it increases much more rapidly. At low velocity the fluid velocity and at high rates it increases much more rapidly. At low velocity the fluid will travel as layers and there is no mixing of the layers of the fluid. This type of flow is called laminar flow. At high velocity this

Teacher's Signature

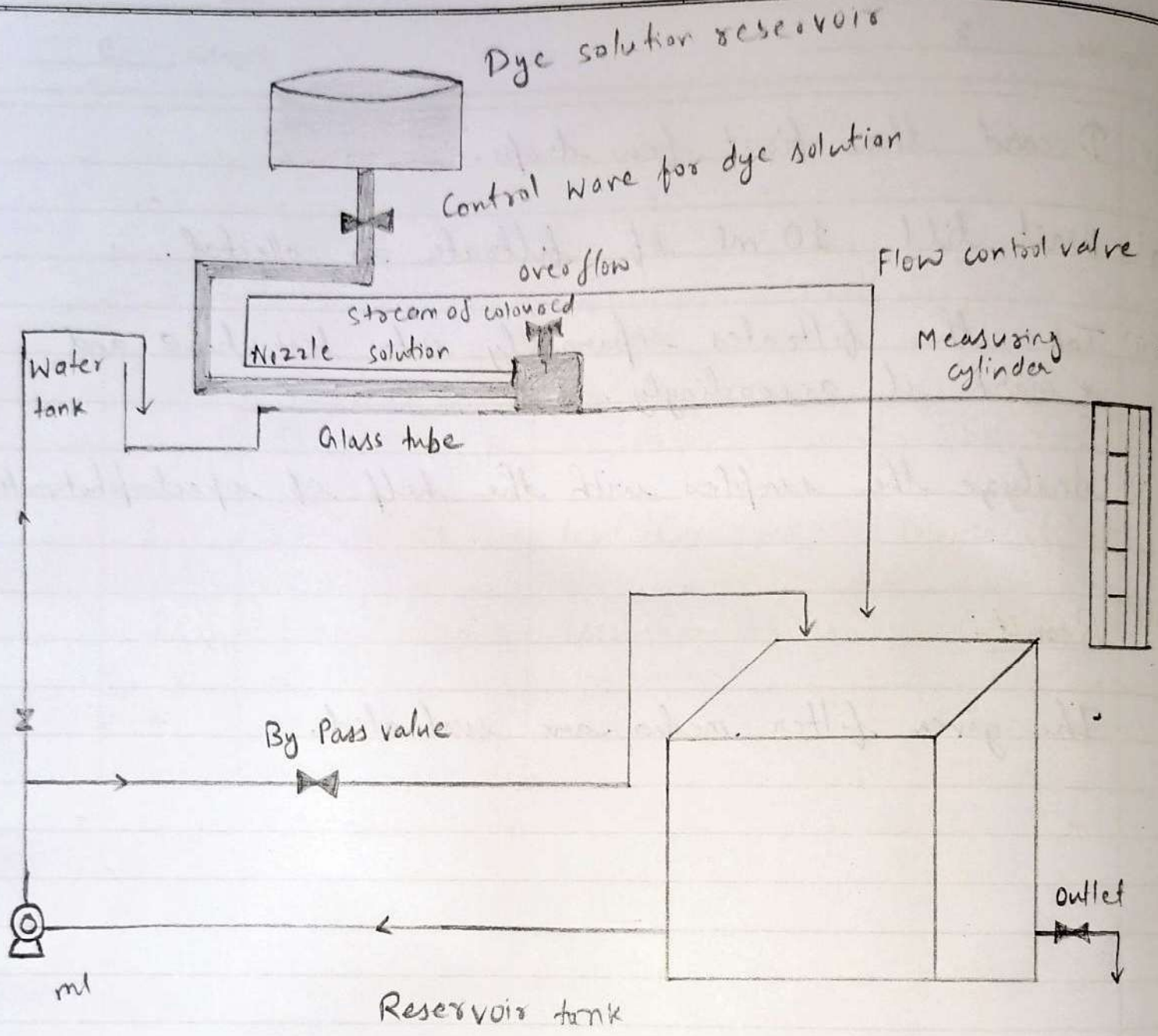

Fig :- Assemble of Reynold's Apparatus.

pattern of flow is called laminar flow. pattern of flow is disturbed and there will be a complete mixing of the layers and production of turbulence. This type of flow is called ~~and~~ turbulent flow.

Operating Procedure :-

i) Clean the apparatus make all the parts of the apparatus dust free.

(ii) Close the drain valves provided.

(iii) Fill the reservois tank 3/4th with clean water.

(iv) Prepare a dye solution ($KMnO_4$) and litre in Pure water. close the flow control valve for the dye solution.

(v) Put this sol^n on the dye vessel after removing all the solid particles from it.

(vi) Open the flow control valve and the bypass valve.

(vii) Switch on the Power supply.

(viii) Switch on the pump.

Teacher's Signature _____

Observation and Calculation

S.No	Type of flow observed	Volume collected (ml)	t (sec)	V (m/sec)	Q (m^3/s)	Reynold's number (RE)
1						
2						
3.						
4						
5						
6						

Internal diameter of the glass tube = ... mm, = ... m

Area of the glass tube = ... m^2

Kinematic viscosity of water = at 0°c = 1.788×10^{-6} m^2/s

= at 20°c = 1.006×10^{-6} m^2/s

To convert litre to m^3 multipled with 0.001.

Reynold's no (RE) = Pvd/u

where,

P = Density of the fluid in kg/m^3

u = Viscosity of the fluid in Ns/m^2

V = Average velocity of the fluid flow in m/sec...

v = Volume of water collected m^3.

t = time taken to collect. V m^3 of water

A = Area of the glass tube

u/p = Kinematic viscosity m^3/s

Discharge of the fluid (V/t) = ... m^3/s

Velocity of the fluid (v) = Q/A = ... m/sec.

ix) The water is filled in the I water tank, and the overflow is maintained at minium.

(x) Allow the water to pass through the glass tube from the water tank at minimum flow rate by regulating the valve at the end of the glass tube.

xi) Adjust the flow of the dye solution through the capillary tube so as to get a narrow fine coloured line of the dye sol^{n} at the centre of the glass tube.

xii) Determine the flow rate with the help of measuring cylinder and stop clock.

xiii) Now slowly increase the flow through the glass tube with the help of flow control valve present at the end of the glass tube.

xiv) Now the clear ~~coated~~ coloured sol^{n} starts to travel in a ~~way~~ wavy form (upper critical velocity).

xv) Find out the discharge and the flow rate.

xvi) Further increase the flow rate so that coloured sol^{n} completely diffusing in to the water (Turbulent flow)

~~xvi)~~

xvii) Determine the discharge and the flow rate.

Teacher's Signature _____

xviii) Decrease the flow of the liquid so as to get the flow in such a way the coloured sol^n travels in wavy form. Find out the discharge and flow rate.

xix) Again decrease the flow so that the wavy fashion of the flow of the coloured solution starts to change in to straight line. Find out the flow rate (lower critical velocity)

xx) Finally keep the flow in such a way that the coloured sol^n is moving in a straight line without any disturbance.

xxi) After taking all the readings switch off the pump and the power supply.

Report :-

Different types of flow Pattern is demonstrated and studied Reynold's ~~no~~ number for

Laminar flow :
Transition flow =
Turbulent flow :

The critical velocity is found to be =

Teacher's Signature _____