OBSERVATIONS AND CALCULATIONS

Table 1. Results of Flow through pipes

S. No	Manometric Reading (cm)		Equivalent head of water (h) m	Time for 'H' cm rise T, sec	Discharge (Q) m^3/sec	Velocity (V) m/s	Friction factor, f
	h_1	h_2					

Diameter of the pipe, d =

Dimensions of the collecting tank =

Length of the tube, l =

Experiment No: Roll No:
Date :

5. DETERMINATION OF FRICTION FACTOR FOR A GIVEN PIPE LINE SUPPLYING WATER TO KONDAPALLI THERMAL POWER PLANT, VIJAYAWADA

AIM

To determine the friction factor of the pipe material

Basic concept

Transportation of fluids through pipes is frequently dealt by engineers. Distribution of water and gas to domestic consumers through conduits, supply of steam through pipes in thermal power plants and gases in process plants, offshore pumping of oil, etc are some of the examples of transportation of fluids through pipes. In order to design such systems, it is necessary to study the friction – flow characteristics through the pipes. The loss of head through the pipe is major loss and it is to be considered for designing pump capacity to supply the fluid. The prediction of frictional losses through the pipes lines enables the designer to estimate the power consumption and hence the type and size of the pumps required for a given application and length of the pipe.

When fluid flows through a pipe the frictional resistance offered to the flow depends on the roughness of the inner surface of the pipe carrying the liquid. The frictional resistance is mostly due to viscous resistance of fluid in case of laminar flow. In turbulent flow it is due to resistance offered by viscosity of the fluid and surface roughness of the pipe.

The following formula is employed

The head loss due to friction (h_f) = $fLV^2/(2gd)$

h_f = Pressure head in terms of flowing liquid = $\frac{(h_1 - h_2)}{100}\left(\frac{s_m}{s_l} - 1\right)$

h_1 = Manometric level in one of the limb of manometer.

h_2 = Manometric level in one of the other limb of manometer.

S_m= Specific gravity of manometric liquid (for Mercury = 13.6)

S_1 = Specific gravity of the flowing liquid (for Water= 1.0)

f = friction factor of the pipe material

L = length of pipe between the pressure taps

D = diameter of the pipe

V = Velocity of flow in the pipe (Q_a/a)

MODEL CALCULATIONS

Q_a = actual discharge (AH/t)

a = cross-sectional area of the pipe

H = rise of water level in the collecting tank

t = time taken for a rise “H” in the collecting tank

g = acceleration due to gravity

APPARATUS

1. Pipe fitted with gate valve
2. Differential U – tube mercury manometer
3. Collecting tank fitted with piezometer and gate valve
4. Stop watch
5. Meter Scale

PROCEDURE

1. The diameter of the pipe, internal plan dimensions of the collecting tank and the length of the pipe between the pressure tapping’s are measured.
2. The gate valve is fully opened control valve in the pipe line is opened for maximum discharge.
3. The manometric heads in both the limbs of manometer are noted down.
4. The outlet valve of the collecting tank is closed and time taken for a rise of “H” cm in the collecting tank is noted down.
5. The above procedure is repeated for different discharges by controlling the gate valve and reading are noted down in table.

GRAPHS

The following graph is drawn by taking h_f on y – axis and V^2 on x-axis
h_f vs V^2

Result

The friction factor for the pipe material, (f) =
(from experiment)

The friction factor for the pipe material, (f) =
(from h_f vs V^2 graph)

INFERENCE