EXPERIMENT :- To determine the elements of a hydraulic jump in a rectangular channel

INTRODUCTION:-

Downstream of many types of hydraulic structures such as dams and barrages, spillways, sluice gates and draft tubes of hydraulic turbines, a considerable portion of the kinetic energy in supercritical flow must be dissipated to prevent scour and erosion. Various methods of energy dissipation have been used to achieve tranquil (sub critical) flow condition as the flow enters the downstream channel.

The primary purpose of all such methods is to convert as much as possible the kinetic energy of flow into turbulent energy and ultimately into the heat energy which is dissipated into atmosphere. This objective is most effectively accomplished by means of a local phenomenon known as hydraulic jump which may assume several distinct forms depending on the geometry of the channel and tail water conditions.

Thus hydraulic jump is a phenomenon well known to hydraulic engineers as a useful means of dissipating excess energy and thereby prevent scour and erosion downstream of spillways, chutes, power houses and other appurtenances. It has also been used to raise the water level on the downstream to provide the requisite head for diversion into canals and rivers etc for irrigation purpose. Hydraulic jump is a one of the most frequently encountered cases of rapidly varied flow which occur when a supercritical flow changes to sub critical flow

HYDRAULIC JUMP

Experimental setup of a rectangular channel for hydraulic jump formation

OBJECTIVE: To compare the experimental value of depth before a hydraulic jump to that calculated from theory and calculate energy loss in a hydraulic jump.

SCOPE: The formation of hydraulic jump is associated with a sudden rise in the water depth, large scale turbulence and dissipation of energy. It is employed at the foot of spillways and other hydraulic structures of dissipate energy for the protection of bed against scour. This experiment helps to understand the features of hydraulic jump.

APPARATUS: (a) Open channel flume (b) Stop watch

$$\frac{2q2}{g} = y1y2(y1 + y2)$$

Where, y1 = Depth before jump. y2 = Depth after jump. q= Discharge per unit width of the flume(Specific discharge), g = acceleration due to gravity

$$\text{Energy loss } E_L = \frac{(y2 - y1)^3}{4y1y2}$$

EXPERIMENTAL PROCEDURE:

(a) Start the pump and set the sluice gate to about 25mm
(b) Adjust the flow rate to give about 300 mm head above the sluice
(c) Raise the adjustable weir to form a hydraulic jump within the central portion of the flume.
(d) Note the depth before and after the jump
(e) Measure the flow rate and hand
(f) Repeat for a head 500 mm above the sluice and steps c, d & e.

OBSERVATIONS

Channel width =
Area of Tank =

Number of observations	Head in cm	Depth y_1 Cm	Depth y_2 cm	Level Difference $(H_2 - H_1)$cm	Time Sec.
1					
2					
3					
4					
5					

CALCULATIONS:

(a) Discharge per unit width q.
(b) Use q and y_2 to compute y_1.
(c) Compute E using theoretically derived y_1 and experimental value.
(d) Show the figure of the apparatus and simple description

Number of observations	Discharge Q m^3/s	Discharge per Unit Width q (m^3/s)	Derived y_1 m	Experiment E_L m	Theoretical E_L m
1					
2					
3					
4					
5					

NOTE:- Go to link-https://www.youtube.com/watch?v=gsQATrCZKMM