SECTION-3

Q1 Ans A. Jet Ratio : It is defined as ratio of mean diameter of Pelton wheel to diameter of jet (d). It is denoted by M.

$$M = D/d, \ (12 \text{ for most cases})$$

(2) Number of buckets on a runner is given by,

$$Z = 15 + \frac{D}{2d} = 15 + 0.5M$$

(3) Number of Jet : It is obtained by dividing the total rate of flow through the ~~tu~~ turbine by rate of flow of water through a single jet.

B. Momentum equation is used to analysis the hydraulic Jump:

1. Due to high ~~tem~~ turbulence and shear action of the roll there is considerable loss of energy in the jump betw Section 1 and 2.

2. In view of the high energy loss, the nature of w is difficult to estimate, the energy equation canno applied to Section 1 and 2 to relate the various parameters.

3. In such situations, we use momentum equation in of hydraulic Jump.

Expression:

1. Consider a horizontal frictionless and rectangular channel. Considering unit width of the channel, the momentum equation can be written as

$$\frac{1}{2}\gamma y_1^2 - \frac{1}{2}\gamma y_2^2 = \beta_2 \rho q V_2 - \beta_1 \rho q V_1$$

$\beta_2 = \beta_1 = 1$ and by Continuity equation
q = Discharge per unit width $= V_1 Y_1 = V_2 Y_2$

$$\left(Y_2^2 - Y_1^2 \right) = \frac{2q^2}{g} \left(\frac{1}{Y_1} - \frac{1}{Y_2} \right)$$

i.e, $Y_1 Y_2 (Y_2 + Y_1) = \frac{2q^2}{g} \; 2Y_2^3$

2. On non-dimensionalizing, $\frac{1}{2} \frac{Y_2}{Y_1} \left(1 + \frac{Y_2}{Y_1} \right) =$

$$= \frac{q^2}{g Y_1^3} = F_{r1}^2$$

Where, F_{r1} = Froude number of the approach flow
$= \frac{V_1}{\sqrt{gY}}$

3. Solving for (Y_2/Y_1) yields, $\frac{Y_2}{Y_1} = \frac{1}{2}\left(1 + \sqrt{1+8F^2}\right.$

4. This equation is relates the ratios of the sequent depths (y_2/y_1) to the initial Froude number F_{r1} in a horizontal, frictionless, rectangular channel is known as the Belanger momentum equation.

5. For high value of F_{r1}, say $F_{r1} > 8.0$ the sequent depth ratio is,

$$\frac{y_2}{y_1} \approx 1.41 F_{r1}$$

6. Similarly, in terms of F_{r2}, $\frac{y_1}{y_2} = \frac{1}{2}\left(-1 + \sqrt{1 + 8F_{r2}^2}\right)$ *