Bernoulli`s Equation: is obtained by integrating the above Euler's equation of motion. If the flow is incompressible, ρ is a constant and

$$\int \frac{dp}{\rho} + \int g dz + \int v dv = \text{constant}$$

If flow is incompressible, ρ is constant and

$$\therefore \quad \frac{p}{\rho} + gz + \frac{v^2}{2} = \text{constant}$$

or

$$\frac{p}{\rho g} + z + \frac{v^2}{2g} = \text{constant}$$

or

$$\frac{p}{\rho g} + \frac{v^2}{2g} + z = \text{constant}$$

is a Bernoulli's equation in which

$\frac{p}{\rho g}$ = pressure energy per unit weight of fluid or pressure head.

$v^2/2g$ = kinetic energy per unit weight or kinetic head.

z = potential energy per unit weight or potential head.

Assumptions made in deriving Bernoulli`s Equation:

The following are the assumptions made in the derivation of Bernoulli's equation:

(i) The fluid is ideal,
(ii) The flow is steady
(iii) The flow is frictionless
(iv) The flow is incompressible
(v) The flow is irrotational

Statement of Bernoulli`s Theorem:

In a steady, frictionless, incompressible and irrotational flow of an ideal fluid, the total energy at any point of the fluid is constant".
The total energy consists of pressure energy, kinetic energy and potential energy or datum energy.
Thus mathematically, Bernoulli's theorem is written as

$$\frac{p}{\rho g} + \frac{v^2}{2g} + z = \text{constant}$$

Application of Bernoulli`s Equation:

1. Venturimeter 2, Orificemeter 3. Pitot Tube

Flow Measurement Devices:

Venturimeter and Orifice meter are the devices used for measurement of flow rate or actual discharge through pipes.
Pitot tube is used to measure the velocity of flow in open canals, pipes as well as measurement of speed of ships, Aircrafts.