4.2 HYDRAULIC AND ENERGY GRADIENT

Concepts of hydraulic gradient line and total energy line will be quite useful when we analyze the problems of fluid flow through pipes.

Hydraulic gradient line and total energy line are the graphical representation for the longitudinal variation in piezometric head and total head.

Hydraulic gradient line

Hydraulic gradient line is basically defined as the line which will give the sum of pressure head and datum head or potential head of a fluid flowing through a pipe with respect to some reference line.

Hydraulic gradient line = Pressure head + Potential head or datum head

$$H.G.L = P/\rho g + Z$$

Where,

H.G.L = Hydraulic gradient line

$P/\rho g$ = Pressure head

Z = Potential head or datum head

Total Energy Line

Total energy line is basically defined as the line which will give the sum of pressure head, potential head and kinetic head of a fluid flowing through a pipe with respect to some reference line.

Total energy line = Pressure head + Potential head + Kinetic head

$$H.G.L = P/\rho g + Z + V^2/2g$$

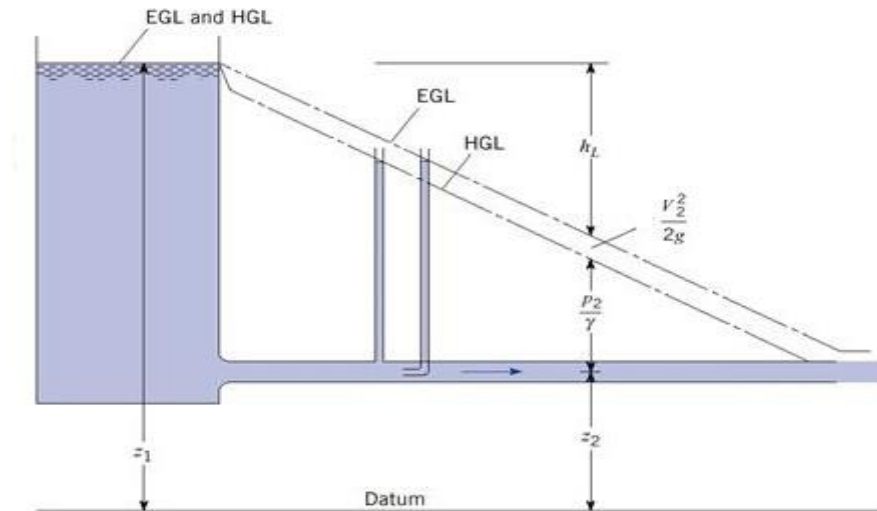Where,

T.E.L = Total energy line

$P/\rho g$ = Pressure head

Z = Potential head or datum head

$V^2/2g$ = Kinetic head or velocity head

Relation between hydraulic gradient line and total energy line

H.G.L = E.G.L - $V^2/2g$

Let us see the following figure, there is one reservoir filled with water and also connected with one pipe of uniform cross-sectional diameter.

Hydraulic gradient and energy lines are displayed in figure.

At Velocity V = 0, Kinetic head will be zero and therefore hydraulic gradient line and energy gradient line will be same.

At Velocity V = 0, EGL = HGL