

Streamline, Streakline, Path line, Streamtube

Streakline →

It is the locus of fluid particles that have passed sequentially through a prescribable point in the flow.

It is an instantaneous picture of the position of all particles in flow that have passed through a given point.

eg: A line formed by the coloured dye injected into a liquid or by the smoke particles ejected into the atm. from a fixed nozzle constitutes a streak line.

Stream tube →

It is an imaginary tube whose boundary consists of streamlines.

The volume flow rate must be the same for all cross sections of the stream tube.

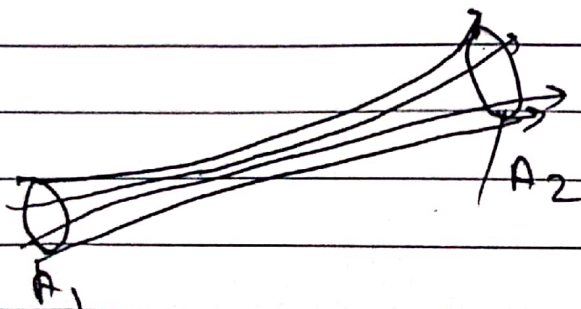
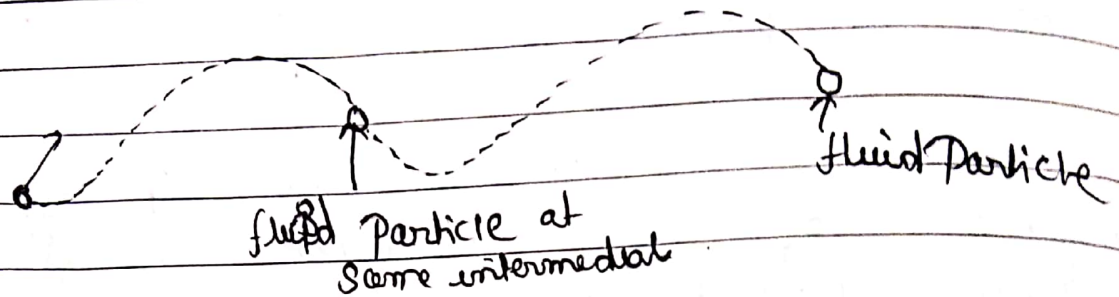


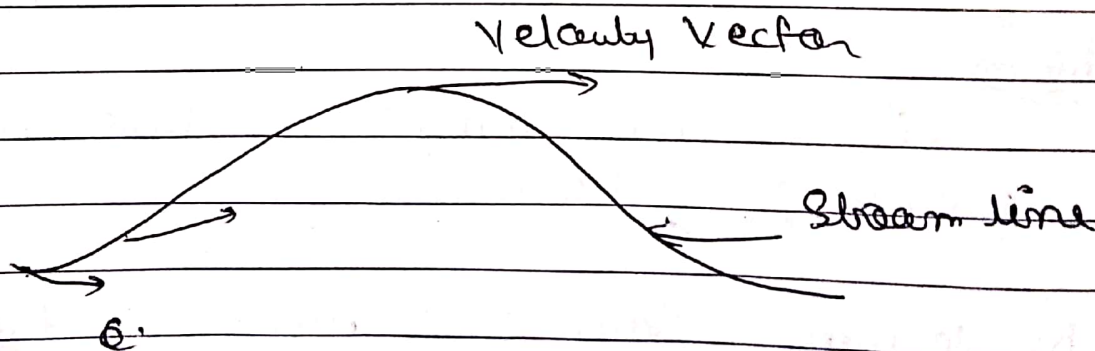
Fig: Stream tube

Path line \rightarrow it is trace made by single particle over a period of time



Stream line \rightarrow it shows the mean direction of a number of particles at the same instance of time.

it is an imaginary curve drawn through a flowing fluid in such a way that the tangent to it at any point gives the direction of the velocity of flow at that point



concept of stream line

Equation of Stream line (general)

$$\frac{dx}{u} = \frac{dy}{v} = \frac{dz}{w}$$

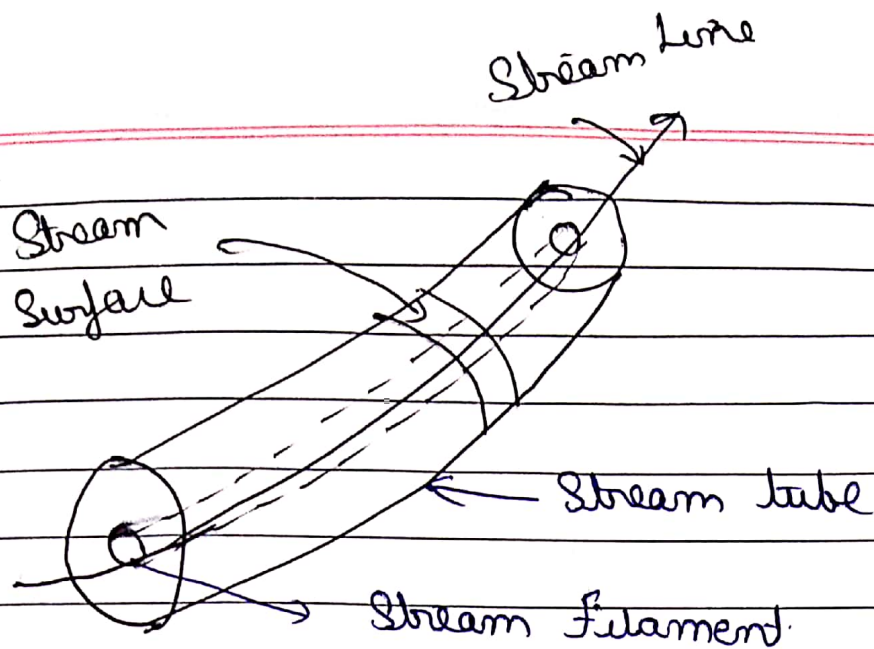
for two dimensional flow in x-y plane

$$\frac{dx}{u} = \frac{dy}{v}$$

$$\boxed{\frac{dy}{dx} = \frac{v}{u}}$$

Characteristics of Stream line →

1. Stream line do not cross each other, otherwise the fluid particle will have two velocities at the point of intersection and that is physical impossible
2. there can be no flow across the stream line
3. pipe and nozzles are example of stream tube.
4. Stream line spacing varies inversely with velocity



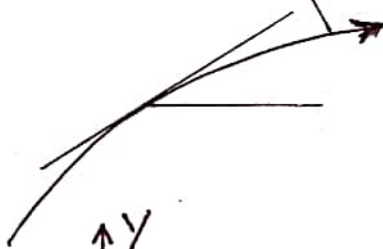
5. Stream tube has finite dimension. Since there is no flow perpendicular to stream lines, hence there is no flow across the surface.

6. The shape of a stream tube change from one instant to another because of change in the position of stream line.

7. A grouping of neighbouring streamlines forming a cylindrical passage with an elementary infinitesimal area of cross section is treated as a stream filament.

A no. of stream filament comprises a stream tube.

STREAM LINE



STREAMTUBE

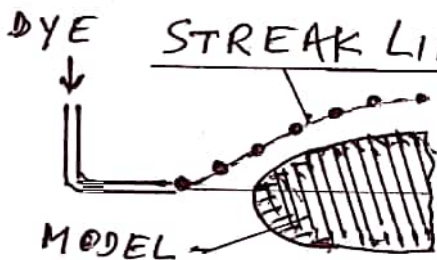


PATH LINE



FLUID PARTICLE

STREAK LINE



TIME LINE

