FLUID MACHINES

A fluid machine is a device which convert the energy stored by a fluid into mechanical energy or vice versa. The energy stored by a fluid mass appears in the form of potential, kinetic and intermolecular energy. The mechanical energy, on the other hand, is usually transmitted by rotating shaft. Machines using liquid (mainly water, for almost all practical purpose) are termed as hydraulic machines. In this chapter we shall discuss, in general, the basic fluid mechanical principle governing the energy transfer in a fluid machine and also a brief description of different kinds of hydraulic machines along with their performance.

FLUID	TYPES OF TURBINE
Water	Hydraulic Turbine
Steam	Steam Turbine
Froen	Vapour Turbine
Gas or air	Gas Turbine
Wind	Wind Mills

Similarly, fluid machines which convert shaft power to fluid power by raising the energy content per unit mass of the fluid are classified as follows:

Fluid	Types of Machine
Water and Other liquids	Pumps
Air and Other Gases (with slight pressure rise)	Fans and Propellers
Air and Other Gases (with higher pressure rise)	Blowers and Compressors

CLASSIFICATION OF FLUID MACHINES

The turbines in general are classified in two ways:

• According to the direction of flow of water through the runner

• According to the action of water on the runner blades.

In order to classify machines according to the direction of flow of water through the runner, three mutually perpendicular directions for flow of water are chosen

RADIAL FLOW MACHINE

The path of water particles is wholly or mainly in the plane of rotation. i.e., the water enters the runner at the outer periphery, flows inwards in the radial direction and leaves at a different radius as shown in figure 4.1(b).

AXIAL FLOW MACHINES

The water mainly flows through the runner in a direction parallel to the axis of rotation as shown in figure 4

MIXED FLOW MACHINES

The flow in the runner may not be merely in one direction.
turbines, water enters radially inwards and emerges out axially so that parallel to the axis of the shaft as shown in figure 4.1(d).

In mixed flow the discharge in According to the action of water on moving blades, the turbine way be placed in one of the two general categories: i Impulse ii Reaction.

In a hydroelectric power scheme, water in a very large quantity is stored in a high

level reservoir. In an impulse turbine, the water is brought to the turbine entrance through penstock pipes ending in one or more fixed nozzles. The entire pressure energy of water is converted into the kinetic energy of an unconfined jet. The jet of fluid then strikes the blades of the runner and loses practically all of its kinetic energy, i.e., the velocity of water at the exit of the runner is just sufficient to enable
it to move out the runner. The static pressure of water at the entrance to the runner
is equal to the static pressure at exit and the rotation of the wheel is caused purely due to the tangential force created by the impact of the jet, and hence an impulse turbine. The most common impulse turbine is called Pelton turbine.

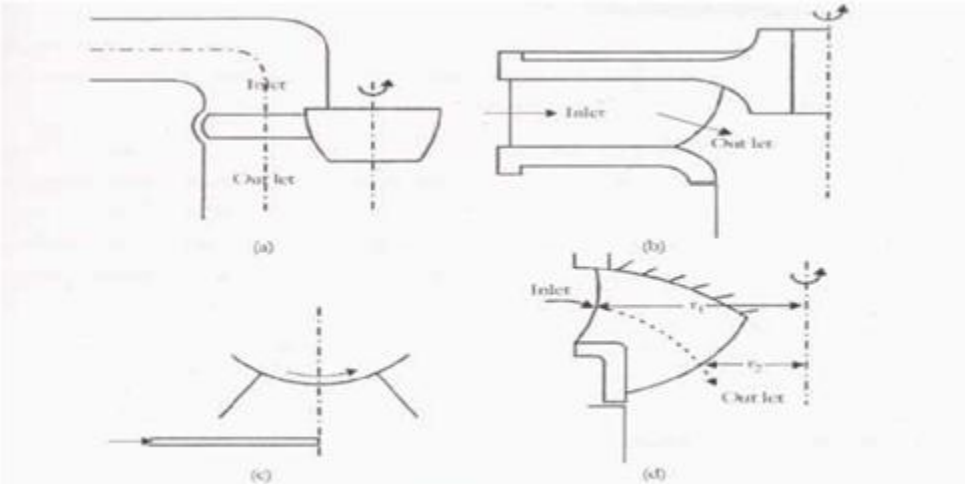

Figure 4.1

Tangential flow machine

The water strikes the blades or buckets of the runner in a direction tangential to the path of rotation. The tangential direction is perpendicular to both axial and radial directions as shown in figure 4.1(c).

EXCHANGE OF ENERGY

- A machine wherein rotary motion is obtained by centrifugal forces which result
from a change in the direction of high velocity fluid jet that issues from a nozzle.

A hydraulic turbine uses the potential and kinetic energy of water and convert it into

usable mechanical energy. The fluid energy is available in the natural or artificial high level water reservoirs which are created by constructing dams at appropriate places in the flow path of rivers. When water from the reservoir is taken to the turbine, transfer of energy takes place in the blade passages of the unit. The mechanical energy made available at the turbine shaft is used to run an electric generator which is directly coupled to the turbine shaft.

The power generated by utilizing the potential and kinetic energy of water has the advantages of

- High efficiency
- Operational flexibility
- Low wear and tear
- Ease maintenance.

Despite the heavy capital cost involved in constructing dams and reservoirs, in running pipelines and in turbine installation (when compared to an equivalent thermal power plant) different countries have tried to tap all their water power resources. Appropriate types of water turbines have been installed for most efficient utilization.

Source : http://mediatoget.blogspot.in/2011/11/fluid-machines.html