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Paper → Power Generation

Date → 24-9-2020

D/p → electrical.

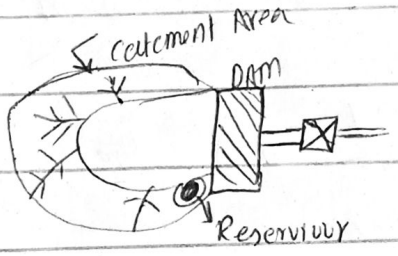
Q1 - (A) Part:-

Answer

Elements Of Hydropower Plant:

① **Catchment Area:**

The whole area behind the dam draining into stream as river across which the dam has been built at suitable place is called catchment area.



② **Reservoir:** A reservoir is employed to store water which is further utilized to generate power by running the hydroelectric turbines.

In Reservoir the water is collected from the catchment area is stored behind a dam.

(3) DAM:- A dam is a barrier which confines or raise water for storage or diversion to create a hydraulic head.

The purpose of dam is to store the water and regulate the out flow of water.

(4) Surge Tank:- additional storage for near to turbine, usually provided in high head plants.

located near the beginning of the penstock.

(5) Penstock:- Penstocks are the water conductor conduit of suitable size connecting this surge shaft to main inlet valve. At the end of the penstock a drainage valve is provided which drains water from penstock to the draft tube.

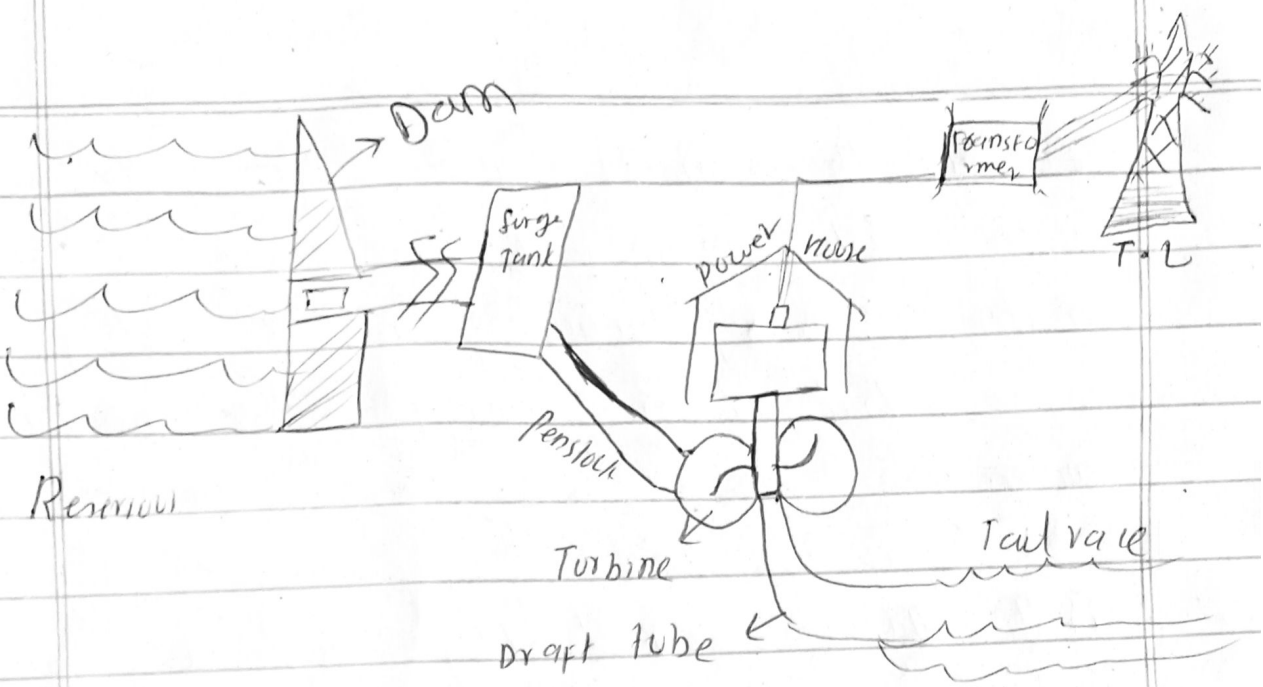
(6) Turbines:- Turbines are used to

convert the energy water of falling water into mechanical energy.
water ~~bridge~~ turbine is a rotary engine that takes energy from moving water.

(7) Spill ways:- Spill way is a kind of canal provided besides the dam.

(i) Over flow spill way
(ii) chute or trough spil way
(iii) side channel spilway
(iv) Shaft spill way.

(8) Power House:- power house is a building in which the turbines, alternators and the auxiliary plant are housed. Some important items of equipment power house are Turbines, Generator, Governors Gate valve, Transformer etc.


Dam
Surge Tank
Transfo rmer
T.L
power House
Penstock
Reservoir
Turbine
Tail race
Draft Tube

Question no 1 → (B) part:

Given data:

$V = 5 \times 10^5 m^3$

$h = 100m$

Hydraulic preqiuency = 85% 0.85

Electrical efficiency = 0.94

overall efficiency = $0.85 \times 0.94 = 0.80$

⟹ We know that:

$$E = \eta \rho g h V$$

$$E = 0.8 \times 1000 \times 9.81 \times 100 \times 5 \times 10^5$$

$$\boxed{E = 3.92 \times 10^{11} \text{ wh}}$$

Q2 A part:

Different Hydropower Turbines:

Impulse Turbine: The impulse turbine generally uses the velocity of the water to move the runner and discharges to atmospheric pressure. The water stream hits each bucket on the runner. There is no suction on the down side of the turbine and the turbine housing after hitting the runner.

Pelton:- A pelton wheel has one or more free jets discharging water into a aerated space and impinging on the buckets of a runner. Draft tubes are not required for impulse turbines since the runner must be located above the maximum tailwater to permit operation at atmospheric pressure.

Cross Flow: A cross flow turbine is drum shaped and uses an elongated, rectangular section nozzle directed against curved vanes on a cylindrically shaped runner. It resembles a squirrel cage blower. The cross flow turbine allows the water to flow through the blades twice. The first pass is when the water flows from outside of the blades to ~~the~~ inside. The second pass is from the inside back out.

Reaction Turbine:-

A Reaction Turbine develops power from the combined action of pressure and moving water. The runner is placed directly in this water stream flowing over the blades rather than striking each individually. Reaction turbines are generally used for sites with lower head and higher flows than compared with the impulse turbines.

Propeller: Propeller turbine is generally has a runner with three to six blades in which the water contacts all of the blades constantly. Through the pipe, the pressure is constant; if it isn't the runner would be out of balance. The pitch of the blades may be fixed or adjustable. The major components besides the runner are a scroll cas, wicket gates and a draft tube. There are several different types of propeller turbines.

⇒ The appropriate type of turbine depends primarily on available head and less so on availatebe head and less so on availabe so on available flow rate.
pelton turbines for high heads.
Francis turbine for low
Kaplan for wide range

Q2 B Part i.

Given data:

$h = 190\ m$

$A = 22\ m^2/s$

~~η~~ $= 85\%$

$N_s = 85.49 (h)^{0.243}$

Diameter $= 38.56 \sqrt{h}/n$ ~~Jet Diameter~~

Jet Diameter $a = (\pi d_j^2) V_j / 4$

$V_j = \sqrt{2} g h$

Solution: We know that,

Diameter $= 38.56 \sqrt{h}/4$

Diameter $= 38.56 \times 16.216$

$D = 625.28896\ m$

$\sqrt{2}$

$\sqrt{2 \times g}$

$V_j =$

Jet diameter $= a = (\pi d_j^2) V_j / 4$

$a = (3.14 \times 625.288)\ 62.02/4$

$a = 29951.7$ Ans

(a)

3 Explain different stages of Nuclear Fuel cycle.

Nuclear Fuel cycle:-

Mining and Milling:-

Uranium is usually mined by either surface (open cut) or underground mining techniques, depending on the depth at which the ore body is found.

The mined uranium ore is sent to a mill. which is usually located close to the mine.

Conversion:- Uranium needs to be in the form of a gas before it can be enriched, the U_3O_8 is converted into gas uranium hexa fluoride (UF_6) at a conversion plant.

(3) Enriching: Need to enrich uranium to at least 3% of for a power plant.

Two Method of Enriching:

Gaseous Diffusion Method

Centrifuge Method.

(4) Fuel Conversion: Enriched Uranium transported to a fuel fabrication plant where it is converted to uranium dioxide (UO_2) powder and pressed into small pellets. These pellets are inserted into thin tubes, usually of zirconium alloy or stainless steel, to form fuel rods.

(5) Fuel Packaging in the Core:

Need roughly 100 tons per years for a 1000 MW plant.

⑥ The Reactor CORES:

The reactor core consists of fuel rods and control Rods.

→ Fuel rods contain enriched Uranium
→ control rods are inserted between fuel rods to absorb neutrons and slow the chain reaction.

⑦ Moderators:

Neutrons produced during fission in the core are moving too fast to cause chain reaction so moderator is used for to slow down the Neutrons.

⑧ Boiling Water Reactor:- Heat generated in core is used to generated steam through a heat exchanger the steam runs a turbine just like a Normal power plant.

(9) Uranium Reprocessing:

Spent fuel still contains approximately 96% of its original uranium, of which the fissionable U-235 content has been reduced to less than 1%. Spent fuels comprises waste products and the remaining 1% is plutonium produced while the fuel was in the reactor.

(10) Nucleaur Waste Disposal:

In the US NO high level nucleaur waste is ever disposed of it sits in specially designed pools resembling large swimming pools (water cools the fuel and acts as a radiation shield or in specially designed dry storage containers.

Spent nuclear fuel must be isolated for thousand of years.

END