GOVT . POLYTECHNIC , BHADRAK

INTERNAL ASSESSEMENT -1

BRANCH – MECH ENGG 5^{TH} SEM

TIME- 1 HOUR

SUB- HM& IFP

ANSWER ANY THREE QUESTIONS (Q.1 COMPULSORY) (2X5)

1. (a) What is the difference between turbine and pump ?
   (b) Classify various type of turbine
   (c) Define impulse turbine
   (d) Define overall efficiency
   (e) What is gross head and Net head ?

g. What do you mean by internet of things?

2. What is the basic difference between impulse turbine and reaction turbine ? (5X2)

3. Draw the layout of a hydro-electric power plant & describe its components.

4. A Peltan Wheel is to be designed for the following specifications: shaft power =11,772 KW ; head =380 m ; speed=750 r.p.m ; overal efficiency=86%; jet diameter is not to exceed one –sixth of the wheel diameter . Determine (i) The wheel diameter (ii) The number of jets required (iii) Diameter of the jet.

Take Kv1=0.985 & Ku1=0.45

any

ifications of ro

ration of Robotic Manipulator.

INTERNAL ASSESMENT

GOVT. POLYTECHNIC, BHADRAK

Session - 2022-2023

Name : SHUBHRANSU SEKHAR SAHOO

Branch: MECHANICAL SEMESTER 5th

SUBJECT : HM & IFP

REGD. NO.: F20157004054

Rakesh kumar Rout

Signature of Invigilator

Full Mark : 20

Mark Obtain : 20

Signature of Examinar : [signature]

Signature of Student : Shubhransu sekhar sahoo

02.012.2022

1.
(a)

Turbine	Pump
(i) The turbine is a machine which convert the hydro-lic energy to mechanical energy is called turbine.	(i) The pump is define as the mechanical energy convert the Hydrolic energy is called pump
(ii) Efficiency is more	(ii) Efficiency is less
(iii) Turbine decreas the energy of the fluid	(iii) Pump increas the energy of the fluid

1.
(b) (i) The turbine classify according to the energy available at inlet of the turbine.

~~→ Pelton wheel turbine~~

⇒ Impulse turbine
Eg - pelton wheel turbine
⇒ Reaction turbine
Eg - Francis turbine, kaplan turbine

(ii) According to the direction of the flow turbine is 4 type

(1) Tangential flow turbine
(2) Radial flow turbine
(3) Axial flow turbine
(4) Mixed flow turbine

According to the head of the turbine

(iii)
(1) low head turbine
(2) medium head turbine
(3) High head turbine.

1.
(c)

→ The impulse turbine is defined as when the at the inlet of the turbine only kinatic energy is available and it work under the atmopharic pressure is called impulse turbine.

→ When the water jet is coming from the nozzle the pressure energy is converted in to kinatic energy that means the entair pressure energy is convert into kinatic energy

→ The example of impulse turbine is pelton wheel turbine

1.
(d)

→ The overall efficiency is defined as the ratio between the power available in the turbine shaft to the power produced by the water at the entranc of the turbine is called overall efficiency

→ It is denoted by the (η_o).

→ Mathematically

$\Rightarrow \dfrac{\text{Shaft power}}{\text{water power}}$

$\Rightarrow \dfrac{SP}{WP} \times \dfrac{RP}{RP}$

$\Rightarrow \dfrac{SP}{RP} \times \dfrac{RP}{WP}$

$(\eta_m) \times (\eta_h)$

$\Rightarrow \boxed{\eta_o = \eta_m \times \eta_h}$

①
(e)

→ The gross head defined as the differance between head race leval to tail race leval is called gross head

→ It is denoted by (Hg.

Net head

→ Head available at the inlet of the turbine when water is flowing from head race to turbine there is some loss due to friction between the water and the penstock and other losses the bend of the pipe, taperness of the pipe and entranc of the pipe

→ It is denoted by 'H'.

→ Hf = frictional head loss

mathmatically

$\Rightarrow \boxed{H = Hg - Hf}$

$H_f = \dfrac{4fLV^2}{D \times 2g}$

4.

Data given

Shaft Powerr = 11.772 KW

$H = 380 m$

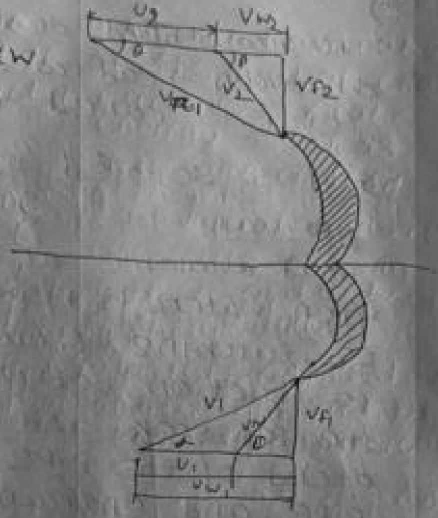
$N = 750 rpm$

$\eta_o = 86\% = 0.86$

$\frac{d}{D} = \frac{1}{6}$

$K_{V_1} = C_v = 0.985$

$K_{U_1} = 0.45$



Solution

$V_1 = C_v \sqrt{2gH}$

$= 0.985\sqrt{2 \times 380 \times 9.81}$

$= 85.05 \ m/s$

we known

$U = U_1 = U_2$

$\Rightarrow K_{U_1} = \frac{U_1}{\sqrt{2gH}}$

$\Rightarrow U = K_{U_1} \times \sqrt{2gH}$

$\Rightarrow U = 0.45 \times \sqrt{2 \times 9.81 \times 380} = 38.85 \ m/s$

$\Rightarrow U = \frac{\pi D N}{60}$

$\Rightarrow 38.85 = \frac{\pi \times D \times 750}{60}$

$\Rightarrow D = \frac{60 \times 38.85}{\pi \times 750}$

$\Rightarrow D = 0.989$ m (Ans) Diameter of wheel

Now

$\Rightarrow \frac{d}{D} = \frac{1}{6}$

$\Rightarrow d = \frac{0.989}{6} = 0.165 m$ (Ans) Jet diameter

The discharge of the jet (q) = velocity of jet × Area of jet

$\Rightarrow 85.05 \times \frac{\pi}{4} \times (0.165)^2$

$\Rightarrow 1.81 \ m^3/s$

The Total discharge Q =

$\Rightarrow \eta_o = \frac{S.P}{WP}$

$WP = \frac{\rho g Q H}{1000}$

$\Rightarrow 0.86 = \frac{11.772 \times 1000}{1000 \times 9.81 \times Q \times 380}$

$\Rightarrow Q = \frac{11772 \times 1000}{1000 \times 9.81 \times 0.86 \times 380}$

$\Rightarrow Q = 3.671 \ m^3/s$

The number of jets is

$\Rightarrow \frac{\text{Discharge of the jet}}{\text{Total discharge}}$

$\Rightarrow \frac{3.671}{1.81} = 2.02$

$= 2$ No of jet (Ans)

∴

(I) The wheel diameter is (D) = 0.989 m

(II) The number of jets required = 2

(III) Diameter of the jet = 0.165 m

2.

Impulse turbine	Reaction turbine
① All head ~~of the water~~ available at the inlet of the turbine is converted into kinatic energy	(1) All head available at the inlet of the turbine is kinatic energy as well as pressure energy
② pressure in the turbine is constant and is at atmospharic from inlet to outlet.	(2) The variation in the pressure ~~a~~ from inlet to outlet of the turbine.
③ water admited over a part of the circumferance.	③ water admited over ~~entire~~ all part of the circumferance
④ There is no function of hydrolic. Air tight casing is not necessary.	4) Air tight casing is necessary.
⑤ Ragulat the flow without loss.	5) impossible to ragulat the flow without loss
⑥ it is suitable for high head and less quantity of water.	⑥ it is suitable for low head and more quantity of water.
⑦ For same ~~operating~~ operating head size of turbine is more	⑦ For same operating head size of turbine is less.
⑧ Draft tude is not necessary	⑧ Draft tude in necessary
⑨ Efficiency is less	⑨ Efficiency is more
⑩ Easy to ~~go~~ governing	⑩ Not easy to governing
⑪ Eg÷ pelton wheel	⑪ Eg÷ Francis turbine kaplan turbine.
⑫ it is high head turbine.	⑫ it is low head turcine
⑬ more space required	⑬ less space required

1. (a)

Turbine	Pump
1. The turbine is machine which convent the hydro ric energy to mechanical energy is called Turbine	1. The pump is define as the mechanical energy convent the Hydrolic energy is called pump.
(ii) Efficiency is more	(ii) Efficiency is less
(iii) Turbine decreas the energy of the Fluid	(iii) pump increas the energy of the Fluid

(b)

(i) The turbine classify according to the energy

→ Impulse turbine

eg: pelton wheel turbine

→ Reaction turbine

eg:- Francis turbine, kaplan turbine

(ii) According to the direction of the Flow turbine is 4 type

① Tangential Flow turbine

② Radial Flow turbine

③ Axial Flow turbine

④ mixed Flow turbine

(iii) According to the head of the turbine

① low head turbine

② Medium head turbine

③ High head turbine

1 (c) → The impulse turbine is defined as when at the inlet of the turbine only kinetic energy is available and it work under the atomic pressure is called Impulse turbine

→ When the water jet is coming from the nozzle the pressure energy is converted into kinetic energy that mean the entain pressure energy is convert into kinatic energy.

→ The example of impulse turbine is pelton wheel turbine.

1. (a) → The overall efficiency is define as the ratio between the power available in the turbine shaft to the power produced the water at the entrance of the turbine is called overall efficiency.

→ It is denoted by the (η_o)

Mathematicaly

$$= \frac{\text{Shaft Power}}{\text{Water Power}}$$

$$= \frac{SP}{WP} \times \frac{RP}{RP}$$

$$= \frac{SP}{RP} \times \frac{RP}{WP}$$

$$= (\eta_m) \times (\eta_h) \Rightarrow \boxed{\eta_o = \eta_m \times \eta_h}$$

1 (c) The gross head defined as the difference between headrace level to tailrace level is called gross head

→ It is denoted by (H_g)

Net head

→ Head available at the inlet of the turbine when water is flowing from headrace to turbine there is some loss due to friction between the water and the penstock and ~~top~~ other losses the bend of the pipe, tuppen-ness of the pipe and entrance of the pipe

→ It is denoted by 'H'

→ H_F :- Frictional head loss

mathematicaly :→

$$H = H_g - H_F$$

$$H = \frac{4FLV^2}{D \times 2g}$$

4. Data given

shaft power = 11.772 kW

H = 380 m

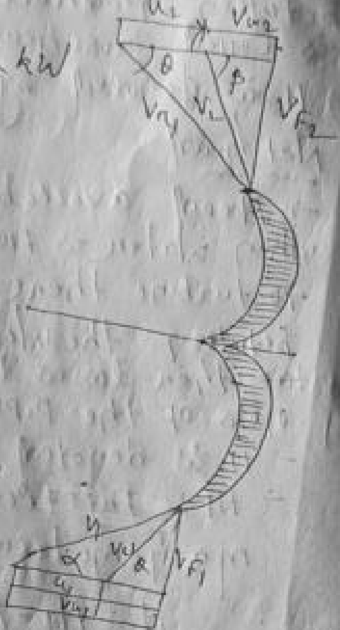
N = 750 Rpm

η_o = 86 % = 0.86

$\frac{d}{D} = \frac{1}{6}$

$k_{v_1} = C_v = 0.985$

$k_{u_1} = 0.45$



Solution:

$V_1 = C_v\sqrt{2gH}$

$= 0.985\sqrt{2 \times 380 \times 9.81}$

$= 85.05$ m/s

We know

$u = u_1 = u_2$

$k_{u_1} = \frac{u_1}{\sqrt{2gH}}$

$u = k_{u_1} \times \sqrt{2gH}$

$u = 0.45 \times \sqrt{2 \times 9.81 \times 380}$

$= 38.85$ m/s

$\Rightarrow u = \frac{\pi D N}{60}$

$\Rightarrow 38.85 = \frac{\pi \times D \times 750}{60}$

$D = \frac{60 \times 38.85}{\pi \times 750}$

$D = 0.989$ m (Ans) Diameter of wheel

Now

$\Rightarrow \frac{d}{D} = \frac{1}{6} \Rightarrow d = \frac{0.989}{6} = 0.165$ m (Ans) Jet diame

2.

Impulse Turbine	Reaction Turbine
(1) All head available at the inlet of the turbine is converted into kinetic energy	(1) All head available at the inlet of the turbine is kinetic energy as well as pressure energy
(2) Pressure in the turbine is constant and is atmospheric from inlet to outlet	(2) The variation in the pressure from inlet to outlet of the turbine
(3) Water admitted over a part a part of the circumference	(3) Water admitted over all part of the circumference
(4) There is no function of hydraulic. Air tight casing is not necessary	(4) Air tight casing is necessary.
(5) Regulate the flow without loss	(5) Impossible to regulate the flow without loss
(6) It is suitable for high head and less quantity of water	(7) For same operating head size of turbine is less
(7) For same operating head size of turbine is more	(6) It is suitable for low head and more quantity of water
(8) Draft tube not necessary	(8) Draft tube is necessary
(9) Efficiency is less	(9) Efficiency is more
(10) easy to governing	(10) Not easy to governing
(11) eg: pelton wheel	(11) Eg: Francis turbine, Kaplan turbine
(12) It is high head turbine	(12) It is low head turbine
(13) More space required	(13) less space required

The discharge of the Jet (q) = Velocity of Jet × Area of Jet

$\Rightarrow 85.05 \times \frac{\pi}{4} \times (0.165)^2$

$\Rightarrow 1.81\ m^3/s$

The total discharge Q =

$\Rightarrow \eta_0 = \frac{SP}{WP}$

$WP = \frac{\rho g Q H}{1000}$

$\Rightarrow 0.86 = \frac{11.772 \times 1000}{1000 \times 9.81 \times Q \times 380}$

$\Rightarrow Q = \frac{11772 \times 1000}{1000 \times 9.81 \times Q \times 380}$

$\Rightarrow Q = 3.671\ m^3 \times s$

The number of Jet is

$\Rightarrow \frac{\text{Discharge of the Jet}}{\text{Total discharge}}$

$\Rightarrow \frac{3.671}{1.81} = 2.02$

$= 2$ No. of Jet (Ans)

∴ (i) The wheel diameter is (D) = 0.959 m

(ii) The numb. of Jet Required = 2

(iii) Diameter of the Jet = 0.165 m