PNS School of Engineering & Technology
Nishamani vihare, Mahishagrai Kendrapara
Internal Assessment Examination - 2022 (5th semester)
Subject: Th-3 Hydraulic machines & Industrial fluid Power
Branch: (Mechanical engineering)

1a) Define turbine.

Ans → Turbine are defined as hydraulic machine which converts which convert hydraulic energy into mechanical energy.

→ The mechanical energy is ~~also~~ use to run the electric generator which directly coupled to the shaft of the turbine.

b) Define manometric efficiency.

Ans → The ratio of manometric ~~of~~ head to the head imparted by the impeller to the water is known as manometric efficiency.

$$\eta_{man} = \frac{\text{manometric head}}{\text{Head imparted by impeller to water}}$$

mathmatically $\boxed{\eta_m = \frac{gH_m}{V_{w_2} u_2}}$

c) Define mechanical efficiency.

Ans → The power at the shaft of centrifugal pump is more than power available at impeller of the pump.

→ The ratio of power available at the impeller to the power at the shaft of centrifugal pump is known as mechanical efficiency.

q) Define reciprocating pump & classify it.

Ans → A machine or device in which the mechanical is converted into hydraulic energy or pressure energy by sucking the liquid into a cylinder in which a piston is reciprocating.

→ which convert the thrust on the liquid and increase it's hydraulic energy pressure energy the pump is known as Reciprocating pump.

The reciprocating pump energy be classified as.

① According to the water being in contact with one side or both sides of the piston.

   ⓐ Single acting Rebiprocating pump.

   ⓑ Double acting Reciprocating pump.

2) Define slip of the reciprocating pump and write % age of slip in reciprocating pump

Ans → Actually we know that the theoretical discharge of the reciprocating pump is always greater than actual discharge.

→ The difference of theoritical discharge (Q_{the}) and actual discharge (Q_{act}) is known as slip of the pump.

$$\text{Slip} = \text{Theoratical discharge} - \text{Actual discharge}$$

$$\text{Slip} = Q_{the} - Q_{act}$$

e) Slip of reciprocating pump in percentage (%)

$$\text{Percentage of slip} = \frac{Q_{the} - Q_{act}}{Q_{the}} \times 100$$

$$= (1 - C_d) \times 100 \quad \left(\because C_d = \frac{Q_{act}}{Q_{the}}\right)$$

f) Write the various components of reciprocating pump.

Ans → The reciprocating pump may be classified as

(a) According to the water being in contact with one side or both sides of the piston.
   (i) Single acting reciprocating pump
   (ii) Double acting reciprocating pump.

(b) According to the number of cylinder provided
   (i) Single acting
   (ii) Double acting
   (iii) Tripple acting.

g) Write the formula of work done by double acting reciprocating pump.

Ans → Work done per second = weight of water discharge × Total Height to lift the water.

$$= \rho g \times \frac{2LAN}{60} (h_s + h_d)$$

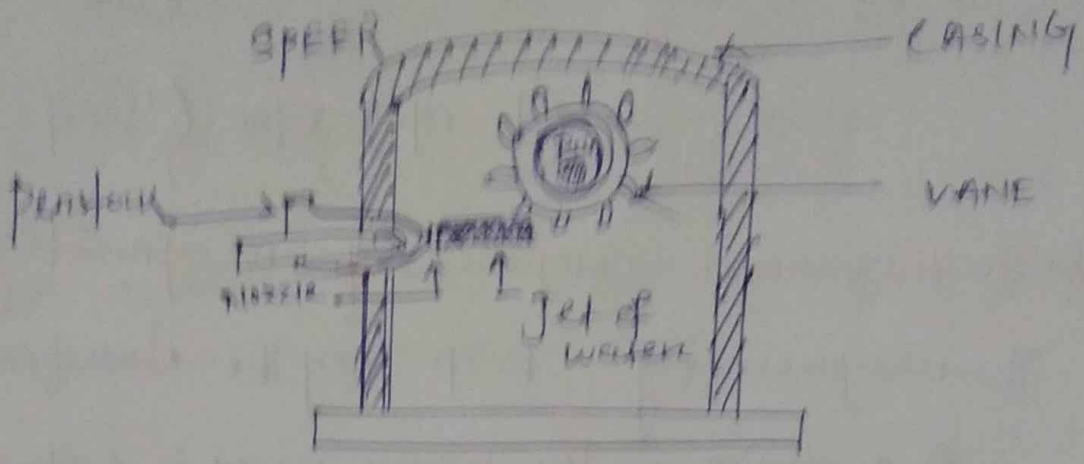
$$= 2 \frac{\rho g LAN}{60} (h_s + h_d)$$

Power required to drive the pump in kW

$$= \frac{\text{work done per second}}{1000}$$

8) a) Describe different part of pelton wheel turbine with neat sketch.

Ans →



→ The main part of pelton turbine are:
① Nozzle and flow Regulating arrangement
② Runner and buckets
③ casing ④ Breaking Jet.

→ The speear is a conical needle which is operated either by hand wheel wen to wheel dirn depending upon the size of the unit.

→ When the speare is push Forword in to the nozzle the amount of water strik to runner.

→ on the other hand if the speaar is pushed back the amount of waters striking on a runner is increased.

→ The energy available at the inlet of the turbine is only kinetic energy.

→ The water striking the bucket along tangent of the runner.

b) A single acting reciprocating pump ... delivery 100 liters of water one second if the diameter of the piston is 20cm and stroke length is 40 cm Determine.

(i) Theoretical discharge of the pump.
(ii) Co-efficient of discharge
(iii) Slip of the pump
(iv) % of slip of the pump.

Ans →

According to question on given data are speed of the pump in rpm N = 60 rpm

Actual discharge of the pump $Q_{act} = 0.01 m^3/sec$

Diameter of the pump D = 20cm = 0.2m

length of the stroke L = 40cm = 0.4m

Theoretical discharge :→

Area of the piston

$$A = \pi/4 \times D^2$$

$$= \frac{\pi}{4} \times (0.2)^2$$

$$= 0.031415\ m^2$$

We know that $Q_{the} = \frac{LAN}{60}\ m^3/sec$

$$= \frac{0.4 \times 0.031415 \times 60}{60}$$

$$= 0.0125.66 m^3/sec$$

(II) co-efficient of discharge :→

We know that $C_d = \frac{Q_{act}}{Q_{the}}$

$= \frac{0.0001}{0.012566} = 0.9957.$

(III) slip of the pump :→

$Slip = Q_{the} - Q_{act}$

$= 0.012566 - 0.001$

$= 0.011566 \ m^3/sec$

(IV) Percentage of slip :→

$\% \text{ of slip} = \frac{Q_{the} - Q_{act}}{Q_{the}} \times 100$

$= \frac{0.012566 - 0.001}{0.012566} \times 100$

~~$= 92.0420\%$~~

$= 92.0420\%$