8. A centrifugal pump running at 1000 rpm has an impeller 350 mm diameter. The outlet vane angle is 30°. The velocity of flow through the impeller is constant at 2.50 m/s. The static suction lift is 3.25 m. The following loses of head take place.

Loss of head in the suction pipe = 0.75 m

Loss of head in the impeller = 0.60 m

Loss of head in the volute casing = 0.95 m

Find the pressure heads :

(i) At the inlet to the impeller

(ii) At the outlet to the impeller

(iii) At inlet to the delivery pipe

Take the velocity in the suction and delivery pipe as 1.50 m/s. **10**

(Compulsory Question)

9. Answer the following questions in brief : **2×10=20**

(a) Describe the forces exerted by a jet on hinged plate.

Roll No. ..... Total Pages : 05

July-22-00353

B.Tech. EXAMINATION, 2022

Semester VI (CBCS)

HYDRAULIC MACHINES

CE-609

Time : 3 Hours *Maximum Marks : 60*

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D. Q. No. **9** is compulsory.

Section A

1. A jet of water impinges on plate at an angle α. Considering that friction between the fluid and plate is negligible, derive an expression for the distribution of flow in the two directions parallel to the plate. **10**

2. A rectangular plate weighing 60 N is suspended vertically by a hinge on the top horizontal edge. The centre of gravity of the plate is 10 cm from the hinge. A horizontal jet of water of 2.5 cm diameter, whose axis is 15 cm below the hinge, impinges normally to the plate with a velocity of 6 m/s. Find the horizontal force applied at the centre of gravity to maintain the plate in vertical position. **10**

Section B

3. Explain the term negative slip as used in connection with the working of reciprocating pump. Why and when negative slip occurs ? **10**

4. A centrifugal pump impeller has diameter of 60 cm and width of 6 cm at the outlet. The pump runs at 1450 rpm and delivers 0.8 m^3/s against a head of 80 m. The leakage loss after the impeller is 4 per cent of discharge, the external mechanical loss is 10 kW, and the hydraulic efficiency is 80 per cent. Determine the blade angle at outlet, the power required and the overall efficiency of the pump. **10**

Section C

5. Establish a relation for the hydraulic efficiency, η of a Pelton wheel in terms of blade outlet angle β_2, ratio of relative velocity of water at exist to that at the inlet K, and the ratio of bucket speed to jet velocity ρ. Comment on the nature of graph between η and ρ and show that maximum efficiency occurs when $\rho = 0.5$. **10**

6. A Kalpan turbine operating under a head of 7.5 m develops 1835 kW with an overall efficiency of 87%. The turbine is set 2.5 m above the tail water level and vacuum gauge inserted at turbine outlet records a suction head of 3.15 m. Calculate the efficiency of the draft tube if it has an inlet diameter of 3 m and the loss of head due to friction in the draft tube equals 25% of kineatic head at outlet. **10**

Section D

7. Describe the bore hole pump and its components in detail with neat sketch. **10**

(b) State impulse momentum equation.

(c) Differentiate between centrifugal and reciprocating pumps.

(d) How did you select the better pump for steep topography ?

(e) How did the assess the efficiency of Francis turbine ?

(f) Explain effective head, available power, and efficiency of Pelton turbine.

(g) Explain different types of draft tubes.

(h) What is Priming ? Why is it necessary ?

(i) What do you understand by penstock ? Explain in brief.

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