

velocity μ of air, the wind velocity V , the diameter D and height H of the chimney in terms of these quantities.

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7. A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40m the velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500mm and with at outlet is 50mm, determine :

- (i) Vane angle of inlet
- (ii) Work done by impeller on water per second
- (iii) Manometric efficiency.

20

SECTION – E

8. (a) Explain the construction and working of a double acting reciprocating pump. 10

(b) Explain the ideal and actual indicator diagram for a reciprocating pump. 10

9. Write a short note on following :

- (a) Hydraulic life and Press 10
- (b) Fluid coupling and Torque converter 10

Roll No.

24259

B. Tech. 5th Semester (ME) (Common With Special Chance) Examination – December, 2019

FLUID MACHINE

Paper : ME-305-F

Time : Three Hours] [Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt five questions in all, Question No. 1 (Section – A) is compulsory and attempt at least one question from each Section.

SECTION – A

1. Write short notes on the following : $4 \times 5 = 20$
- (a) Impulse turbines.
 - (b) Specific speed of turbines.
 - (c) Thomas cavitation factor.
 - (d) Air vessels and their utility.

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SECTION - B

2. (a) Show that the force exerted by a jet of water on an inclined fixed plate in the direction of jet is given by : $F_x = \rho AV^2 \sin^2 \alpha$. Where V - velocity of jet, A is area of jet, α - inclination of plate to the direction of jet. 10
- (b) A jet of water 50 mm diameter and moving with a velocity of 25m/s strikes a fixed plate (flat) in such a way that the angle between jet axis and the plate is 60° . Make calculations for the force exerted on the plate in the direction normal to the plate. 10

3. (a) Explain the layout of a Modern Hydro based power plant. 8

- (b) A pelton wheel is supplied with water under a head of 45m and at a rate of $48 \text{ m}^3/\text{min}$. The buckets deflect the jet through 165° and the mean bucket speed is 14m/s. Calculate the power delivered to shaft and overall efficiency of the machine. Assume coefficient of velocity 0.985 and mechanical efficiency 0.95. 12

SECTION - C

4. (a) Explain the purpose of providing scroll casing and guide vanes for a reaction turbine. 5

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- (b) A Francis turbine with an overall efficiency of 75% is required to produce 150kW when working under a head of 7.62m. Its peripheral velocity is $0.26\sqrt{2gH}$ and the radial velocity of flow is $0.96\sqrt{2gH}$. The wheel runs at 150 rpm and the hydraulic losses in the turbine are 22% of the available energy. Assuming Radial discharge determine : 15

- (i) Guide vane angle
(ii) Wheel vane angle
(iii) Diameter of the wheel at inlet.

5. (a) Explain construction, components and working of a Kaplan turbine. 8

- (b) A Kaplan turbine is to be designed to develop 7350kW the net available head being 5.5m ; speed ratio = 2.08; flow ratio = 0.68; overall efficiency = 60% and diameter of boss = $1/3$ rad of the runner diameter. Make calculations for the diameter of runner, its speed and specific speed. 12

SECTION - D

6. (a) Define fundamental quantities, derived quantities and repeating variables. 6

- (b) The resistance R due to wind on a tall vertical chimney is dependent upon the density ρ and

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