

(3 Hours)

[Total Marks 80]

- N.B (1) Question no. 1 is compulsory
 (2) Attempt any **Three** questions from remaining 5 questions.
 (3) Assume any **suitable** data if necessary and state it very clearly.
 (4) Answer the questions with **neat sketch** wherever necessary.

1. Solve any Four

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- (a) Define Moment of Momentum Equation.
 (b) Explain the term Similitude.
 (c) Explain Jet Propulsion of Ships.
 (d) Write a short note on specific speed of turbine.
 (e) What is Cavitation in Pump.
 (f) Write a short note on Hydraulic Accumulator.
2. (a) The diameter of a pipe bend is 0.3 m at inlet and 0.15 m at outlet and the flow is turned through 120° in a vertical plane. The axis at inlet is horizontal and centre of the outlet section is 1.5 m below the centre of inlet section. The total volume of fluid contained in the bend is 0.085 m^3 . Neglecting friction, calculate the magnitude and direction of the force exerted on the bend by the water flowing through it at 225 l/s when the inlet pressure is 137.34 kN/m^2 . 10
- (b) A twin jet unequal lawn sprinkler delivers a total discharge of 1.5 lps. Taking jet diameter as 0.9 cm, inclination of jet with the axis of pipe 45° in opposite directions and distance from the axis of rotation to jets 15 cm and 30 cm. Neglecting friction, find speed of sprinkler and torque required to keep the sprinkler stationary. 10
3. (a) A ship 300 m long moves in sea water, whose density is 1030 kg/m^3 . A 1:100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30 m/s and the resistance of the model is 60 N. Determine the velocity of ship in sea-water and also the resistance of the ship in sea-water. The density of air is given as 1.24 kg/m^3 . Take the kinematic viscosity of sea water and air as 0.012 stokes and 0.018 stokes respectively. 10
- (b) A jet propelled boat, moving with a velocity of 5.5 m/s, draws water amid-ship. The water is discharged through two jets provided at the back of the ship. The diameter of each jet is 155 mm. The total resistance offered to the motion of the boat is 4905 N. Determine: (a) Volume of water drawn by the pump per second, and (b) Efficiency of the jet propulsion. 10
4. (a) Penstock Supplies water from a reservoir to the Pelton wheel with a gross head of 500 m. One third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of the penstock is $2.0 \text{ m}^3/\text{s}$. The angle of deflection of jet is 165° . Determine the power given by the water to the runner and also hydraulic efficiency of the pelton wheel. Take speed ratio = 0.45 and $C_v = 1.0$. 10
- (b) An outward flow reaction turbine has internal and external diameters of the runner as 0.5 m and 1.0 m respectively. The guide blade angle is 15° and velocity of flow is 4.0 m/s and is constant. If its speed 200 rpm, head 10 m and discharge at outlet is radial, find (a) runner vane angles at inlet and outlet, (b) Work done/sec./kg of water, (c) Hydraulic efficiency. 10

[TURN OVER]

5. (a) A hub diameter of Kaplan turbine working under head of 14 m is 0.35 times the diameter of the runner. The turbine is running at 100 rpm. If vane angle of the extreme edge of runner at outlet is 20° and flow ratio 0.6. Find 10
- Diameter of runner.
 - Diameter of Boss.
 - Discharge through runner.
- (b) A conical draft tube having inlet and outlet diameters 1 m and 1.5 m discharges water at outlet with a velocity of 2.5 m/s. The total length of the draft tube is 6 m and 1.3 m of the length of draft tube is immersed in water. If the atmospheric pressure head is 10.3 meters of water and loss of head due to friction in the draft tube is equal to $0.2 \times$ velocity head at outlet of the tube, find : 10
- A Pressure head at inlet and efficiency of the draft tube
6. (a) A centrifugal Pump is running at 1000 rpm. The outlet vane angle of the impeller is 45° and the velocity of flow at the outlet is 2.5 m/s. The discharge through the pump is 200 lit/s when the pump is working against a total head of 20 m. If the manometric efficiency of the pump is 80%, determine the outer diameter of the impeller and the width of the impeller at outlet. 10
- (b) Explain with neat sketch the construction and operation of Hydraulic Ram. 10
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