Objective Questions:-

1. The force exerted by a jet impinging normally on a fixed plate is

   a. $\frac{\rho a v}{4}$

   b. $\rho a v$

   c. $\frac{\rho a v^2}{4}$

   d. $\rho a v^2$

2. The force exerted by a jet impinging on a fixed plate inclined at an angle   with the jet is

   a. $\frac{\rho a v \sin 2\theta}{4}$

   b. $\rho a v \sin \theta$

   c. $\frac{\rho a v^2 \sin 2\theta}{2}$

   d. $\rho a v^2 \sin 2\theta$

3. The ratio of the normal force of jet of water on a plate inclined at an angle   as compared to that when the plate is normal to the jet, is

   a. $\frac{1}{\sqrt{2}}$

   b. ½

   c. 2

   d. $\sqrt{2}$

4. The force exerted by a jet of water in the direction of jet on a stationary curved plate is

   a. $\rho a v^2$

   b. $\rho a v^2 \sin^2 2\theta$

   c. $\rho a v^2 (1 + \cos \theta)$

d. $\rho a v^2 (1 + \sin \theta)$

5. Maximum efficiency of a series of vertical plates is

   a. 66.67%

   b. 33.33%

   c. 50%

   d. 100%

6. Efficiency of the jet of water with velocity v striking on a series of vertical plates moving

   with a velocity u is

   a. $\eta = \dfrac{2v(v-u)}{u^2}$

   b. $\eta = \dfrac{2u(v-u)}{v^2}$

   c. $\eta = \dfrac{u^2}{v^2(v-u)}$

   d. *none of the above*

7. The water jet after striking the flat plate will be deflected at an angle of

   a. 110^0

   b. 60^0

   c. 90^0

   d. None of the above

8. In a centrifugal pump, the liquid enters the pump

   a. At the centre

   b. At the bottom

   c. At the top

   d. From sides

9. Overall efficiency of a centrifugal pump is the ratio of

   a. Energy available at the impeller to the energy supplied to the pump by the prime mover

   b. Actual work done by the pump to the energy supplied to the pump by the prime mover

   c. Energy supplied to the pump to the energy available at the impeller

   d. Manometric head to the energy supplied by the impeller per Newton of water

10. Multi stage centrifugal pumps are used to

    a. Give high discharge

    b. Produce high heads

    c. Pump viscous fluids

    d. All the above

11. Discharge of a centrifugal pump is

    a. Directly proportional to N

    b. Inversely proportional to N

    c. Directly proportional to N^2

    d. Inversely proportional to N^2

12. A centrifugal pump is superior to a reciprocating pump because

    a. It is a high speed pump

    b. It is more economical

    c. It gives smooth flow

    d. All the above

13. In a reciprocating pump, air vessels are used to

    a. Reduce the flow

    b. Increase the delivery head

    c. Smoothen the flow

    d. Reduce the acceleration head

14. The discharge through a single acting reciprocating pump is

    a. $Q = \dfrac{2ALN}{60}$

    b. $Q = \dfrac{ALN}{60}$

    c. $Q = ALN$

    d. None of the above

15. A turbine is a device which converts

    a. Kinetic energy in to mechanical energy

    b. Mechanical energy in to hydraulic energy

    c. Hydraulic energy into mechanical energy

    d. None of the above.

16. An impulse turbine is used for

    a. Low head of water

    b. High head of water

    c. Medium head of water

    d. High discharge

17. Francis turbine is

    a. A reaction radial flow turbine

    b. An axial flow turbine

    c. A radial flow turbine

    d. An impulse turbine

18. A draft tube is not required for a

   a. Francis turbine

   b. Kaplan turbine

   c. Pelton wheel turbine

   d. None of the above

Answers:-

1(d)	2(c)	3(b)	4(c)	5(c)	6(b)	7(c)	8(a)
9(c)	10(b)	11(a)	12(d)	13(d)	14(b)	15(c)	16(b)
17(a)	18(c)						

Subjective Questions:-

1   Derive an expression for force of jet of water exerted on a fixed vertical plate in the direction of the plate.

2   Show that the force exerted by a jet of water on a inclined fixed plate in the direction of the jet is given by,

$$F_X = \rho a v^2 sin^2\theta$$

Where, a= area of the jet; v= velocity of the jet;   = inclination of the plate with the jet.

3   Explain the working principles of a centrifugal pump with sketches

4   Define the term: suction head, delivery head, static head and manometric head.

5   What is priming of a centrifugal pump? Explain clearly why priming is essential before starting a centrifugal pump?

6   Define the term specific speed of a centrifugal pump and deduce an expression for it in terms of the head H, discharge Q, and the speed N.

7   Differentiate between a single acting reciprocating pump and double acting reciprocating pump.

8   What are the factors, which influence the speed of a reciprocating pump?

9   Differentiate between the turbine and pump.

10 State the difference between an impulse turbine and a reaction turbine.

11   Define and explain hydraulic efficiency, mechanical efficiency and overall efficiency of a turbine.

12   Define the terms "unit power", "unit speed" and "unit discharge" with reference to a hydraulic turbine.

13   A jet of water of 5cm diameter is discharging under a constant head of 80m. Find the force exerted by the jet on a fixed plate. Take coefficient of velocity 0.9. (*Ans.2491.0N*)

14   A jet of velocity of 5 m/s strikes a flat plate inclined at 30^0 with the axis of jet. If the cross sectional area of the jet is 5 cm^2, find the force exerted by the jet on the plate. Also, calculate the components of the force in the direction normal to the jet. Find also the ratio in which the discharge gets divided after striking the plate. (*Ans. 6.25N, 5.41N 13.928*)

15   A jet of water of diameter 0.20m moving with a velocity of 25m/s, strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the jet of water in the direction of the jet, if the jet is deflected through an angle of 120^0 at the outlet of the curved plate. (*Ans. 29437.5N*)

16   A jet of 0.20 m in diameter strikes tangentially on a curved vane. The tangent at the outlet end makes an angle of 60^0 with the x-axis and the velocity of the jet is 20 m/s. find the force exerted by the jet on the vane in the direction of jet. (*Ans. 6280.5N*)

17   A centrifugal pump delivers 0.35 cumecs of water to a height of 20 m. If the pump runs at 1000 rpm, find the specific speed. (*Ans. 62.55*)

18   The diameter of an impeller of a centrifugal pump at inlet and outlet are 20 cm and 40 cm respectively. Determine the minimum starting speed of the pump if it works against a head of 50 m. (*Ans. 1733.2 rpm*)

19   A centrifugal pump delivers 25 liters of water per second against a head of 10 meters and running at 1300 rpm requires 10 kW of power. Determine the discharge, head of the pump and power required if the pump runs at 1500 rpm. (*Ans. 0.0288cumec, 13.31m, 15.36kw*)

20 A single acting reciprocating pump having a bore of 150 mm and a stroke of 300 mm length discharges 250 liters of water per minute at 50 rpm. Neglecting losses, find:

   a. Theoretical discharge

   b. Coefficient of discharge

   c. Slip of the pump.

   (Ans 4.4 $X10^{-3} cumecs$, *0.9469, 5.3%)*

21 A single acting reciprocating pump has its piston diameter as 0.15 m and stroke 0.25 m. The piston moves with simple harmonic motion and makes 50 double -stroke per minute. The suction and delivery heads are 5 m and 15 m respectively. Find the force required to work the piston during the suction and delivery stroke. Assume the efficiency of the suction and delivery strokes as 65% and 75% respectively. Determine the power required by the pump. (*Ans 1.001 KW*)

22 The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke is 300 mm. the pump runs at 50 rpm and lifts water through a height of 25 m. The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 L/s, find the percentage slip. Also, determine the acceleration head at the beginning and middle of the delivery stroke. (*Ans. 0.0044175cumec, 4.92%, 1.083KW, 20.75m, 0*)

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