**Uttaranchal University**

**B.Tech. Even Sem. (VI)**

Subject: Fluid Machinery Sub Code: TME-604

**QUESTION BANK**

**Unit-1**

1. Define the term impact of jet.
2. Draw inlet and outlet velocity diagram of velocity of jet of moving curved vanes.
3. A jet of water 50mm in dia. under constant head of 50m impinges on a fixed blade normally. Find force exerted by jet if coefficient of velocity is 0.95.
4. Draw neat sketch for impact of jet on a moving vertical flat plate and write the formula to determine the work done.

**Turbines**

1. Draw a layout of hydroelectric power plant and explain its working briefly.
2. Give the classification of hydraulic turbines.
3. State the function of draft tube and draw the neat sketches of draft tube.
4. Differentiate impulse turbine with reaction turbine.
5. Differentiate Francis turbine with Kaplan turbine
6. Explain the working of Pelton wheel turbine.
7. A Pelton wheel has mean bucket speed of 30 m/s with a jet of water flowing at the rate of 1cubic meter per sec under a head of 250m. The bucket deflect jet through angle of 170 degree. Calculate power developed and the efficiency of the turbine. Assume Coefficient of velocity= 0.98
8. A Francis turbine has external and internal diameters as 1m and 0.6m respectively . The hydraulic efficiency of turbine is 90% when the head on the turbine is 36m . The velocity of flow at outlet is 2.5m/sand discharge at outlet is radial. If the vane angle at outlet is 15degree and width of the wheel is 100mm at inlet and outlet. Determine (i) Guide blade angle (ii)speed of turbine.
9. What is Specific Speed of a Turbine? Derive the expression for the Specific Speed of a Turbine
10. A Francis turbine has inner diameter of wheel 0.6 times the outer diameter. Water enters the turbine at 12° to the tangent of the wheel. Blade angles are radial at the inlet. The velocity of flow is constant through the turbine and is 2.5 m/sec. The speed of the runner is 280 rpm. The width of the wheel at the inlet is 10 cm. 5% of area of flow is blocked by the runner blade. Determine:
    * 1. (i). Inner and Outer diameter of Wheel
      2. (ii). Working Head.

11. A jet of water of diameter 75 mm moving with a velocity of 25 m/sec. strike a fixed plate in such a way that angle between the jet and the plate is 60°. Find the force exerted by the jet on the plate.

(I) in the direction normal to the plate (ii) in the direction of jet.

12. Describe various components of a Hydro-Power plant with neat sketch

13. A Pelton wheel is to be designed for the following specification: Shaft power = II772 Kw, Head = 380 m. Speed = 750 r.p.m., Overall efficiency = 86% Jet diameter is not to exceed one-sixth of the wheel diameter. Determine:

* 1. The Wheel Diameter
  2. Diameter of Jet
  3. No. of Jets required, Take Kv1 = 0.985 and KU1= 0.45.

**UNIT-II**

1. The external diameter of an inward flow reaction turbine is 0.5 m. The width of the wheel at inlet is 150 mm and the velocity of flow at inlet is 1.5 m/s. Find the rate of flow passing through the turbine.

1. The external and internal diameters of an inward flow reaction turbine are 600 mm and 200 mm respectively and the breadth at inlet is 150 mm. If the velocity of flow through the runner is constant at 1.35 m3 /s, find the discharge through turbine and the width of wheel at outlet.

1. An inward flow reaction turbine running at 500 rpm has an external diameter is 700 mm and a width of 180 mm. If the guide vanes are at 20º to the wheel tangent and the absolute velocity of water at inlet is 25 m/s, find (a) discharge through the turbine (b) inlet vane angle.
2. A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 1.2 m and the flow area is 0.4 m2 . The angle made by the absolute and relative velocities at inlet is 20º and 60º respectively with the tangential velocity. Determine (i) the discharge through the turbine

(ii) Power developed (iii) efficiency. Assume radial discharge at outlet.

1. The peripheral velocity at inlet of an outward flow reaction turbine is 12 m/s. The internal diameter is 0.8 times the external diameter. The vanes are radial at entrance and the vane angle at outlet is 20º. The velocity of flow through the runner at inlet is 4 m/s. If the final discharge is radial and the turbine is situated 1 m below tail water level, determine:
2. The guide blade angle
3. The absolute velocity of water leaving the guides
4. The head on the turbine
5. The hydraulic efficiency
6. An inward flow water turbine has blades the inner and outer radii of which are 300 mm and 50 mm respectively. Water enters the blades at the outer periphery with a velocity of 45 m/s making an angle of 25º with the tangent to the wheel at the inlet tip. Water leaves the blade with a flow velocity of 8 m/s. If the blade angles at inlet and outlet are 35º and 25º respectively, determine
   1. Speed of the turbine wheel
   2. Work done per N of water
7. A reaction turbine 0.5 m dia develops 200 kW while running at 650 rpm and requires a discharge of 2700 m3 /hour; The pressure head at entrance to the turbine is 28 m, the elevation of the turbine casing above the tail water level is 1.8 m and the water enters the turbine with a velocity of 3.5m/s. Calculate (a) The effective head and efficiency, (b) The speed, discharge and power if the same machine is made to operate under a head

of 65 m

1. A Francis turbine has inlet wheel diameter of 2 m and outlet diameter of 1.2 m. The runner runs at 250 rpm and water flows at 8 cumecs. The blades have a constant width of 200 mm. If the vanes are radial at inlet and the discharge is radially outwards at exit, make calculations for the angle of guide vane at inlet and blade angle at outlet
2. Determine the overall and hydraulic efficiencies of an inward flow reaction turbine using the following data. Output Power = 2500 kW, effective head = 45 m, diameter of runner = 1.5 m, width of runner = 200 mm, guide vane angle = 20degree, runner vane angle at inlet = 60Degree and specific speed = 100.
3. Determine the output Power, speed, specific speed and vane angle at exit of a Francis runner using the following data. Head = 75 m, Hydraulic efficiency = 92%, overall efficiency = 86 %, runner diameters = 1 m and 0.5 m, width = 150 mm and guide blade angle = 18Degree. Assume that the runner vanes are set normal to the periphery at inlet.
4. The following data is given for a Francis turbine. Net Head = 60 m; speed N = 700 rpm; Shaft power = 294.3 kW; Efficiency = 84%; hydraulic efficiency = 93%; flow ratio = 0.2; breadth ratio n = 0.1; Outer diameter of the runner = 2 x inner diameter of the runner. The thickness of the vanes occupies 5% circumferential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine:
   1. Guide blade angle
   2. Runner vane angles at inlet and outlet
   3. Diameters of runner at inlet and outlet
   4. Width of wheel at inlet

**UNIT-III, IV**

**Centrifugal Pump and Reciprocating pump**

1. What is priming? Why it is required?
2. State any two faults and their remedies on centrifugal pump.
3. What are the different types of impellers?
4. What is an air vessel? Describe the function of air vessel for reciprocating pump.
5. Define slip, percentage slip and negative slip of a reciprocating pump.
6. Draw theoretical indicator diagram for single acting reciprocating pump.
7. Explain the construction and working of centrifugal pump.
8. Explain submersible pump with neat sketch.
9. Explain jet pump with neat sketch.
10. What did you understand by the term cavitation? How it can be avoided?
11. Describe the principle and working of a reciprocating pump with neat sketch.
12. Differentiate between centrifugal pump and reciprocating pump.
13. Mention the applications of reciprocating pump.
14. Explain the working of double acting reciprocating pump.
15. Compare Centrifugal and Reciprocating Pumps.
16. A single acting reciprocating pump has a plunger diameter of 250 mm and stroke of 45O mm and it is driven with S.H.M. at 60 r.p.m. The length and diameter of delivery pipe is 60 m and 1OO mm respectively. Determine the power saved in overcoming friction in the delivery pipe by fitting an air vessel on the delivery side of the pump. Assume friction factor = 0.01.
17. A double acting reciprocating pump, running at 40 r.p.m. is discharging 1.0 m3 of water/minutes. The pump has a stroke of 400 mm. The diameter of the Piston is 200 mm. The delivery and suction heads are 20 m and 5 m respective. Find the slip of pump and the power required to drive the pump.
18. Centrifugal Pump Works against a head of 8 m and pumps 1500 litre/sec. It rotates at 180 r.p.m. Diameter of the impeller at the outlet is 1.3 m and the area at the outer periphery is O.3 m2. Assume the ratio of the external to the internal diameter to be 2 m and the vane angle at the outlet 3O°, find:
    * 1. (i). Hydraulic Efficiency
      2. (ii). Power Required
      3. (iii). Minimum Starting Speed.
19. Explain various methods to prevent Cavitation.
20. Write short note on Submersible Pump.

**Unit-V**

1. Explain Hydraulic lift with Diagram

2. What do to you mean by Hydraulic accumulator and Intensifier?

3. What is Hydraulic press?

4. The diameter of the ram of a hydraulic accumulator is 40 cm which is working under a total weight of 50 tones. Frictional resistance against the movement of the ram is 5% of the total weight. Calculate the intensity of pressure of water, when (a). Ram moves down with Uniform Velocity (b). Ram moves up with Uniform Velocity

5. The efficiency of a Hydraulic Crane, which is supplying water under a pressure of 7O N/cm2 for lifting a weight through a height of 10 m is 60%. If the diameter of the ram is 150 mm and velocity ratio is 6, find:-

(i). the weight lifted by the crane (ii). the volume of water required in liters to lift the weight.

6. Explain Torque Converter with neat sketch.

7. Explain The working of hydraulic Coupling with diagram

8. What are Propeller Pumps?

9. Explain the difference between Vane and Gear Pump

10. List the applications of vane pumps?