Question Bank

Fluid Machinery (BTME-603)

Section-A

1. State impulse momentum principle and write its equation.
2. Derive the equation of work done for the jet impingement upon a moving flat inclined plate.
3. Classify the turbines on the basis of head available.
4. What is specific speed of turbine?
5. What are the different forms of draft tubes?
6. What is slip of the impeller?
7. What is priming?
8. Define overall efficiency of turbine.
9. Name the various problems commonly experienced during operation of centrifugal pumps.
10. What is Thomas Cavitation number?
11. What is the function of braking jet in Pelton turbine?
12. State advantages of Kaplan turbine over Propeller Turbine.
13. What is Cavitation, List down cavitation susceptible areas in turbines and pumps?
14. Why Jet pumps have been phased out?
15. What is the function of draft tube?
16. Differentiate between fluid coupling and Torque converter.
17. Define the term "Manometric Head"?
18. What is the function of surge tank?
19. What is the function of Air vessel?
20. What are 'Unit Quantities'?

Section - B

1. Derive an expression for specific speed of pump.
2. Derive an expression for the minimum speed for starting a centrifugal pump.
3. State "Impulse momentum equation", also give its applications. Why the case of jet striking single moving vane is not feasible?
4. A Pelton wheel is to be designed for the following specifications: Power (BP) 9560 kW, Head = 350 m, speed = 750 r.p.m., overall efficiency = 85%, jet diameter not to exceed 1/6th of wheel diameter. Determine i) wheel diameter, ii) diameter of jet, iii) number of jets required.
5. Derive an equation for work done by the jet impingement upon a series of moving curved vanes mounted radially on a wheel.
6. Derive Eular's equation for energy conversion through hydrodynamic rotor.
7. Show from the first principles that work saved in a single-acting reciprocation pump, by fitting an air vessel is 84.8%.
8. How submersible pump is different from a Monoblock pump?
9. List down cavitation susceptible areas in turbines and pumps?
10. What is the function of undercut on Pelton turbine blades?

Section - C

1. In an Inward flow reaction turbine (vertical shaft) the sum of the pressure and kinetic heads at entrance to the spiral casing is 132 m and vertical distance between this section and tail race level is 3.3 m. The peripheral velocity of the runner at entry is 33 m/s, the radial component of velocity of water (velocity of flow) is constant at 11.0 m/s and the discharge from the runner is without whirl and radial. The hydraulic losses are:
   (a) Losses between turbine entrance and discharge from guide vanes = 4.95m,
   (b) Losses in the runner = 8.8m,
   (c) Losses in the draft tube = 0.88m,
   (d) Kinetic energy rejected to tail race = 0.55m.
   Determine:
   (i) the guide blade angle and runner blade angle at inlet;
   (ii) the pressure head at entry to and discharge from runner.
2. A Kaplan turbine operating under a head of 7.5m develops 1835 kW with an overall efficiency of 87%. The turbine is set 2.5 m above the tail level and vacuum gauge is 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 kinetic head at outlet.
3. (a) What is the function of Draft tube? Derive an expression for efficiency of draft tube.
   (b) Discuss in detail with diagram the governing mechanism of francis turbine.
4. A centrifugal pump impeller has diameter of 60 cm and width 6 cm at outlet. The pump runs at 1450 rpm and delivers 0.8 m_3/s against a head of 80m. The leakage loss after the impeller is 4% of discharge, the mechanical loss is 10 kW and the hydraulic efficiency is 80%. Determine the blade angle at outlet, the power required and overall efficiency of pump.
5. Derive expressions for model relationships in case of a hydraulic turbine.
6. Define specific speed of a turbine and its importance. Derive an expression for the same.
7. What is negative slip in Reciprocating pump? Explain with sketches the function of an air vessel in a reciprocating pump.
8. A single acting reciprocating pump has a plunger diameter of 75 mm and stroke length 150 mm. It takes supply of water from a Pump 3 m below the pump through a pipe 5m long and 40 mm diameter. It delivers water to a tank 12 m above the pump through a pipe 30 mm diameter and 15 m long. If the separation takes place at $75KN/m_2$ below atmospheric pressure, find the maximum speed at which the pump may be operated without separation, plunger operates with S.H.M.
9. What are performance curves? Discuss importance and plotting of these curves in detail for impulse and reaction turbines.
10. (a) Explain with neat sketch the construction and working of a Differential Accumulator.
    (b) With the help of neat diagram, explain the working principle of fluid coupling. Also, describe the slip and the efficiency of the fluid coupling
    (c) Discuss in detail the working of hydraulic ram with diagram