Important Questions

Semester- V **Faculty:-Mr. Tanvir Singh**

Subject: **Fluid Machines (ME- 305 F)**

Q1. Derive the expression for the jet propulsion of ship when,

1. *Inlet orifice is at right angle to the direction of motion of ship*
2. *Inlet orifice facing the direction of motion of ship*

Q2. A jet propelled boat discharge water through a jet of area 240 cm^2, the water being drawn from inlet openings facing the direction of motion. The total drag is estimated to be 21.2 u^2N, where u is the speed of the boat in m/s, if the boat moves at 64.8 km/h, determine

1. *Relative velocity of jet.*
2. *Energy supplied by the jet*
3. *Power of the motor required to work the pumps.*

Take efficiency of pump set as 80% and density of water 1020 Kg/m^3.

Q3. An inward flow reaction turbine has an external diameter of 1m and its breadth at inlet is 250mm, if the velocity of flow at inlet is 2m/s, find weight of water passing through the turbine per second. Assume 10 % of the area of flow is blocked by blade thickness, if the speed of the runner is 210 rpm, and guide blades make an angle of 10º to the wheel tangent, draw the inlet velocity triangle and find

1. *The runner vane angle at inlet*
2. *The velocity of wheel at inlet*
3. *The absolute velocity of water leaving the guide vanes.*

Q4. Explain the performance characteristics curves of Francis and Kaplan turbines with neat sketch?

Q5. Explain the working of Francis and Kaplan turbine and also derive the expression of workdone with neat sketch?

Q6. The propeller reaction turbine of runner diameter 4.5m is running at 48 rpm. The guide blade angle at inlet is 145º and the runner blade angle at outlet is 25º to the direction of vane. The axial flow area of water through the runner is $30m^2$, if the runner blade angle at inlet is radial, determine

1. *Hydraulic efficiency of the turbine*
2. *Discharge through the turbine*
3. *Power developed by the runner*

Q7. Derive the expression for minimum speed required to start the centrifugal pump?

Q8 A centrifugal pump with 1.2 m diameter runs at 200rpm and pumps 880 liters/s. The average lift being 6m The angle which the vane makes at exit with the tangent to the impeller

is 26º and the radial velocity of flow is 2.5 m/s. Determine the manometric efficiency and the least speed to start pumping against a head of 6m, the inner diameter of the impeller being 0.6m.

Q9. Derive the expression for model testing & specific speed of the centrifugal pump?

Q10. Derive the expression for variation of velocity and acceleration in the suction and delivery pipe due to acceleration of piston with neat sketch?

Q11 A single acting reciprocating pump, running at 50 rpm delivers 0.00736 m^3/s of water. The diameter of the piston is 200mm and stroke length 300mm. The suction and delivery heads are 3.5 m and 11.5 m resp. Determine,

1. *Theoretical discharge*
2. *Co-efficient of discharge*
3. *Percentage slip of the pump*
4. *Power required to run the pump*

Q12. Explain the working of hydraulic press & hydraulic intensifier with neat sketch?

Q13 Explain the working of air vessel by deriving the expression of discharge/s for single acting reciprocating pump. ?

Q14. A Pelton wheel is receiving water from a penstock with a gross head of 510m. One third of the gross head is lost in friction in the penstock. The rate of flow through the nozzle fitted at the end of the penstock is 2.2 m^3/s. The angle of deflection of the jet 165º Determine

1. *The power given by water to the runner*
2. *Hydraulic efficiency of the Pelton wheel*

Take, C_v = 1.0 and speed ratio = 0.45

Q15. Derive the expression of condition for maximum blade efficiency in case of 50% reaction turbine?

Q16. An inward flow turbine runner has an outer diameter of 0.6m and an inner diameter of 0.3m and runs at 750rpm. The radial velocity of flow at inlet and exit is 6m/s. Water enters the runner making an angle of 12º to the direction of motion of the blades at inlet. It leaves the runner radially. The mass flow rate is 1Kg/s. Calculate

1. *Power developed*
2. *Angle between the relative velocity of water and tangential velocity of the runner at exit.*

Q17. Explain the performance characteristics curves of Francis and Kaplan turbines with neat sketch?

Q18. Explain the working of Francis and Kaplan turbine and also derive the expression of workdone with neat sketch?

Q19. The propeller reaction turbine of runner diameter 4.5m is running at 48 rpm. The guide blade angle at inlet is 145º and the runner blade angle at outlet is 25º to the direction of vane. The axial flow area of water through the runner is 30m^2, if the runner blade angle at inlet is radial, determine

1. *Hydraulic efficiency of the turbine*
2. *Discharge through the turbine*
3. *Power developed by the runner*

Q20. Derive the expression of maximum suction lift for centrifugal pump?

Q21. A centrifugal pump impeller has diameters at inlet and outlet as 360mm and 720mm resp. The flow velocity at outlet is 2.4 m/s and the vanes are set back at an angle of 45º at the outlet if the manometric efficiency is 70%. Calculate

1. *Minimum starting speed of the pump.*

Q22. Derive the expression for NPSH and cavitation in centrifugal pump?

Q23. Tests on a pump model indicate a cavitation parameter σ_c = 0.10. A homologous unit is to be installed at a location where atmospheric pressure P_a = 0.91 bar and vapour pressure P_v = 0.035 bar absolute and is to pump water against a head of 25m. What is the maximum permissible suction head?

Q24. Derive the expression for discharge, workdone, and power required to derive the double acting reciprocating pump with neat sketch?

Q25. A single acting reciprocating pump, running at 50 rpm delivers 0.00736 m^3/s of water. The diameter of the piston is 200mm and stroke length 300mm. The suction and delivery heads are 3.5 m and 11.5 m resp. Determine,

1. *Theoretical discharge*
2. *Co-efficient of discharge*

Q26. Derive the expression for effect of acceleration and friction in suction and delivery pipe on indicator diagram?

Q27 Explain the working of hydraulic lift and hydraulic coupling with neat sketches?