B.E. Mechanical Engineering Sem IV

ME405 - Hydraulic Machines

P. Pages : 2 **GUG/S/18/3924**

Time : Three Hours * 1 0 3 1 * Max. Marks : 80

Notes :
1. All questions carry as indicates marks.
2. Answer Q. 1 OR Q. 2, Q.3 OR Q. 4, Q.5 OR Q. 6, Q7 OR Q.8, Q.9 OR Q.10
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and Chemical equation should be given wherever necessary.
6. Illustrate your answers wherever necessary with the help of neat sketches.
7. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
8. Use of Non-programmable calculator is permitted.

1. a) explain Impulse – Momentum principle. **6**

b) Derive an expression for the force exerted by a jet of water on an inclined fixed flat plate in the direction of the jet. **10**

OR

2. a) Explain the construction and working of a Pelton Turbine. **5**

b) The water in a jet propelled ship is drawn amidship and discharged at the back with an absolute velocity of 20m/s. The cross-sectional area of the jet at the back is $0.02m^2$ and the boat is moving in sea water with a speed of 30km/h Determine: **11**
i) The propelling force on the boat,
ii) Power required to drive the pump,
iii) Efficiency of the jet propulsion.

3. a) Explain the principle of operation of a pure Reaction Turbine. **4**

b) An Inward flow Reaction Turbine (Francis turbine) has external and internal diameters as 0.9m and 0.45m respectively. the turbine is running at 200 rpm and the width of the turbine at inlet is 200 mm. The velocity of flow through the runner is constant and is equal to 1.8m/s. The guide blade makes an angle of 10^o with tangent of the wheel and the discharge at the outlet of the turbine is radial. Draw the inlet and outlet velocity triangles and determine: **12**
i) The absolute velocity of the runner at the inlet of the runner.
ii) The velocity of wheel at inlet,
iii) The relative velocity at inlet,
iv) The runner blade angles,
v) The width of the runner at outlet,
vi) The mass of water flowing through the runner per second.
vii) The head at the inlet of the turbine,
viii) The power developedment and
ix) The hydraulic efficiency of the turbine.

OR

4. a) Explain the performance characteristics of Reaction Turbine. **8**

b) What is governing of a turbine? Explain the governing mechanism of a Francis Turbine. **8**

5. a) How will you classify hydraulic Pumps? **4**

b) Derive an expression for the work done per second per unit weight of liquid for a centrifugal pump. **12**

OR

6. a) What do you understand by N. P. S. H.? **7**

b) Explain the construction and working of a self priming pump. **9**

7. a) Derive expressions for the discharge, work done per second and power required to drive single cylinder, single Acting Reciprocating piston pump. **8**

b) A Double acting Reciprocating pump running at 40 rpm is discharging $1.0m^3$ of water per minute. The pump has a stroke of 400 mm. The diameter of the piston is 200mm. the delivery and suction head are 20m and 5m respectively. Find: **8**

i) Slip of the pump,
ii) Percentage slip of the pump,
iii) Power required to drive the pump.

OR

8. a) What do you mean by Rotary Pumps? Explain the construction and working of a sliding vane pump. **7**

b) Explain the construction and working of a screw pump. **9**

9. a) Explain the various types of similarities. **6**

b) A single stage centrifugal pump with impeller diameter of 30cm rotates at 2000 rpm and lifts $3m^3$ of water per second to a height of 30m with an efficiency of 75% Find the number of stages and diameter of each impeller of a similar multistage pump to lift $5m^3/s$ to a height of 200m, when running at 1500 rpm. **10**

OR

10. Write short notes on **any four.** **16**

a) Air Lift pump. b) Hydraulic ram.

c) Bore Hole pump. d) Jet Pump.

e) Regenerative pump.

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