

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE, APRIL- 2023**

HYDRAULIC MACHINES

[Maximum marks: 100]

(Time: 3 Hours)

PART – A

Maximum marks : 10

I (Answer *all* the questions in one or two sentences. Each question carries 2 marks)

1. Give an idea about jet propulsion.
2. Write the use of breaking jet.
3. Which governor commonly using in pelton wheel?
4. List the functions of draft tube.
5. Give full form of NPSH.

(5 x 2 = 10)

PART – B

Maximum marks : 30

II (Answer any *five* of the following questions. Each question carries 6 marks)

1. Derive an expression to find the force exerted by the jet on stationery curved plate at its center.
2. A horizontal jet of water is issuing under an effective head of 30metre. The force exerted by the jet on a fixed vertical plate is 1250N. Find the diameter of jet, if the coefficient of velocity is 0.97.
3. Write advantages of hydraulic turbine.
4. A hydraulic turbine working under a head of 150 meters run at 300 r.p.m. If the discharge of the turbine is 1000 liters/sec and overall efficiency is 0.90%. Find the specific speed of turbine.
5. Differentiate impulse turbine and reaction turbine.
6. Explain with figure the working of hydraulic ram.
7. Illustrate the types of casing used in centrifugal pumps.

(5 x 6 = 30)

PART – C

Maximum marks : 60

(Answer one full question from each unit. Each full question carries 15 marks)

UNIT –I

III. (a) Derive an expression to find the work done by the jet on a flat inclined plate moving in the direction of jet (7)

(b) A jet of water of 40mm diameter strikes a curved vane at its center with a velocity of 20m/sec. The vane is moving with a velocity of 10m/sec in the direction of jet. Then the jet is deflected through 160° . Assume the plate is smooth. Determine.

(i) Force exerted by the jet in the direction of jet. (ii) Power of the jet
(iii) Efficiency of the jet (8)

OR

IV.(a) Explain the propulsion of ships by water jets. (7)

(b) A jet of water of diameter 50mm, having a velocity of 20m/sec strikes a curved vane which is moving with a velocity of 10m/sec in the direction of jet. The jet leaves the vane at an angle of 60° to the direction of motion of vane at outlet. Find.

(i) The force exerted by the jet on the vane in the direction of motion.
(ii) Work done/sec by the jet (8)

UNIT-II

V. (a) Classify hydraulic turbines. (7)

(b) A pelton turbine works under a head of 940 meter and produces 8MW. The turbine runs at 600rpm and overall efficiency is 85%. Assume speed ratio = 0.46 and coefficient of velocity = 0.98 find

(i) Least diameter of jet (ii) Mean diameter of wheel (iii) Jet ratio (iv) No of buckets. (8)

OR

VI. (a) A double jet pelton wheel operates under 50 meters head, develops 1MW when running at 400rpm. Make calculations for the flow rate and the diameter of the nozzle jet.

Overall efficiency is assumed as 85% and coefficient of velocity as 0.98. (7)

(b) With neat sketch explain the working of pelton wheel. (8)

UNIT-III

- VII.(a) In an hydro electric station, water is available at the rate of $250\text{m}^3/\text{s}$ under a head of 25m . If the available turbines run at a speed of 150rpm with overall efficiency of 85% . Find the minimum number of turbines of same size required in case of (i) Francis turbine with maximum specific speed 300 and (ii) Kaplan turbine of maximum specific speed 350 . (7)
- (b) Differentiate Francis turbine and Kaplan turbine? (8)

OR

- VIII.(a) With neat sketch explain the working of Kaplan turbine. (7)
- (b) A Kaplan turbine working under a head of 20m develops 12MW shaft power. The outer diameter of the runner is 3.6m hub diameter is 1.8m . The guide blade angle at an extreme edge of the runner is 35° . The hydraulic and overall efficiencies are 88% and 84% respectively. If the velocity of the whirl is zero at the outlet, determine Speed of the turbine in r.p.m? (8)

UNIT-IV

- IX. (a) With figure explain the working of single acting reciprocation pump? (8)
- (b) A multi stage centrifugal pump is required to lift 100 liters of water per second. Total head against which the pump has to works is 500 meters. If the speed of the pump is 1500rpm , find the least number of stages. Specific speed per stage is not to be less than 20 . (7)

OR

- X. (a) Differentiate centrifugal pump and Reciprocating pump? (8)
- (b) A single acting reciprocating pump has a plunger of 250mm diameter and a stroke of 300mm runs at 40rpm . It delivers water 6.5 liters per second at a total height of 30m . Find (i) Slip (ii) Percentage slip (iii) Power (7)
