

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE – APRIL -2021.

HYDRAULIC MACHINES

(Maximum Marks : 75)

[Time : 2.15 hours]

PART-A

Marks

I. Answer **any three** questions in one or two sentences. Each question carries 2 marks.

1. What is meant by fluid jet?
2. What is the difference between gross head and net head?
3. Define specific speed of a turbine.
4. Define NPSH.
5. Give the expression or force exerted by a jet normally on a fixed plate. (3x2=6)

PART - B

II Answer **any four** of the following questions . Each question carries 6 marks.

1. Explain the Propulsion of ships by water jet.
2. Water is flowing through a pipe at the end of which a nozzle is fitted. The diameter of the nozzle is 100mm and the head of water at the centre off nozzle is 100m. Find the force exerted by the jet of water on a fixed vertical plate. The coefficient of velocity is given as 0.95.
3. Explain the different types of efficiencies of turbines.
4. How do you classify water turbines?
5. Explain the function of draft tubes and different types of draft tubes with sketches.
6. Explain the different types of casing of centrifugal pumps.
7. Explain the cavitation in centrifugal pumps. [4x6 =24]

PART - C

(Answer **any of the three units** from the following. Each full question carries 15 marks)

UNIT I

- III** (a) Derive the equations for force developed by the jet striking on a moving flat vertical plate. (8)

- (b) A jet of water having a velocity of 20 m/s strikes a curved vane which is moving with a velocity of 10 m/s. The jet makes an angle of 20° with the direction of motion of vane at inlet and leaves at an angle of 130° to the direction of motion of vane at outlet. Calculate:
- (i) Vane angles, so that the water enters and leaves the vane without shock.
- (ii) Work done per second per unit weight of water striking the vane per second. (7)

OR

- IV** (a) Derive the equation for the angle of swing when a jet striking on hinged plate. (8)
- (b) A jet of water of diameter 50mm strikes a fixed plate in such a way that the angle between the plate and the jet is 30° . The force exerted in the direction of the jet is 1471.5 N. Determine the rate of flow of water. (7)

UNIT- II

- V** (a) Explain the governing of an impulse turbine with sketches. (8)
- (b) A Pelton wheel has a mean bucket speed of 10 metres per second with a jet of water flowing at the rate of 700 litres/s under a head of 30 metres. The buckets deflect the jet through an angle of 160° . Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98. (7)

OR

- VI** (a) Explain the different components of a pelton turbine. (8)
- (b) A Pelton wheel is to be designed for the following specifications:
 Shaft power = 11,772 kW; Head = 380 metres; Speed=750 r.p.m;
 Overall efficiency = 86%; Jet diameter is not to exceed one-sixth of the wheel diameter.
 Determine:
 (i) The wheel diameter, (ii) The number of jets required, and
 (iii) Diameter of the jet.
 Take $K_{v1} = 0.985$ and $K_{u1} = 0.45$. (7)

UNIT- III

VII (a) State the selection of Turbines based on specific speed and head. (8)

(b) A Francis turbine with an overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62 m. The peripheral velocity = $0.26\sqrt{2gH}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gH}$. The wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine:

- (i) The guide blade angle, (ii) The wheel vane angle at inlet,
(iii) Diameter of the wheel at inlet, and (iv) Width of the wheel at inlet (7)

OR

VIII (a) Describe the principle of working of Francis turbine. (8)

(b) A Kaplan turbine runner is to be designed to develop 9100 kW. The net available head is 5.6 m. If the speed ratio is 2.09, flow ratio is 0.68, overall efficiency 86% and the diameter of the boss is 1/3 of the diameter of the runner. Find the diameter of the runner and its speed. (7)

UNIT – IV

IX (a) Explain the multistage centrifugal pumps with sketches. (8)

(b) Compare centrifugal pump and reciprocating pump. (7)

OR

X (a) Explain the Hydraulic rams with sketches. (8)

(b) Illustrate the jet pump with sketches. (7)
