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Signature

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2019

HYDRAULIC MACHINES

[Time : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

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

1. Define impact of jet.
2. State the expression for the force exerted by a jet on a stationary curved symmetrical plate at its centre.
3. Name any two reaction turbines.
4. Define governing of a turbine.
5. State the functions of the air vessel for reciprocating pumps.

(5×2 = 10)

PART — B

(Maximum marks : 30)

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

1. Explain the principle of jet propulsion of ships.
2. A jet of water of diameter 50 mm moving with a velocity of 40 m/s, strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the jet in the direction of the jet, if the jet is deflected through an angle of 120° at the outlet of the curved plate.
3. Classify hydraulic turbines.
4. Compare impulse turbines and reaction turbines.
5. Define : (i) unit power (ii) unit speed and (iii) unit discharge.
6. Describe slip, percentage slip and negative slip in reciprocating pumps.
7. Explain the working of air lift pump with a sketch.

(5×6 = 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 for the force exerted by a jet on a series of vanes. 7
- (b) A jet of water of 75 mm in diameter, strikes a curved plate at its centre with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of the jet. The jet is deflected through an angle of 165° . Assuming the plate to be smooth, find :
- (i) Force on the plate in the direction of the jet and (ii) Power of the jet. 8

OR

- IV (a) Derive an expression for the force exerted by a jet on a flat vertical plate moving in the direction of jet. 7
- (b) A jet of water 50 mm in diameter, moving with a velocity of 15 m/s, impinges on a series of vanes moving with a velocity of 6 m/s. Find (i) Force exerted by the jet. (ii) Work done by the jet. 8

UNIT — II

- V (a) Describe briefly with a sketch the method of governing of Pelton wheel using oil pressure governor. 7
- (b) A Pelton wheel is required to develop 6615 kW when working under a head of 300 m. The wheel may rotate at 500 rpm. Assuming the jet ratio as 10 and the overall efficiency of 85%, calculate (i) quantity of water required (ii) diameter of wheel, and (iii) number of jets. Take speed ratio, $K_u = 0.45$ and coefficient of velocity, $C_v = 0.97$ 8

OR

- VI (a) Describe briefly the main parts of Pelton wheel with sketches. 7
- (b) A Pelton wheel has a mean bucket speed of 10 m/s 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. 8

UNIT — III

- VII (a) Draw a neat sketch of a Kaplan turbine and indicate the main components. Also state the expression for discharge. 7
- (b) A Kaplan turbine develops 24647.6 kW power at a head of 39 metres. Assuming a speed ratio of 2, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate diameter and speed of the turbine. 8

OR

	Marks
VIII (a) Describe with sketches different type of draft tubes.	7
(b) An inward flow reaction turbine has external and internal diameters as 1m and 0.5 m respectively. The velocity of flow through the runner is constant and is equal to 1.5 m/s. Determine (i) Discharge through the runner and (ii) width of the turbine at outlet if the width at inlet is 200 mm.	8
UNIT — IV	
IX (a) Compare centrifugal pump and reciprocating pump.	7
(b) The internal and external diameters of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.	8
OR	
X (a) What is cavitation? What are its effect in centrifugal pumps?	7
(b) A double acting reciprocating pump, running at 40 r.p.m delivers 1.0 m^3 of water per minute. The pump has a stroke of 400 mm. The diameter of piston is 200 mm. The delivery and suction heads are 20 m and 5 m respectively. Determine : (i) The theoretical discharge of the pump (ii) Slip of the pump and (iii) Power required to drive the pump.	8