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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE, APRIL - 2026

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. What is meant by jet propulsion?
2. Write the principle of working of Impulse turbine.
3. Mention two types of reaction turbines.
4. Define suction head and delivery head of pump.
5. Define slip of a reciprocating pump. (5 x 2 = 10)

PART – B
Maximum marks: 30

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

1. Derive the expression for force exerted by a jet on a stationary flat vertical plate.
2. A 30 mm diameter jet exerts a force of 1.5 kN in the direction of flow against an inclined plate at 35° with the axis of the jet. Find the rate of flow.
3. Write the classification of water turbines.
4. What is the use of unit quantities? Define unit speed and unit power.
5. Explain the working of Francis turbine with neat sketch.
6. Explain the working of centrifugal pump with neat sketch.
7. Distinguish between centrifugal pump and reciprocating pump. (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 the expression for force exerted by the jet on a stationary symmetrical curved plate, when the jet is striking at its centre. (8)

(b) A jet of water of 2 cm diameter moving with a velocity of 20 m/s, strikes a hinged square plate of weight 250 N at the centre of the plate. Find the Angle through which the plate will swing. (7)

OR

IV. (a) A jet of water of diameter 20cm strikes a flat plate normally with a velocity of 10 m/s. The plate is moving with a velocity of 4m/s in the direction of jet. Find

1. Force exerted by jet on the plate 2. Workdone
3. Power of the jet in kW 4. Efficiency of the jet. (8)

(b) Derive the expression for the force exerted by the jet on a flat inclined plate moving in the direction of the jet. (7)

UNIT - II

V. (a) Explain the working of a Pelton wheel turbine with neat sketch. (8)

(b) A double jet Pelton wheel turbine operates under a head of 100m and develops 150 kW at an overall efficiency of 90% and coefficient of velocity of 0.98. Find the discharge and jet diameter. (7)

OR

VI. (a) Explain the governing of impulse turbine with neat sketch. (8)

(b) A pelton wheel turbine develops 10 MW under a net head of 250m. If the overall efficiency is 80%, determine the discharge of the turbine in Litres per second. (7)

UNIT - III

VII. (a) Compare the characteristics of impulse turbine and reaction turbine. (8)

(b) What is a draft tube? List the functions of draft tube. (7)

OR

VIII. (a) Define hydraulic efficiency, volumetric efficiency, mechanical efficiency and overall efficiency of a turbine. (8)

(b) A Kaplan turbine working under a net head of 5 meters develops 7000kW. The speed ratio and flow ratio are 2.1 and 0.7 respectively. If the boss diameter is 1/3 of that of runner and the turbine has an overall efficiency of 80%, find diameter of runner and speed of the turbine. (7)

UNIT – IV

IX. (a) Explain the principle of working of a hydraulic ram with neat sketch. (8)

(b) A centrifugal pump delivers 0.03 cubic meters of water per second against a manometric head of 30 m. If the overall efficiency of the pump is 70%, find the power required to drive the pump. (7)

OR

X. (a) Define manometric head, manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump. (8)

(b) A single acting reciprocating pump having a piston of 250 mm diameter and a stroke of 175 mm runs at 45 rpm. It delivers water at a rate of 6 litres per second. Find the coefficient of discharge, slip and percentage slip of the pump. (7)
