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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE, NOVEMBER - 2022

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. Recall the equation for force exerted by the jet on a stationary vertical plate in the direction of jet
2. Define jet ratio of Pelton wheel.
3. Select the turbine which is suitable where a large quantity of water at low head is available.
4. Name the principle of working of centrifugal pump.
5. Define priming. (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 force exerted by the jet on a stationary curved plate at the center.
2. Explain the principle of jet propulsion.
3. Classify water turbines.
4. Explain the selection of turbine based on specific speed.
5. Explain the terms hydraulic efficiency, mechanical efficiency and overall efficiency of a turbine.
6. Classify pumps.
7. Explain the use of air vessel in a 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 an equation for the force of jet impinging on a hinged plate. (7)

(b) A nozzle discharges 60mm diameter water jet at a velocity of 18m/s at right angles to a plate moving away from the nozzle at 6m/s. Find the force on the plate and the work done on the plate per second. (8)

OR

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

(b) A 150mm diameter jet moving at 30 meters per second impinges on a series of vanes moving at 15m/s in the direction of the jet. The jet leaves the vanes at 60^0 with the direction of motion of the vanes, Calculate. (i) The force exerted by the jet in the direction of motion of the vanes (ii) Work done by the jet per second. (8)

UNIT-II

V.(a) Describe the spear regulation of impulse turbine with neat sketch. (7)

(b) A Pelton wheel works under a net head of 310 m at a speed of 560 rpm developing 5890 kW. The overall efficiency of the turbine is 80%. The ratio of the jet diameter to the mean bucket circle diameter is 1/10. Find the diameter of the turbine and the quantity of water supplied to the turbine. Assume Cv=0.97, bucket speed= 0.47 jet speed. (8)

OR

VI.(a) Describe the working of Pelton wheel with neat sketch. (7)

(b) A Pelton wheel working under a head of 500 m has an overall efficiency of 85% and runs at 430 rpm developing 6990 kW. Taking the bucket speed at 0.47 times the jet speed and assuming Cv=0.97. Find the (i) wheel diameter (ii) jet diameter (8)

UNIT-III

VII.(a)Write any seven differences between Kaplan turbine and Frnacis turbine. (7)

(b) A Kaplan turbine develops 24650 kW at an average head of 39 m. 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 the diameter and specific speed of the runner. (8)

OR

VIII. (a) Define a draft tube. Mention its classifications with sketches. (7)

(b) A Francis turbine has inner diameter of wheel 0.6 times the outer diameter. Water enters the turbine at 12^0 tangent to the wheel. Blade angels are radial at inlet. Velocity of flow is constant through the turbine and is 2.5m/sec. Speed of the runner is 280 rpm. The width of the wheel at the inlet is 10cm. 5% of area of flow is blocked by runner blades. Determine. (i)Discharge from the turbine (ii) diameters at inlet and outlet. (8)

UNIT-IV

IX. (a) Explain multistage centrifugal pumps with sketches. (7)

(b) A centrifugal pump running at 1450 rpm discharges 110 litres per second against a head of 23 meters. If the diameter of the impeller is 250 mm and its width is 50 mm, find the vane angle at the outer periphery. The manometric efficiency of the pump is 75%. (8)

OR

X.(a) Explain hydraulic ram with sketch. (7)

(b) A single acting reciprocating pump having a 150 mm bore and a 300 mm stroke raises water from a sump. If the pump runs at 40 rpm and it delivers 209.5 litres per minute, find (i)the Theoretical average discharge and (ii) percentage slip. (8)

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