[Total No. of Questions - 9] [Total No. of Printed Pages - 4]

Dec-25-0228

CE-609 (Hydraulic Machines)

B.Tech. 6th (CBCS)

Time : 3 Hours Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt one question each from Sections-I, II, III and IV. Section-V is compulsory. Assume missing data suitably, if any.

SECTION - I

1. (a) Discuss the impulse-momentum principle. How is impulse-momentum equation useful in impact of jet problems? (4)

   (b) A nozzle of 60 mm diameter delivers a stream of water at 24 m/s perpendicular to a plate that moves away from the jet at 6 m/s. Find: (i) the force on the plate, (ii) the work done, and (iii) the efficiency of the jest. (6)

2. A vane having an inlet angle of zero degree and an outlet angle of 25° receives water at velocity of 50 m/s.

   (a) Determine the components of force acting on it in the direction of the jet velocity and normal to it. Also find the resultant force in magnitude and direction per kg of flow.

   (b) If this vane is moving with a velocity of 20 m/s in the direction of the jet, calculate the forcec omponents in the direction of the vane velocity and across it, and also find the resultant force in magnitude and direction. Calculate the work done and power developed per kg of flow.

   (5+5=10)

SECTION - II

3. (a) Differentiate between centrifugal pump and reciprocating pump. What are the advantages of centrifugal pumps over reciprocating pumps? (5)

   (b) Describe different types of head losses which occur in centrifugal pumps. (5)

4. A three-throw reciprocating pump has cylinders of 250 mm diameter and stroke of 500 mm each. The pump is required to deliver 0.1 m^3/s water at a head of 100 m. Friction losses are estimated to be 1 m in suction pipe and 19 m in delivery pipe. Velocity of water in delivery pipe is 1 m/s, overall efficiency is 85% and the slip is 3%. Determine: (i) speed of the pump, and (ii) power required to run the pump. (10)

SECTION - III

5. (a) Explain the design and working of a Pelton wheel turbine with the help of suitable sketches. (5)

   (b) In an inward flow reaction turbine, the head on the turbine is 32 m. The external and internal diameters are 1.44 m and 0.72 m respectively. The velocity of flow through the runner is constant and equal to 3 m/s. The guide blade angle is 10° and the runner vanes are rigid at the inlet. If the discharge at outlet is radial, determine:

   (i) The speed of the turbine,

   (ii) The vane angle at outlet of the runner, and

   (iii) Hydraulic efficiency. (5)

6. (a) What is a draft tube and its functions? Describe its theory and derive expression of draft tube efficiency. (5)