BTS (C) – IV – 10 – 015 – I

B. Tech Degree IV Semester Examination, April 2010

ME 405 HYDRAULIC MACHINERY

(2006 Scheme)

Time: 3 Hours | Maximum Marks: 100

PART – A

(Answer ***ALL*** questions) (8 x 5 = 40)

I. (a) Explain Buckingham's Pi Theorem.
(b) Describe Momentum equation applied to a control volume.
(c) Differentiate between Impulse and Reaction Turbines.
(d) What is specific speed? What is its importance?
(e) What is priming? On what types of pumps priming is necessary.
(f) What is 'slip' in reciprocating pumps? Is it possible to have a negative slip? How it occurs?
(g) With the help of a sketch explain working of a Hydraulic Ram.
(h) Differentiate between Vane pumps and Gear pumps? What are the common uses of these pumps?

PART – B

(4 x 15 = 60)

II. A geometrically similar model of an air duct is built to 1/25 scale and tested with water which is 50 times move viscous and 800 times denser than air. When tested under dynamically similar conditions, the pressure drop is 200 kN/m^2 in the model. Find the corresponding pressure drop in the full scale prototype and express in cm of water.

OR

III. A 15 m/s velocity jet of water 5 cm in diameter strikes perpendicularly on a flat smooth plate. Determine the force exerted by the jet on the plate, if (i) the plate is at rest (ii) it moves in the direction of jet with a velocity of 5 m/s. Also determine the work done in each case and the efficiency of jet in the second case.

IV. The water jet in a pelton wheel is 8cm in diameter and has a velocity of 93 m/s. The rotational speed of the wheel is 600 rpm and the deflection angle of the jet is 170^0. If the speed ratio is 0.47, determine the diameter of wheel and the power developed.

OR

V. A Francis turbine has to be designed to develop 367.5kw under a head of H = 70m while running at N = 750 rpm. Ratio of width of runner to diameter of runner, m = 0.1, inner diameter is half the outer diameter. Flow ratio ϕ =0.15, Hydraulic efficiency = 95 percent, mechanical efficiency = 84 percent. Four percent of the circumferential area of runner to be occupied by the thickness of vanes, velocity of flow is constant and discharge is radial at exit. Calculate:

(i) diameter of wheel
(ii) the quantity of water supply
(iii) the guide vane angle at inlet and runner vane angle at inlet and exit.

VI. The piston of a double acting reciprocating pump has a diameter of 20cm and a stoke of 60cm. The pump runs at 20 rpm and discharges through a 15cm main 76m long (friction factor f = 0.03), the vertical lift being 46m. If no air vessel is used, determine the heads in the cylinder at the ends and middle of the stroke.

OR

VII. A centrifugal pump rotates at 1000 rpm and delivers 300 liters /sec of water. The impeller has a diameter of 35cm and a width of 5cm at the periphery. The blades tip angle are inclined backwards 60^0 from the radius (The blade angle 30^0). Determine the velocity and direction of water as it leaves the impeller.

VIII. With neat sketch explain working of:
(i) Hydraulic intensifier (ii) Hydraulic Accumulator

OR

IX. Write notes on:
(i) Surge tank (ii) Hydraulic press (iii) Hydraulic coupling

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