B. Tech Degree IV Semester Examination, April 2009

ME 405 HYDRAULIC MACHINERY

(2006 Scheme)

Time : 3 Hours Maximum Marks : 100

PART - A

(Answer ***ALL*** questions)

(8 x 5 = 40)

I. (a) Assuming the power delivered to a pump is a function of the specific weight of the fluid, the flow rate, and the head delivered, establish an equation by dimensional analysis.

(b) A jet of water, 75 mm in diameter, issues with a velocity of 30 m/sec and impinges on a stationary flat plate which destroys its forward motion. Find the force exerted by the jet on the plate and work done.

(c) Distinguish between impulse and reaction turbines.

(d) Explain cavitation.

(e) List out the advantages of centrifugal pump over displacement pump.

(f) Explain the function of an air vessel in an reciprocating pump.

(g) Obtain an expression for the capacity of a hydraulic accumulator.

(h) With a neat sketch explain the working of a hydraulic intensifier.

PART – B

(All questions carry ***EQUAL*** marks)

(4 x 15 = 60)

II. A ship whose hull length is 140 m is to travel at 7.6 m/sec. (i) Compute the Froude number (ii) For dynamic similarity, at what velocity should a 1 : 30 model be towed through water.

OR

III. A jet of water of 60 mm diameter strikes a curved vane at its centre with a velocity of 18 m/sec. The curved vane is moving with a velocity of 6 m/sec in the direction of the jet. The jet is deflected through an angle of 165°. Assuming the plate to be smooth find :

(i) Thrust on the plate in the direction of jet
(ii) Power of the jet
(iii) Efficiency of the jet

IV. The mean bucket speed of a Pelton turbine is 15 m/sec. The rate of flow of water supplied by the jet under a head of 42 m is 1 m^3/sec. If the jet is deflected by the buckets at an angle of 165°, find the power and efficiency of the turbine. Take coefficient of velocity as 0.985.

OR

V. A reservoir has a head of 40 m and a channel leading from the reservoir permits a flow rate of 34 m^3/sec. If the rotational speed of the rotor is 150 rpm, what is the most suitable type of turbine to use?

VI. It is required to deliver 0.048 m^3/sec of water to a height of 24 m through a 150 mm diameter pipe and 120 m long, by a centrifugal pump. If the overall efficiency of the pump is 75% and coefficient of friction for the pipe line is 0.01, find the power required to drive the pump.

OR

VII. A single acting reciprocating pump running at 60 rpm delivers 0.53 m^3 of water per minute. The diameter of the piston is 200 mm and stroke length 300 mm. The suction and delivery heads are 4 m and 12 m respectively. Determine –

(i) Theoretical discharge
(ii) Coefficient of discharge
(iii) Percentage slip of the pump
(iv) Power required to run the pump.

VIII. Water is supplied to hydraulic ram from a height of 1.5 m by a pipe 75 mm in diameter and 12 m long. The waste valve, which is 125 mm in diameter and of weight 15 N, lifts through 6.5 mm. Determine (i) the number of beats per minute and (ii) the quantity of water delivered per minute to a tank 10 m above the waste valve.

OR

IX. A hydraulic press has a ram of 180 mm diameter and a plunger of 36 mm diameter, with stroke length of 300 mm. Weight exerted by press ram amounts to 7 kN and distance moved is 0.9 m in 15 minutes. Determine (i) the force applied on plunger (ii) the number of strokes performed by the plunger (iii) work done by the press ram, and (iv) power required to drive the plunger.

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