(DME 314)

B.Tech. DEGREE EXAMINATION, MAY - 2015

(Examination at the end of Third Year)

MECHANICAL ENGINEERING

Paper - IV : Hydraulic Machines

Time : 3 Hours **Maximum Marks : 75**

Answer question No.1 compulsory ***(15)***

Answer ONE question from each unit ***(4 × 15 = 60)***

1) a) Find the force exerted by a jet of water of diameter 75 mm on a stationary flat plate, when the jet strikes the plate normally with velocity of 20 m/s.

b) Define the terms : Hydraulic Machines, Turbines & Pumps.

c) Define the terms : Suction head, delivery head & static head.

d) Define slip, percentage slip & negative slip of a reciprocating pump.

e) What is meant by geometric, kinematic & dynamic similarities?

UNIT - I

2) a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.

b) A jet of water of diameter 50 mm having a velocity of 20 m/s strikes a curved vane which is moving with a velocity of 10 m/s in the direction of the jet. The jet leaves the vane at an angle of 60º to the direction of motion of vane at outlet. Determine. **(5 + 10 =15)**

i) The force exerted by the jet on the vane in the direction of motion.
ii) Work done per second by the jet.

OR

3) A jet of water of diameter 100 mm strikes a curved plate at its centre with a velocity of 15m/s. The curved plate is moving with a velocity of 7m/s in the direction of the jet. The jet is deflected through an angle of 150º. Assuming the plate smooth find : **(3 × 5 =15)**

a) Force exerted on the plate in the direction of the jet.
b) Power of the jet & c) Efficiency.

UNIT - II

4) A Peltan wheel is revolving at a speed of 200 r.p.m. and develops 5886 kW S.P. when working under a head of 200 m with an overall efficiency of 80%. Determine unit speed, unit discharge & unit power. The speed ratio for the turbine is given as 0.48. Find the speed, discharge & power when this turbine is working under a head of 150m. **(15)**

OR

5) A Francis turbine with an overall efficiency of 70% is required to produce 147.15 kW. It is working under a head of 8m. The peripheral velocity = $0.30\sqrt{2gH}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gH}$. The wheel runs at 200 r.p.m. and the hydraulic losses in the turbine are 20% of the available energy. Assume radial discharge, determine **(3 + 4 + 4 + 4 = 15)**

i) The guide blade angle.

ii) The wheel vane angle at inlet.

iii) Diameter of the wheel at inlet, &

iv) Width of wheel at inlet.

UNIT - III

6) A single – acting reciprocating pump has a plunger of 10 cm diameter and a stroke of length 200 mm. The centre of the pump is 4m above the water level in the sump & 14 m below the level of water in a tank to which water is delivered by the pump. The diameter and length of suction pipe are 40 mm and 6 m while of the delivery pipe are 30 mm & 18 m respectively. Determine the maximum speed at which the pump may be run without separation. If separation occurs at 7.848 N/cm^2 below the atmospheric pressure. Take atmospheric pressure head is 10.3 m of water.

(7½ + 7½ = 15)

OR

7) a) With the help of a neat sketch explain the various component parts of a centrifugal pump. **(10)**

b) How will you obtain an expression for the minimum speed for starting a centrifugal pump? **(5)**

UNIT - IV

8) Derive on the basis of dimensional analysis suitable parameter to represent the thrust developed by a probelles. Assume that the thrust P depends upon the angular velocity ‘ω’ speed of advance ‘V’ diameter ‘D’ dynamic viscosity ‘μ’ mass density δ and elasticity of the fluid medium which can be denoted by the speed of the sound in the medium C. **(15)**

OR

9) Assuming that the viscous force F exerted by a fluid on a sphere of diameter D depends on the viscosity μ, mass density of fluid P, & the velocity of sphere ‘V’ obtain an expression for the viscous force. **(15)**

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