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ME401

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 140405

Roll No.

B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15
FLUID MACHINERY

Time : **3** Hours]   [Total Marks : **100**

Note :   (1)   Attempt all questions.

(2)   All questions carry equal marks.

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1   Attempt any four parts of the following :

(a)   What is kinetic energy of fluid?

(b)   In detail give classification of hydrodynamic machine?

(c)   A pelton wheel is working under a net head of 450m with a water flow rate of $0.3 m^3/s$, r.p.m 1000, and overall efficiency of 80%. Find:
(i)   Dia of wheel
(ii)   Dia of jet
(iii)   Size of buckets
(iv)   Power available from turbine shaft
(v)   No. of buckets

(d)   Calculation of work, Power and efficiencies of inward reaction turbines?

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(e) Give the factors for selection of turbines?

(f) Derive an expiration to show that pressure of fluid after runner   is less than atmospheric pressure?

2 Attempt any four parts of the following:

(a) Explain component and working of Kaplan turbine?

(b) A turbine works under a head of 200m and it develops 6000kw power at 200rpm .The overall efficiency of turbine is 87%.Find its unit speed, unit discharge and unit power. A model is to built which is similar to above turbine in all respect having the scale ratio 1:10. It is tested under a head of 20m .Find the speed, discharge power and specific speed of model having the same overall efficiency as turbine

(c) What are unit quantities used in reaction turbine and also give expiration how it derives?

(d) What is cavitation in turbine? Give its effect and methods of preventing cavitations in turbine, what is Thomas's cavitations factor?

(e) What is the difference between model and prototype? And also give the similarities between both of them?

(f) The following data is given for a Francis turbine. Net head H=60m; breadth ratio n=0.1; Outer dia. of the runner is two times of inner dia. of runner. The thickness of vanes occupies 5% of circumferential area of the runner, Velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine
(i) Guide blade angle
(ii) Runner vane angles at inlet and outlet
(iii) Diameters of runner at inlet and outlet
(iv) Width of wheel at inlet

3 Attempt any two parts of the following:

(a) Difference between single and multi stage centrifugal pump? And also give the advantages of centrifugal pumps over reciprocating pumps?

(b) Derive an expression for the minimum starting speed of centrifugal pump? Define all the casing used in centrifugal pump.

(c) A centrifugal pump impeller has diameter at inlet and outlet as 360mm and 720mm respectively. The flow velocity at outlet is 2.4m/s and the vanes are set back at an angle of 45° at the outlet if the manometric efficiency is 70%, calculate the minimum starting speed of the pump?

4 Attempt any two parts of the following :

(a) Why air vessels are used in reciprocating pump? Draw and discuss the effect of friction in suction & delivery pipes on indicator diagram?

(b) Prove that work done by the pump is proportional to the area of indicator diagram. What do you know about slip both positive and negative in a reciprocating pump?

(c) The cylinder bore diameter of a single acting reciprocating pump is 150mm and its stoke is 300mm. The pump runs at 50rpm and lifts water through a height of 25m. The delivery pipe is 22m long and 100mm in diameter. Find the theoretical discharge and theoretical power required to run the pump. If the actual discharge is 4.2litres/s, find the percentage slip. Also determine the acceleration head at the beginning and middle of delivery stroke.

5   Attempt any two parts of the following :

(a)   Find the power of the motor to drive the plunger of a hydraulic press to lift a load of 12kN to a height to 1m in 10 minutes. The area of the ram and plunger are 1.77×10^{-2} m^2 and 4.9×10^{-4}m^2 respectively. The stoke of the plunger is 0.3m. Find also the number of stokes required by the plunger?

(b)   How does a torque converter different from a fluid coupling? Explain the working principal of any one of them?

(c)   With the help of a suitable diagram, discuss, the Function, Construction and Operation of hydraulic press?